Lessons from a Multispecies Studio

Uncovering Ecological Understanding and Biophilia Through Creative Reciprocity

by Julie Andreyev

in memory of

Tom

the miracle dog

(2004-2020)

Contents

"…ethics is a form (I've called it a 'manner' or a 'way') inseparable from life itself…Interpreted further it means that to live ethically, to live with others, is to forge out of their and our fates a common destiny."

—Michael Marder [1]

[1] Marder, Michael. "Plant Morality vs. Plant Ethics." October 26, 2016. *The Philosopher's Plant. A Los Angeles Review of Books channel.* Web. www.philosoplant.lareviewofbooks.org.

Introduction

"Then suddenly I observe a hovering kestrel. In a moment everything is altered. The brooding self with its hurt vanity has disappeared. There is nothing now but kestrel." [2]

—Iris Murdoch

" Art…inspires love in the highest part of the soul. It is able to do this partly by virtue of something which it shares with nature: a perfection of form which invites unpossessive contemplation and resists absorption into the selfish dream life of the consciousness." [3]

—Iris Murdoch

[2] Murdoch, 82.

[3] Murdoch, 83.

Sensing the dawn's blue light, the elms in the park across the street open up their stomata—the tiny pores in their leaves that respond to the Earth's diurnal rhythms. They breathe in carbon dioxide and release oxygen and water vapor in preparation for photosynthesis. In the summer, the early mornings are a good time to create nutrients from the sun. Later, as the air gets hot and dry, the trees will close their stomata to preserve water. It's 6:00am, and I'm on my roof deck looking and listening for more-than-human goings-on.

I hear crow calls and look up to see single ones flying a few metres above my head, commuting westward into the city; others fly higher up, still having a distance to their home territories. They call loudly in order to be heard above the commuter traffic noise and the drone of the container port kilometres away. I walk towards the east end of the deck and lay out a line of peanuts on the railing. It's a morning tradition as a meal for the crow family whose territory includes my home. The crow neighbours should be awake by now. They spent the night locally because the youngsters are not yet ready for the daily travel to and from the roost in the nearby municipality of Burnaby[4] where thousands congregate for the night to socialize and share knowledge about the day. I look over at the park just in time to see the family pop out of a tree—first the adults, then the two fledglings—onto the grass. The male parent looks my way, hops into the air and flies towards me. The youngsters, cawing in high pitches, follow him. The three alight on the telephone line beside the house, flicking their tails for balance. The female parent stays back, preferring to troll the park's lawn, listening for earthworms who may have surfaced with the morning's dew.

I retreat to the back of the deck to sit on a bench and watch. Facing east, I have to shield my eyes from the sun's rays that are now piercing the tree branches. The male crow glides down from the telephone line onto the deck's railing. He spends a few moments smashing one of the nuts with his beak and swallowing the small pieces. Then, he swiftly gathers up the rest into his crop. The larger youngster hops after him, pecking at leftover crumbs. The adult jumps down to the roof and heads over to the water dish where he draws water into his crop. The fledglings follow him and call for some of the food mixture. Taking turns, he regurgitates a bit into each of their red mouths. After the meal, they all fly to the telephone pole across the street where they groom, using their beaks to smooth feathers and root for fleas. In a few minutes, they're joined

[4] Burnaby is located on the ancestral and unceded territories of the hən̓q̓əmin̓əm̓ and Sḵwx̱wú7mesh peoples.

by the starling couple who nest in the eaves of a commercial building on the corner. Next, a pair of northern flickers perch on the telephone pole's cross timbers. All the birds face the sun as it rises above the trees and warms the air. Collectively we enjoy the dawn.

This is a regular happening on summer mornings in my East Vancouver neighbourhood.[5] I cherish these moments for the feeling I get being part of a multispecies community. We're here together appreciating the sunrise, and feeling its light and warmth. Over the past few years, I've watched these urban birds—former forest- and grassland-dwelling species—raise their new generations. They've adapted to city life. Their kin from past generations successfully negotiating the complexity of human infrastructure and its inhabitants, and passing this knowledge to their offspring. Other birds have not been as successful.

In 2019, The Cornell Laboratory of Ornithology released a study on bird declines since 1970, for 529 species in Canada and the US. They found that there's been an overall loss of 30 percent, nearly 3 billion birds.[6] (Growing up in the 1970's in Burnaby, I saw a variety of forest birds in my backyard—Stellar's jays, grosbeaks, waxwings. Today, these birds are found less frequently, or not at all, in urban areas.) The declines are primarily due to diminished wildlife habitat, such as forests and grasslands, as a result of human deforestation, development, and agriculture. Forest birds alone have suffered a decline of one billion birds. The majority of the losses are in the common families of birds, such as sparrows, finches, and blackbirds. The irony is that when we look around the city, it seems that these birds are ok because we find them in our neighbourhoods and at our bird feeders. But if we compare their numbers to the 1970 baseline, we see the significance of the declines.

Ken Rosenberg, the lead scientist of the Cornell study, says that the bird losses signal a tipping point.[7] Bird populations are indicators of wild habitat health, and the declines are a precursor to the "coming collapse of the overall environment."[8] So, the urban dawn I experience with my bird neighbours is particularly poignant for its real-world account. They are here because their kin from previous generations were faced with shrinking wild habitats, and they had to learn to

[5] Vancouver is located on the unceded, traditional and ancestral territories of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh Úxwumixw (Squamish), and səl̓ilw̓ətaʔɬ (Tsleil-Waututh) nations.

[6] Rosenberg et al.

[7] Rosenberg in Axelson.

[8] Rosenberg quoted in Axelson.

cohabitate with the human populations who colonized their lands. Now with climate change, wild birds—and everyone—are faced with existential challenges.

In 2018, the Intergovernmental Panel on Climate Change released their report on the planet's rising temperatures as a result of greenhouse gas emissions caused by human activity, and it predicted global heating trends.[9] Global heating has already produced observable changes in air, land and ocean systems—severe storms, melting glaciers, droughts, wild fires, floods. In the coming decades, global temperatures will likely increase by 1.5°C compared to pre-industrial levels. The report warns that if the planet heats beyond this, there will be greater stresses on ecosystems, and more biodiversity losses than we are faced with today. Risks to human health and survival will increase, brought about by extreme weather patterns, rising sea levels, and other challenges. The report insists on a 1.5°C limit, and in order to achieve this, it says we need to reduce emissions by 45 percent (from 2010 levels) before the year 2030, and reduce emissions to net zero by 2050.

These pressures—wild habitat degradation and climate change—are but two planetary emergencies brought about by anthropogenic forces. There are also the ecological degradations from ocean acidification, declines in aquatic habitat and marine life from over-fishing, and the diminishment of clean fresh water from industry and agriculture. The immensity of the challenges they present gives rise to pressing questions regarding the future role of humanity. Will societies continue to do business as usual, expanding human footprints on land and ocean ecosystems, destroying wildlife habitat, furthering the conditions for mass extinctions, including for populations of humans? Or will societies shift their course, paying attention to the interconnectedness of human and nonhuman livelihoods, and support the conditions for relational flourishing? The precarity of this moment, and the need for change, is what motivated me to write this book.

Working as a university educator since 1998, I've seen the attitudes of young people shift over the years towards ecological awareness. These days, my students are much more informed about harms against nonhumans, the climate emergency and ecological degradations. Globally, this awareness is demonstrated by the direct action initiatives of young people, such as with Greta Thunberg, Fridays for Future, the Sustainabiliteens, the Sunrise Movement, and the

[9] Masson-Delmotte et. al.

Extinction Rebellion. Young people understand the catastrophes as interconnected ecological and social injustices and, because of this awareness, they experience climate anxiety and fears about the future. My students tell me about their yearning to connect with animals, plants and the land. But, with their busy lives, including their social media ones, they're continually drawn away. This separation from nonhuman life, combined with fear and uncertainty about the future, characterizes human life in the Anthropocene.

As a child and teen growing up in the 1970's, I also yearned for connections with plants and nonhuman animals. I was fortunate, because even though I lived in the suburbs of Burnaby, I was encouraged by my family to get outside and interact with the world. Around the yard, my mother enthusiastically drew my attention to birds and plant life, integrating these into my lived experience. I'd ride my bike around the neighbourhood (unsupervised) exploring back alleys and local parks. My older brothers knew a short-cut to get to Burnaby Lake. We'd crawl under the Trans-Canada Highway through a large culvert and walk along a trail leading to the lake. We'd stop at a stream feeding the lake and watch sticklebacks amongst the pebbles and currents. I remember feeling a sense of wonder for these tiny silvery fish who feed on insects and have transparent fins. A good friend whose backyard ran up against the forest of Capilano River Regional Park, would play games with me on the trail where low-hanging dried cedar branches created a gauzy brown haze, and smelled amazing. We'd climb the stumps of old-growth trees, the giant remains from logging over a century ago. These massive stumps were scattered widely through the forest amongst the more abundant, and thinner, living third-growth trees. My father built a boat and took us on summer holidays around the coastal islands where we'd explore ocean habitats and tidelines. At night, using oars, we'd stir the water around the boat and the ripples would light up with the bioluminescent plankton. These experiences were tantalizing journeys into other-worlds where extraordinary beings unfolded knowledge before my eyes. Their affects stuck to me like cedar pollen and dried ocean, fertilizing my growth and preparing me for the future.

During college, I developed a landscape painting practice and this took me outdoors to connect with, and paint, wild spaces around my region. After my graduate work, I began using new technologies for their abilities to reveal hidden relations. In 2005, with encouragement from my canine companions Tom and Sugi, I began focusing on more-than-human ways of knowing and creating. The projects with the dogs were the first purposeful instances of interspecies art

collaboration. Together we launched the *Animal Lover* body of work and, over the following decade, grew the practice to include fishes, birds, trees and forest life. During my doctoral study, I researched links between art and other fields, such as post-humanist philosophy, critical animal studies, and science to inform theoretical and applied approaches to interspecies art. Now, I combine this knowledge with a blend of creative techniques—listening walks, field recording, computer vision, and generative systems—to build creative relationships with nonhuman beings. Through the stages of theoretical and applied practice, I've developed a view about the challenges presented by the Anthropocene and how art methods can contribute positive change towards a better future.

This book tells real-world stories about encounters with animals, plant-life, mineral beings, and forest ecosystems, and how they helped shift my own outlooks. Each chapter presents a weaving together of personal reflection, critical thought and ecological art methods. The threads converge on this main point: the need to move away from detrimental beliefs in the exclusivity of humans and towards an understanding of the interconnected reality of life. This transformation in thought is essential to the survival of our planet. To undertake the change, we need to acknowledge the damaging effects of colonialism and resource-extraction, and feel its effects, like my students do. We need to forge a path of care to support the multispecies communities that make up the living Earth. This book provides a way to walk, with humble steps, along a trail of connection with nonhuman beings and the ecologies we share. The local journeys in each chapter are guided by more-than-human ways of knowing which provide an expanded sense of the world and an understanding of the imperative for action.

The Anthropocene is a term used to describe the geological era in which we live (its start date still under debate), marking the realization that humans have become such a force that we are affecting the Earth's air, lands, oceans, climate. At its core, in the modern Eurocentric societies that typify this era, is an entrenched worldview of nature as a means to fuel global capitalist-colonial systems. This anthropocentric worldview justifies the colonization and exploitation of ecosystems and nonhuman life seen as 'resources' available for human expansion and prosperity, and readily available as free labour. The consequential outcomes are manifest in today's climate emergency and ecological degradations which include animal slavery, industrial farming, overfishing, deforestation and habitat loss, and the coming environmental collapse with its sixth mass extinction.

Anthropocentric views are based on the naturalization of a false truth—that humans are naturally more valuable than other beings. Historically, this ideology derives from philosophical, religious, and cultural beliefs regarding what it means to be 'human'. The definition of human has shifted over time, but shares a reliance on various problematic beliefs in human exclusivity with regard to reason, intelligence, soul, emotion, sentience, language, culture or creativity. [11] This has led to the unecological worldview typified by the human / nature divide—that humans are separate and distinct from nature and have dominion over it. Anthropocentric views determine hierarchies of worth for nonhuman lifeforms and are used to justify all sorts of harms, such as in today's meat and dairy industries, animal testing, soil degradation, monocropping agricultures, forest clear-cutting, and other forms of abuse. A view that holds humans as separate and exclusive is not only ecologically problematic, but evolutionarily untrue. Furthermore, its outcomes are tremendously detrimental to nonhuman life, and consequential for human populations. Anthropocentric views include a belief in an idealized form of the human, based on the European adult-male model, and this ideal has been used to marginalize individuals that don't measure-up. Not only has it been used to dominate and exploit nonhuman life and nature, but also women, BIPOC, LGBTQ peoples, peoples of differing faiths, physically or mentally impaired peoples, and children.[12]

Within recent decades, the sustainability of human-centric worldviews has been called into question across disciplines. Scientists have found that nonhuman lifeforms share traits previously believed to be exclusively human—reason, intelligence, emotion, sentience, language, creativity—and have diversities that are intrinsically valuable: species-specific perceptual and cognitive abilities, communications, cultures, and traditions.[13] Outside of science, ecofeminism, critical animal studies, and post-humanist philosophy have linked the interconnected sufferings of humans and nonhumans;[14] decolonial methodologies have critiqued colonial impulses that oppress humans and nonhumans alike;[15] and indigenous methodologies have contested anthropocentric worldviews by acknowledging the value of more-

[11] Castricano and Rasmus; Derrida; Derrida and Roudinesco; Nocella, Sorenson, Socha, Matsuoka; Plumwood; Wolfe.

[12] Derrida; Derrida and Roudinesco; Nocella, Sorenson, Socha, Matsuoka; Plumwood; Wolfe.

[13] Bekoff 2007b; Balcombe; Berns; de Waal; Goodall; Marzluff and Angell; Slobodchikoff.

[14] Donovan and Adams; Plumwood; Wolfe.

[15] Kovach.

than-human ways of knowing.[16] In their various critiques, such forward-looking discourses call for de-anthropocentric approaches as it is clear that the ideologies endemic to the Anthropocene can no longer hold.

A broad cultural transformation in thought and action must take place if we are to move towards a future of holistic planetary survival. This transformation must include a correction in thought that rejects notions of humans as separate from nature, and accepts human embeddedness in the extensive natural systems of the Earth. Some thinkers articulate this transformation as "The Great Transition," calling for a movement away from extraction-based capitalism, and towards social and ecological justice on a planetary scale.[17] Others further argue that the transformation must include a correction in feeling through new kinship models based on empathic and compassionate relations with nonhuman life.[18] This book joins with these movements and offers additional applied approaches—through art—to help shape and evolve human outlooks, emotions and actions.

In the face of ecological collapse and the prospect of irreversible climate change, personal contributions to transformation can seem insignificant and out of reach. Yes, public policy and broad social advances need to happen in order to do a better job of ecological protections and harm reduction from human activities. But it's also important to make individual efforts, because these can provide incremental positive steps towards the crucial shifts needed to affect broader cultural viewpoints and societal norms. Individual change can involve critical reflection on choice and action, such as in the foods we eat, the consumption we choose, and the travel we undertake. It can also involve an enhancement in perceptual and emotional capabilities. This expanded sensibility can be a way to join with multispecies communities, creating immediately-felt change. Individual transformations can be communicated and shared with other members of society, and this can accumulate into grass-roots change that can inspire communities.

The environmental historian Steve Duguid says that "…a new radical sensibility based on sensing and feeling coupled with wonder and reverence rather than just knowing"[19] should be at the core of ecological transformation. I agree. While science and philosophy provide new

[16] Abram; Kovach; Stuckey; Kimmerer.

[17] Demos; Klein; Raskin et. al.

[18] Donovan and Adams; Haraway 2016; Plumwood.

[19] Duguid, 204.

knowledge about nonhuman life and the relationships between humans and nature, a new radical sensibility can provide applied approaches, accessible through the immediacy of lived experience. Using our own sensing and feeling bodies, we can open up to the vitality of nonhuman life and ecosystems in our homes, our neighbourhoods and our regions, and simultaneously get to know our own felt responses. This outward-looking attentiveness, combined with inward reflection is what I call *biophilic attention*. It involves the development of expanded perception towards the natural systems and nonhumans around us, and a simultaneous understanding of how our states of mind and heart are co-created with these more-than-human worlds. Because biophilic attention involves sensing and feeling, it can lead to wonder and reverence for the ecologies we share.

The stories in the chapters detail biophilic attention methods I've used in my interspecies art practice, with the help of canines, birds, stones, fishes, trees and forests. The techniques are based on art methods that are especially good at honing the senses, providing new ways to see, hear, and feel the world. Each story about encounters with others includes a description of the emergent affect and emotions, and how they helped shift my own outlooks and understandings. Sensing the expressiveness of dogs, the playfulness of crows, the tenacity of salmon, and the cooperative efforts of forest communities, helped me grow love for multispecies communities.

In the 1970's, psychologist Eric Fromm theorized *biophilia*—love for life—as a biological trait in humans.[20] Fromm argued that biophilia is an innate impulse, in contrast to necrophilia—tendencies towards destruction—caused by cultural and societal factors. He believed that modern life limits an individual's ability to shape respect for self and others, resulting in destructive thought and action. Fromm's view may be regarded as *biophilic ethics*, offering a way to intertwine love for life with applied practice for improved conditions. It includes the principle of goodness, rooted in respect for all that is alive, and a call for constructive growth and unfolding without force.[21] Fromm's writing emphasized human life, but it can be a starting point to expand ethics for nonhumans.

[20] Eckardt; Fromm.

[21] Ibid.

The concept of biophilia has been elaborated by biologist Edward O. Wilson in his 2009 book of the same title. Wilson focused on the importance of gaining knowledge about organisms and ecosystems, saying that "…knowing them well elevates the very concept of life."[22] Gaining knowledge on nonhuman life is important, but *how* we gain it is also crucial. Wilson neglected to take a critical look at his own field of biology which uses trapping, tagging, and culling for acquiring knowledge. These harmful methods create fear, injury or death for the nonhumans involved, and these harms effect their communities. Violent methods undermine the veracity of his call to 'elevate' views on life because means that endanger nonhumans for the sake of human knowledge do not fully taken into account what is at stake for those nonhumans involved.

Indeed, modern cultures have largely failed to provide ethics for nonhuman life involved in human activities because colonial cultures base ethics on what *humans* value. This leads to hierarchies of worth with regard to nonhumans, in relation to humans. Even animal welfare,[23] and some animal rights[24] advocate for certain animals based on traits that are important to humans, such as intelligence and sentience. The problem with these approaches is that they narcissistically value animals that are most like us (or like the ideal notion of the human) and, as a result, devalue other animals. In contrast, biophilic ethics accepts all living beings as intrinsically valuable, and advocates respect for nonhumans and their interests, families, communities, and cultures. Biophilic ethics is *inclusive*, rooted valuing diversity. It is an ethics reflecting the complexity of life emerging from the realism of evolutionary processes.

According to evolutionary theory, each species has evolved the capacities needed for flourishing within the ecosystems they inhabit. Claims of 'higher' or 'lower' lifeforms have no validity here; all beings have adapted to survive and flourish within conditions of their ecological niche. For example, salmon sense the Earth's magnetic fields, water movement, and the scent of oceans and streams; they navigate using the sun, seasons, landmarks, and currents. Their species-specific senses, perceptions and capabilities allow them to creatively carry out the migration projects that are necessary for their survival and growth in the various marine

[22] Wilson, 22.

[23] Grandin.

[24] Nussbaum; Regan; Singer.

ecosystems they habitat. By looking at life through the lens of evolution, it's clear that an ethics which values diverse minds and bodies is an ecological one.

Contemporary art and discourse can also be blind-sided by entrenched anthropocentric views. Today, many artists are exploring the challenges emerging from the Anthropocene, but some continue to espouse anthropocentric views and employ harmful methods.[25] For instance, the genre of bioart tends to limit its examinations to *human* challenges brought about by climate change and ecological destruction. Some bioart, involving nonhumans treats organisms as living art materials, resulting in violent and even lethal situations for the nonhumans involved.[26] The artists of these works argue for 'freedom of expression' and its benefit to themselves and to human publics in order to justify their harmful means.[27] I would argue that these practices are harmful for human publics too because they reinscribe outdated anthropocentric views that justify the objectification of nonhumans in the service of human cultural expression. Some of these artists claim that they are drawing attention to the power dynamics between humans and nonhuman animals.[28] They don't seem to see the problematics of instrumentalizing nonhuman life in order to draw attention to exploitation.

Likewise, art discourse, for the most part, has not made significant change to anthropocentric thinking in contemporary art. Post-humanist philosophy, such as Donna Haraway's, has been well-integrated into contemporary art discourse and, on first reading, seems to advocate for better relations with nonhuman life. However, if read through the lens of critical animal studies, even Haraway's thought is based on a utilitarian foundation which maintains hierarchical relationships with nonhuman life. Her philosophy falls short of fully advocating for nonhumans involved in human enterprises. Some of Haraway's more recent ideas are worth noting, such as the call to increase compassion for nonhumans.[30] But, while her philosophy advocates for new kinship models with lab animals and animals in agriculture, it maintains a hierarchical structure on which to build those 'new' relations.[33] In the end, her philosophy is human-centric. It does not

[25] Baker 2000, 2013; Davis and Turpin.

[26] Examples of exploitive artwork that presents living nonhuman animals in harmful and/or lethal situations include: *Biomodd [NYC4]* by Diego S. Maranan; *Rara Avis* by Eduardo Kac; *Cockroach Controlled Mobile Robot* by Garnet Hertz; *Theatre of the World* by Huang Yong Ping; *GFP Bunny* by Eduardo Kac; *Helena* by Marcus Evaristti*; Eres Lo Que Lees* by Guillermo Vargas*; Deeparture* by Mircea Cantor*; from here to ear* by Céleste Boursier-Mougenot; *Library for the Birds* by Marc Dion. Andreyev, 2016; Gigliotti 2009, 2015a, 2015b; Phillips; Baker 2000.

[27] In particular, artists Eduardo Kac, Huang Yong Ping; Marcus Evaristti; Guillermo Vargas. Baker 2000, 2013; Gigliotti 2015a.

[28] For instance, artists Marcus Evaristti; Mircea Cantor; Marc Dion; Guillermo Vargas. Baker 2000, 2013; Gigliotti 2015a.

[30] Haraway 2016.

[33] Haraway 2008.

take into consideration what it's like for those nonhumans, and whether there is the possibility of an ethics of autonomy to be extended to nonhumans involved in human enterprises.

Ethics of autonomy has been well developed in research environments involving humans. At its core is respect for the participants' right to refuse. For a moment, imagine applying ethics of autonomy for nonhuman animals involved in the laboratory or the food industry. Would these animals choose to participate in the harmful or lethal situations presented to them? Or would they protest their conditions using tactics such as self-defense or escape? Some people would argue that it's impossible to implement an ethics of autonomy for nonhumans because humans don't know what the nonhuman animals are thinking or feeling, and therefore would not be able to recognize a refusal to participate. I'd say that recognizing the agency of nonhuman animals can begin quite simply, by paying attention to signals that we all empathically intuit, such as whole-body gestures—movements away from a situation—and these clearly articulate a refusal to engage.

In order for humans to understand more subtle signals from nonhumans, an ethics of autonomy would need to incorporate interspecies communication. Animal ethics philosopher Eva Meijer writes about the myriad historical instances of nonhuman communications and how, if we examine the interspecies context, can begin to understand what nonhuman animals are telling us.[35] The challenge for humans is to develop a willingness to communicate with nonhumans *on their terms*.

There are current models inside and outside of art that incorporate communication ethics. An example from contemporary art is Mari Keski-Korsu's "Alpaca Oracle" (2014-15), a participatory artwork that invites humans to mingle and communicate with alpaca, but only if the herd decide they want to. [36] The communications from the herd are interpreted by an onsite animal communicator. In the field of neuroscience, biologist Gregory Berns has developed an method to work with dogs in fMRI environments in order to understand how they're feeling. His team uses ethics of autonomy for the dogs who are given the opportunity to choose whether they want to participate.[37] Dogs who show distress in the research stages are given the opportunity

[35] Meijer.
[36] Keski-Korsu.

[37] Berns. Other examples can be seen in the work of Jane Goodall, Con Slobodchikoff and Marc Bekoff expanded in later chapters in this book.

to go home with their human companions. The field of cognitive ethology and some naturalist methods include deep observation and attention to context in order to gain knowledge about nonhuman communications. An early example is Jane Goodall's work in the 1970's with chimpanzees in Gombe, Africa where she learned to understand the gestures and vocalizations of individuals within their natural habitat and communities. Through her respectful interspecies research, she was able to contribute tremendous knowledge to primatology which led to improved respect and care for these species. More recently, Marc Bekoff has studied how canids use gesture and scent as their primary communication modality, and Con Slobodchikoff has researched prairie dog vocalizations to find that it includes information about other species, their shape, size and colour, and from which direction they are approaching. Likewise, ornithologists have discovered that some wild bird species have complex vocal and gestural communications indicating a potential wealth of knowledge about avian languages. By using respectful methods to explore nonhuman communication it may be possible to develop kinships with nonhuman life that doesn't involve exploitation and harm.

In the interspecies art processes of my *Animal Lover* body of work, I've adopted ethics of autonomy and communication methods for the nonhuman beings participating in the projects. To begin, I find ways to understand some of the one-way communications from animals and plant-life, by looking at research about those species, combined with my own close observation. These approaches help me evaluate whether my presence, or the situation I am presenting, is acceptable or whether the other beings are signaling a refusal to engage. This is a first step that can lead to negotiations into further engagement and involve two-way communications. For example, I got to know Tom's and Sugi's gestures, facial and vocal communications, and was able to find ways to respond to them using my own gestures, facial expressions and vocals which could be understood. This led to fun and interesting collaborative projects for all of us. With my crow neighbours, we've developed two-way communications using objects—stones and other items—that carry shared meaning between us. This has led to interspecies projects including my current research and artwork with local birds called *Bird Park Survival Station*. Interspecies communication is key to inviting nonhumans to participate, and recognizing their willingness to engage. Using this approach, I've been able to see and hear unpredictable creative responses based on reciprocity, and this has led to new forms of democratic art.

It's my belief that all lifeforms are creative, each responding to their world in innovative and intrinsically valuable ways. One of the first naturalists to describe nonhuman creativity was Charles Darwin who wrote about earthworms, birds and plants who responded to new situations and materials.[38] Today, some biologists are writing about the creativity of lifeforms and their innovative responses to environmental and social factors.[39] Even trees are being talked about has responding creatively to conditions. For instance forest trees respond to emergent stresses of other trees by generating nutrients and sharing these, via the underground mycorrhizal network, with their neighbours.[40] Philosophers are also describing the creativity of plant life[41] and nonhuman animals.[42] For example, Brian Massumi writes about animal play with its improvisational creativity and communications, each player responding to the other's moves—pounces, bumps and chases—using on the fly metacommunication throughout the event as commentaries on their actions. Yelps, play-bows and pauses, re-establish an understanding with their partner that their actions are playful. They let the other know, using feedback and reassurances that their nips and tumbles are not intended to harm. Being immersed in play is a social situation, the players must rely on empathy to understand and appropriately respond to their partner. Humans can also develop their empathy to gain insight on how to respond appropriately to nonhumans.

Empathy is key to connecting with others because it allows for felt-knowledge about what the other is experiencing, and this is crucial for social species, such as dogs, fishes, crows, trees and humans. Cognitive ethologist Marc Bekoff developed an empathic approach, called biocentric anthropomorphism, which he used in his field studies with canids.[43] He described it as critical anthropomorphism, considering the other beings' points of view, taking into account knowledge about their perceptual, emotional and cognitive capabilities. For example, feeling-like-a-dog, or thinking-like-a-wolf was a way for Bekoff to gain a better understanding of what was going on with the individuals he was researching in the field. In terms of interspecies art processes, empathic techniques can be applied where considering the others' states of mind

[38] Crist.

[39] Balcombe; Bekoff 2004; Goodall; Slobodchikoff; Wohlleben.

[40] Wohlleben.

[41] Marder.

[42] Massumi.

[43] Bekoff 2000.

and feelings are crucial. In my collaborations with Tom, feeling-like-a-dog was an important technique to understand his emotions in certain situations. For instance, I let my empathy run and feel the euphoria he experienced jumping and catching a ball. This communication ethics informed our collaborative processes for the project *EPIC_Tom*. Similarly, thinking-like-a-crow helped me create an unobtrusive video and sound recording system to document the creative activities of the birds and therefore gain insight into their lives. By emotionally and imaginatively entering into the experience of another, more-than-human ways of knowing and creating can happen and help expand human outlooks on life.

Interspecies art also involves lessons on loosening human constraints, and thereby creating more open situations for nonhuman participation. This indetermancy method has its roots in the Fluxus art movement of the 1950s and 60s. John Cage described it as a process for diminishing authorial control, favoring less predetermined conditions.[44] Applied to interspecies art, it can be a process that allows for the diminishment of *human* control, in order to foreground *nonhuman* contributions. It can involve developing a simple set of instructions, based on existing knowledge about other life, for the human artist to use in order to set up respectful conditions for nonhuman encounters. Also, it encourages a diminishment of preconceived ideas in favour of emergent nonhuman responses. Therefore, it creates space for recognizing more-than-human creative contributions. For example, in my field recording sessions within a forest community, I used a simple instruction “sit still and listen while recording sound for 2 minutes.” The instruction allowed for me to assume a passive and respectful role—sitting quietly and listening—while the soundscape of the forest could be recorded. The recorded results are indeterminate in that they are not determined in advance. Instead, they are realized through the motivations of the calling animals and soundings of trees and other life forms. Using this technique, the will of the human artist (me) is held in check, and the agency and creativity of nonhuman participants emerges. Indeed, listening is a key method I use in all my field work. It has helped me expand my perception because it involves making-time, slowing-down and taking-in the emergent creativity of life around me.

Each chapter in this book describes forms of relating with animals and plant-life using these interspecies art processes. It also includes critical reflections on how nonhuman contributions

[44] Jaeger.

can be represented in text, sonic and visual forms. The chapters are structured in relation to four *Animal Lover* projects: dogs contributing lead vocals and animations in *EPIC_Tom*; crows co-creating a music score for *Crow Stone Tone Poem*; salmons co-directing cinematography for *Salmon People*; and trees, birds, insects and frogs tuning the biophony of the forest for *Biophilia*. Each nonhuman encounter takes into consideration the physical involvement of those creatures, and critically considers how they may be represented in the artwork. This coupling of ethics of engagement and ethics of representation is crucial to modelling improved conditions for viewing-reading-listening publics.

Representation plays a key part in how other beings are thought about in culture. In Eurocentric speech and text, nonhumans are usually described using the pronoun *it*. This has a deadening effect for living beings because the use of *it* aligns them with nonliving, inert objects. In contrast, some indigenous languages use lively pronouns, such as *he*, *she*, *they*, to reflect nonhuman vitality.[45] Indigenous scholar and botanist Robin Wall-Kimmerer describes how her Potawatomi language is made up of animate and inanimate verbs representing human relationships with living beings vs nonliving objects. A different verb is used for hearing a blue jay versus hearing an airplane, thereby "distinguishing that which possesses the quality of life from that which is merely an object. Birds, bugs, and berries are spoken of with the same respectful grammar as humans are, as if we were all members of the same family. Because we are."[46] The use of appropriate pronouns to describe life is a form of representation that can help mend the human / nature divide.

In this book, I've opted out of the use of the word *it* to describe other living beings, instead using *him*, *her* or *they* to refer to individuals. I use the term *animals* occasionally, mostly in contexts where its use includes humans. While I do use the term *nonhuman* so characteristic of contemporary discourse, I acknowledge its limitations. It suggests other beings as inversions of humans, potentially reconstituting the binary represented by human / everyone-else. I prefer the word *beings* or *lifeforms* for their inclusiveness. I use *more-than-human* as an expanded view on life that includes humans and everyone else.[47]

[45] Bai; Kimmerer; Stuckey.

[46] Kimmerer, 4.

[47] Abram was one of the first theorists to use the term more-than-human.

Careful representation also involves critical approaches to visual and sonic depictions of other lifeforms. In this book, representation is handled through reflections on the choices made with regards to the art approaches used the projects. Ethics of representation for nonhumans involved in art involves three interconnected questions:

> *What kind of respectful processes can be put in place for the beings involved?*
>
> *How are the respectful processes used in the interspecies encounters evidenced the artwork itself in order to model improved ethics for nonhumans?*
>
> *How are the nonhumans' creative responses depicted in the artwork, thereby representing the creativity of those beings for viewing and listening publics?*

The chapter "Dogs" details how these questions were explored in the first *Animal Lover* works carried out with Tom and Sugi. The research between the dogs and I helped establish the methods used in subsequent projects with birds, fishes and forest communities in and around my neighbourhood and region.

Steve Duguid, (the environmental historian who called for "radical sensibilities" referred to earlier), examined the importance of locale in rethinking ideas of connectedness and kinship. He exemplified this with historical examples of John Muir and Aldo Leopold who developed lasting respect for beings and natural systems through practices of *being-with* other animals in their native habitats.[48] We have the best chance of changing outlooks if we take notice locally, and act within our immediate communities, including multispecies ones. In the following chapters, thinking and doing in-place is explored within respective ranges of ecological locatedness—the home, the neighbourhood, the territory, the planet.

The first chapter "Dogs," gives examples of day-to-day cohabitation with Tom and Sugi as well as our significant shared experiences. It begins with the story about meeting Tom, and how getting to know him influenced how I thought about other animals. Being with Tom made me consider other animals' emotional states and their rich inner lives, and this led to my adoption of vegetarianism and veganism. As I became aware of the culture's normalization of violence towards animals, I could no longer reconcile how one species (dogs) can be treated with care,

[48] Duguid.

while animals raised for meat can be so readily exploited. Adopting a plant-based diet was a way for me to take immediate action against the harms of carnism.[49] A plant-based diet is also much healthier for the planet, with a potential to significantly reduce greenhouse gases, global hunger and poverty, deforestation, and harms against nonhumans. Indeed, the 2018 report by the Intergovernmental Panel on Climate Change lists meat production one of the top contributors to green-house gases. The report advocates for the adoption of plant-based diets in order to reach zero emissions by 2050. [50]

The chapter "Dogs" weaves my interpersonal relatings with respectful human and canine discussion into an argument for ethics of autonomy for nonhumans involved in human activities. The chapter includes biological and naturalist research that supports a much needed upgrade on thought about other beings' communications. It covers the creative processes of *EPIC_Tom,* a performance and installation collaboration with Tom and Sugi, that uses new media technologies, such as motion capture, live computational animation, and electro-acoustic processes to reveal the dogs' creative expression. The performance involves the participation of other musicians, and incorporates sound art approaches such as listening, improvisation, call and response, and musicking.[51]

In 2018, the WFF "Living Planet Report" released information about the 58 percent decline in wild vertebrate animal populations between 1970 and 2012, as a result of growing of human populations and human development. [52] The report anticipates a two-thirds decline by 2020. Deforestation for agriculture and development has significantly diminished wild spaces, and this has been deadly for many nonhuman populations. Some surviving populations enact creative strategies by adapting to urban and rural areas. This is evident in my Vancouver environs where raccoon, deer, bear, coyote, skunk, squirrel, eagle, hawk, heron, geese, sparrow, finch, woodpecker, raven, crow and others attempt to coexist with humans. Many nonhuman animals use liminal spaces; they travel through green margins, fly from tree to tree, work at night, and generally avoid human contact. [53] But sometimes these strategies don't work and local

[49] See Castricano and Simonsen for important essays of veganism and activism; Joy writes about the normative culture of carnism.

[50] Carus.

[51] Small theorizes the practice of music making as a social one, and coined the term musicking to acknowledge this relationship.

[52] Grooten and Almond.

[53] Coyotes who inhabit the city have reversed their diurnal cycles so that they hunt at night and sleep during the day in order to avoid contact with humans. Hart.

authorities use lethal measures. For example, in the Oak Bay area of Victoria, a city close to Vancouver, deer are regularly killed, by order of City officials, as a result of complaints by human residents whose tulips are nibbled.[54] The chapter "Crows and Stones" looks to crows for wisdom on peaceful coexistence with urban living animals. It covers the processes of the project, *Crow Stone Tone Poem* (2016-17), created with the crow couple who inhabit the territory that includes my home. The project started when one of the crows began communicating with me, initially leaving a stone gift to signal appreciation for the fresh water I provided. As a result of this exchange, we developed interspecies play, using pebble arrangements, each taking turns to adapt each other's arrangement. The creative processes of the pebble-play were developed into a music score. This chapter elaborates on the crows' use of stones, and other gifts, as means to communicate with me. It includes naturalist observations and ornithological studies on the species' ability to recognize and respond to individual humans, and use objects for interspecies communication.[55] The significance of stones as meaning-making material is elaborated in this chapter through a critical look at Japanese dry landscape practice (*karesansui)* where stones are used to represent natural water features. *Karesansui* provides a context for the crow's stone gift as an object of shared meaning in relation to the water I left for the birds. This chapter also includes the subsequent interpersonal events between the crow couple and myself, and how this led to my current and ongoing slow-art multispecies research project *Bird Park Survival Station* involving local and migratory birds.

The chapters, "Salmon" and "Forest", take a look at Westcoast salmon and old-growth trees, and their native environments which are diminishing because of human development and industry and the effects of climate change. The chapter "Salmon" describes the production processes for my public art project *Salmon People* and the interspecies creativity, with fishes, that emerged. The project's research stages, with the physical participation of the Adams River sockeye salmon population, had a profound impact on my outlook on fishes. I learned that sockeye salmons undertake a variety of amazing migration projects over their lifetimes: young ones find their way to the ocean from their natal lake, and adults to find their way back to their birth place using scent and other perceptual abilities. By understanding the capabilities of these fishes I gained a new sense of wonder and respect for difference and wildness. The chapter

[54] Bains.

[55] Kilham; Marzluff and Angell.

winds-in marine biology research about salmons, and the ecologies of the Fraser River—a water system that supports aquatic life, along with forests, grasslands and marshlands that run along its sides—with a critical reflection on current anthropogenic stresses affecting the Fraser River ecosystem. The chapter describes how the sound and video content from the river and fishes, combined with computational techniques, helped create *Salmon People*, a generative public art display representing the interconnected lives of salmons and humans.

The last chapter "Forest" explores the consciousness and connectedness of old-growth trees, and the multispecies happenings in a regional forest. It's structured as a walk in the woods, with Tom and Sugi, in a Pacific Northwest forest. Forests are a good place to get a sense of the interconnectedness of life particularly now as knowledge about their crucial value to climate change reversal becomes evident. In particular, old-growth trees are crucial because they breathe in vast amounts of carbon from the atmosphere, provide habitat for countless forest beings, increase water contributions to Earth's rivers, survive forest fires, and cool the air. This chapter includes forest ecology research which takes a critical look at how over-logging has had a dramatic effect on biodiversity and climate change.

In "Forest," the global is brought to bear through the micro: realms inhabited by bacteria, fungi and phytochemicals from trees. The chapter entangles microbiology and plant behaviour research with art methods, inviting readers to imagine the complex vitality beneath the forest floor. Walking, using mindfulness and embodied techniques—such as listening, observing, feeling, and imagining—helped me get a sense of the interconnectedness of this multispecies community. These processes informed my interspecies project *Biophilia*, a generative installation that uses sound and video recordings from the forest, theremin soundings, and computation to model the biophony and ecological patterns of relating between humans and forest inhabitants.

This book is an invitation to readers to step into more-than-human worlds, re-sense life, and re-think their relationship with the planet and all its inhabitants. The aesthetic encounters with dogs, crows, fishes and forest beings asks readers to slow down, look around and listen—and *feel*. Love for life is practiced by all beings in their lively projects. It's what joins us together in the relational flourishing that is the vital wondrous complexity of the Earth.

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Dogs

We and all animals with whom we share our time and space should be viewed as friends and partners in a joint venture where we enjoy an egalitarian give-and-take relationship.

—Marc Bekoff [56]

Go look at your dog. Go to him! Imagine his *umwelt*—and let him change your own.

—Alexandra Horowitz [57]

[56] Bekoff 2007a, 164.

[57] Horowitz, 297.

Dog lessons

Fig. 1. Tom at nine weeks old. Photo courtesy of Greg Snider.

March 17, 2004—practically spring—but there were still patches of snow dotting the hills on the sides of the road. The air cooled as I ascended the Coquihalla Highway, my destination the toll-booth, between Vancouver and Merritt, where I would meet Valerie. I brought along a small dog

kennel because my plan was to put the puppy in the kennel for the ninety minute return journey home. I approached the toll building, and found a place to park. I walked across to the other side of the road to Valerie and we exchanged greetings. I gave her cash, and she handed me the pup. As I took him in my hands, I realized it was the first time I'd held a puppy. He was only eight weeks old, but already strong. "He's bigger than I thought!" was all I could say, his warmth and softness already giving me an overwhelming sense of comfort.

He had no collar or jacket, his fine black fur the only thing between his skin and the cold air. I mentioned the kennel to Valerie. "Oh, he won't be happy in there. He'll probably cry," she said. She explained that he was used to being close to her, and he would expect that of me. She reached into the back seat of her car and pulled out an old flannel shirt, something familiar for his transition to a new home. We parted, and the pup and I began our drive back to Vancouver. He was curled up on the shirt in my lap, and I could feel his body relax as he fell asleep into a sense of trust. After a while, we pulled into a rest stop and he wandered around sniffing the grass. He did his business and I gave him a drink of water. He looked up at me, probably wondering who I was and what we were doing there. He allowed me to pick him up and continue the drive home.

As a child, I didn't have a dog of my own. But when I was six or seven years old, my older brother Alex, got a dog. He was married and had an apartment a few blocks away. Soon after getting Sprinky, he was hired to teach at a school in New Zealand, so he and his wife had to move. He gave Sprinky to an elderly neighbour, Mrs. Pettijon, who lived down the street from me. She called him Sprinkley. Most days after school and on weekends I'd go get Sprinky and bring her home to play with me in the backyard. I grew to love her and she became my best friend. When she was four or five years old, she developed a cancerous tumor on her forehead—probably caused by the flea collar she continuously wore, and she died shortly afterwards. I don't remember grieving her death, but I do know that I avoided seeing her in those last days of her life. Probably the thought of her death was too much for me to bear. I didn't develop any other friendships with dogs until much later. When I turned 41, the need for dog companionship unexpectedly surfaced again. I wanted to feel that special friendship of a canine, and continue my growing up where I had left off.

It didn't take much to convince Greg, so we started researching breeds, discussing the size of certain dogs and their features. At the time, it didn't occur to us to adopt a rescued dog, instead of purchasing one from a breeder. We were naïve, unaware of the many millions of existing

dogs that needed homes.[58] Instead, we based our decision on my allergies and our limited outdoor space. We settled on a miniature schnoodle puppy—a non-shedding schnauzer-poodle breed—that would grow to 20 or so pounds. A new puppy would need to be house-trained. For the first few weeks, they'd need access to the outdoors every two hours. Our tiny Japanese garden in the back of the house could accommodate this training, but for play and walks we'd use the park across the street and the neighbourhood.

We found Valerie online. She lived about a hundred miles away but we corresponded with her, and she sent us information about her two breeding dogs—a schnauzer and a schnoodle—and their puppies. She had a pen in her yard for the dogs and their pups. In the evenings, she'd bring everyone inside her home for warmth and safety. She quizzed us on our ability to care for a puppy, and what kind of outdoor space we had. Satisfied with our situation, she sent us pictures to decide which puppy we wanted. The pups were only five weeks old, and still dependent on their mom, so even if we chose one, we'd have to wait another three weeks until they were fully weaned. One photo was of a black puppy with a little white star on his chest. He looked directly at the camera with an inquisitive gaze. He was the one.

This chapter focuses on canine-human relationships for lessons in kinship and creativity. It includes my own personal experience with my companion dogs, and how they helped transform my home-life, the choices I made, and the art work I produced. Our lived experiences inspired the first instances of my body of art called *Animal Lover*, and help shift my practice to the interspecies art and ecology research I'm doing today. In the studio, the dogs and I developed a system of two-way communications using touch, voice, facial expression, gesture and movement. We also developed an ethics of autonomy so the dogs could freely choose to participate in the emerging artwork. Making *EPIC_Tom* (2014-16) together inspired me to consider how art can offer more-than-human ways of knowing for public audiences.

Early days

After I returned home with the pup, Greg and I fed him and played with him. We let him roam around the house, showed him the Japanese garden in the back of the house, and encouraged him to use it. After he got familiar with the space we prepared him for sleep. The few articles

[58] The US produces 6,200,000 puppies per year from household births, small breeders and commercial breeders. The majority of dogs, 4,000,000, spend part of a year in an animal shelter, and 2,400,000 are euthanized or die in these shelters. Coppinger and Coppinger. While these statistics reflect US numbers, they are probably indicative of Canadian numbers as well. Clearly, there's a need to adopt dogs rather than breed more.

we'd read about dog training advocated against new puppies sleeping with their humans. They said that if the dog is kept apart, they would learn to be independent. So, Greg and I made a plywood pen, located by the front door and close to our bedroom, and furnished it with newspaper, a dog bed, blanket, and soft toys. We put the puppy in the pen and headed to bed. After ten minutes, I heard whining and, within seconds, little feet running down the hall to the bedroom. The puppy found my side of the bed, stood up on his hind legs, and reached up with his front paws towards me. That was my first lesson in canine communications. Clearly, he wanted to be with us and this desire motivated him to call out to us and, when we didn't respond, make an effort to climb out of the pen to find us. Greg got up, added another board to the fence surrounding the pen, making it higher and more difficult to climb. We put the puppy back in and returned to bed.

He cried for hours. We tried to ignore him. I felt terrible—his first night away from his parents, in a new home and forced to be by himself. Greg and I hoped it would get easier. Finally, we all fell asleep.

The following night at bedtime, we put him back in the pen. He whined even louder than the previous night. After a few minutes, I heard a scratching sound and then little feet running down the hall to the bedroom. Despite his size, he'd managed to climb the half-metre tall fence. He came around to my side of the bed and sat there looking at me. I couldn't stand the thought of rejecting him again and listening to his cries. So, I picked him up and made a little space by my pillow. I covered him with a light blanket, and he fell asleep. I stayed awake for a while listening to his soft rhythmic breathing. We were all much happier. Since then, he slept on the bed with us every night.

The next day, we named him Tom, after Thomas Bernhard—our favorite author at the time—and Mark Twain's character Tom Sawyer. The name fit what we already knew about his critical attitude, tenacity and adventurous spirit.

In subsequent weeks, I kept Tom close. I'd even take him to class on the days I had to teach at the University.[59] According to a sign on the door, 'pets' weren't allowed in the building, but I brought him along anyway. I carried him in a bag that looked like a satchel and allowed him to be tucked away, hidden from view. In the classroom, I'd set the bag down on the desk and Tom would crawl out. The energy in the classroom would immediately relax. Any tension evaporated

[59] Emily Carr University of Art + Design (ECU), Vancouver, Canada.

as the students became transfixed by his presence. They liked having him there, and he liked being in the class. He'd get passed around and cuddled, and then rest on a blanket on the desk. At lunch and during breaks, I'd take him outside to a nearby park and he'd walk around sniffing the plants and using the grass. Sometimes I'd visit the administrative assistants in the President's office, and they'd stroke and admire him. He never barked or cried. It was clear that he enjoyed being near me and interacting with my students and colleagues. He became well socialized and accepting of all humans and this paid off later in life.

During his first year, his vitality expanded. He seemed to need continuous physical and cognitive challenges. If he wasn't satisfactorily engaged, he'd take out his frustrations on objects around the house, or on me. He'd attack pillows, socks and shoes as though they were prey, pouncing on them, biting and giving them a quick shake. With his sharp baby teeth, he'd snap at the bottoms of my pants as I'd walk around the house, sometimes catching my ankle in the process. When I'd work in the Japanese garden, he'd 'help' by furiously digging holes around me. In the evening, when we'd let him out for a pee, he'd run tight circuits around the garden's perimeter, dispelling any pent-up energy. Because of his perpetual liveliness, he was always hungry. Even after being fed, he'd sit and point with his nose at the kitchen counter, asking for more.[60] That was my second lesson in canine communication. Tom was quite capable of communicating what he wanted, and letting me know if his emotional, cognitive and physical needs weren't being met.

In order to channel his energy, we developed strength and skill-building activities. Some were beneficial, but others had a negative effect on his health. We attended puppy school where I learned to ask him to *come*, *sit*, *heel* and generally pay attention to me. At home, we taught him to *go see Greg*, or *go see Julie*. We taught him to *get the mail*, and bring the appropriate envelops to Greg or myself as requested: *give it to Greg* or *give it to Julie*. He accommodated—mouth to hand. He even learned to anticipate our requests. When he'd hear the letter carrier put the mail through the slot, he'd run downstairs and retrieve the envelopes. We rewarded him with positive reinforcement, using verbal praise and small treats. In all our training sessions, we'd end on a well-accomplished task, a technique used to reinforce positive memories. We never used punishment for incorrect responses or behaviors. If he didn't respond to a request, we'd try

[60] Pound for pound, dogs eat more than humans, generally twice as much. This is because the normal canine body temperature—101.5 degrees Fahrenheit—is higher than human's 98.6 degrees Fahrenheit. It takes more calories to maintain this higher temperature. Dogs who spend time outside in cold temperatures have to generate even more heat and so they eat more. In terms of weight, active puppies need two to three times as many calories as a resting adult dog. Coppinger and Coppinger.

a different approach, or move on to a different task. If he responded aggressively towards us, such as with biting or scratching, we'd let out a little *yelp* to let him know it was painful. We had learned that dogs use yelp feedback in play sessions with each other in order to communicate their discomfort. A too aggressive dog will learn from the yelp of a partner, and will temper their play to reduce potential harm.[61] This seemed to do the trick for his biting behaviour.

Tom loved the play and training sessions, and he'd let us know by laughing. His laugh, like all dogs, is a series of short breathy exhalations.[62] I found it infectious; when I'd hear his laugh, I'd laugh too.

[61] Bekoff 2004; Horowitz.

[62] Horowitz.

Fig. 2. Tom as a pup learning to catch a ball. Photo courtesy of the author.

We used jump and catch games to develop eye-to-mouth coordination and core strength. Tom became an expert at catching small bits of food tossed to him from the kitchen. He also learned to jump and catch balls in mid-air. He could do it for hours. At the park, he developed a keen interest in chasing airborne toys—balls, sticks and frisbees. As he ran after them, his body would take on a compact aerodynamic shape, his back and head inline, legs moving at top speed to intercept. He'd use a similar technique to chase squirrels, despite my protests.

We developed different kinds of jumping games. One involved a stick held at waist level, with Tom jumping and grabbing the stick in his mouth. He was only as tall as my knee, so this was a considerable accomplishment. He concerned himself with grabbing the stick, not my hand. He could do this over and over. After a while, the repetitive jumping and the intense ball chasing, took a toll on his back and we noticed changes in his movements.

Sometimes during a chase or jump, Tom would abruptly stop. Panting, he'd look over at me with a worried expression on his face. He'd refuse to do anymore. In the evening, he was reluctant to jump onto the bed. Instead, he'd stand and wait for me to pick him up. The next morning, he'd hobble up the stairs to the living room, one step at a time. If I tried to touch his back or hind legs, he'd growl and snap at my hand. I interpreted these signs as an expression of pain. We took him to the vet.

X-rays showed a smaller space between one set of vertebrae in the middle of his back. The vet said he may have a chronic muscle spasm or injury due to stresses on that part of his back. The vet advised us not to play ball every day and not to do any jumping for a while. He warned that dogs will chase at top speeds and jump even if they're in pain, thereby exacerbating their condition. We reduced the running and eliminated jumping games. Each morning, I'd use gentle massage on his back which I'd learned from a canine masseuse. It took time for him to trust my touch. I learned that it was important to be consistent with the pressure and duration of touch, otherwise he'd anticipate pain and bite at my hand or move away. When I'd massage correctly, he'd express his gratitude by licking my hand. If I stopped too soon, he'd ask for more by gesturing with his front paw. His overall movements improved, he stopped favouring his back and legs. He began to enjoy his massages. If he felt the need for one, he'd sit at my feet and present his back to me.

Despite his small stature, Tom's athleticism resulted in a body weight of 23 pounds, heavier than any other miniature schnoodle we came across. This meant he was now too big and heavy to carry in a bag and bring to school. Greg and I didn't like the idea of leaving him at home alone

when we went to work. I learned that young dogs can get anxious or bored if left by themselves while their humans are away.[63] We knew he could only tolerate being alone for an hour or two before chewing rugs and shoes. We arranged a doggy daycare, and I took Tom there when we had to teach. He enjoyed this, but after a while, the facility demanded he be kept up-to-date with vaccinations for the dog flu called Bordetella. At the time, I was skeptical of the benefits of these vaccinations because, according to my naturopathic vet they could inadvertently cause health issues, such as life-long allergies.[64] Instead, we decided to get a second dog as a playmate and companion for Tom. We understood that it would mean more work, but we hoped the dogs would keep each other company while we were working.

The new pup resembled Tom in body shape, facial features and size, but had a completely different character. He was less rambunctious, more thoughtful. Inspired by his red-brown fur, and his Zen-like demeanor, we named him *Sugi* after a species of Japanese cedar. We imagined Tom would welcome Sugi to the household. Instead, he protested Sugi's existence. Tom would growl at Sugi or deliberately ignore him. Being good natured, Sugi would playfully nip at Tom's legs, and then leap under the sofa to escape his wrath. This annoyed Tom who would bark and dive under the couch after Sugi, and then chase him around the living room. Sugi loved this attention from his big brother.

[63] Coppinger and Coppinger; Horowitz.

[64] Views within homeopathic medical practice suggest that vaccinations can cause over-stimulation of the immune system in some dogs leading to allergies and other ailments. This is a controversial view, but continues to inform some homeopathic veterinarians. Goldberg; Hamilton.

Fig. 3. Sugi as a pup. Photo courtesy of the author.

It took about 2 weeks for Tom to accept Sugi and start playing with him. After a tumble or chase, they'd curl up on the arm chair, or lay side-by-side in front of the fireplace. Tom became protective of Sugi, and would even help him avoid risky situations. For example, Sugi would always want to go meet new dogs. If he saw a dog at the off-leash playing field, he'd throw himself into a charge at top speed towards the dog. Tom knew this was not a good idea. A charging canine may cause alarm in the other dog, and elicit an aggressive response. So, Tom would run after Sugi. Being larger and faster, Tom would easily catch up, and when he did he'd

shoulder-bump Sugi just enough to slow him down, and steer him off his direct course. Tom's interception modified Sugi's charge creating a slower, more polite approach. After I observed this a few times, I mentioned it to our dog-walker Judy Lopes. She confirmed that it's common for a more knowledgeable dog to teach a less experienced one. That information gave me pause: Tom was anticipating a problematic outcome, and using empathy to help Sugi avoid a potentially dangerous situation.

As Tom and Sugi and I became best buddies, we developed creative games together. One was the *name-game*, involving verbally asking each dog to retrieve a named toy from their toy basket: *Tom, where's the meteor?* Tom would growl as he poked around in the basket. He'd pick up the appropriate blue knobby ball in his mouth and drop it in front of me. If Sugi had trouble understanding which item I was asking for, he'd just grab the last toy Tom mouthed and present it to me. Tom would get annoyed at this and vocalize with a short forceful bark—*I know the answer!* If asked, Tom would quickly present the correct toy. Because Sugi was not good at remembering the names of the toys, I'd have to spend more time with him in these sessions. Tom would protest by articulating three quick forceful barks, communicating his displeasure about the unfair allotment of attention.[65] At the end of the *name-game*, after all the toys were retrieved, I'd ask each of the dogs to put the toys back in the basket. They'd grab each one and hurriedly attempt to drop them over the rim. In their excitement, they'd often miss the basket, and the item would bounce outside. Regardless, they'd sit and expect a reward for a job well done.

Observing Sugi's interactions with other dogs, humans, and objects I learned that he had quite a different character from Tom. He'd have to work harder in social situations. When he'd approach unfamiliar dogs, they'd often growl or snap at him. He avoided being touched by other humans. He was fearful of unfamiliar objects around the house and would react to loud sounds by running away, or crouching close to the ground with his knubby tail between his legs. But despite his social awkwardness and fears, Sugi was keen to learn new things. In particular, he loved to hike in the forest and use his scent perception.

On hikes, Sugi was fearless. He'd boldly run ahead, stop and sniff along the way. His cedar-brown fur camouflaged him against the tree trunks and dirt trails. Because he so loved the forest trails, we decided to enroll him in a couple of scent-tracking classes. Sugi found these

[65] Both Bekoff (2004) and Horowitz discuss observations of justice and fairness in canines.

exhilarating! His eyes would grow wide as I'd point to the ground and say *search!* He'd focus his nose on the dirt, and quickly sniff out the appropriate direction to get to the item I'd stashed in the underbrush. When he'd locate the item, he'd point with his nose and sit—the gesture for *I found it.* I'd reward him with a treat and praise. Later, I adapted the game for him to find chanterelle mushrooms. He found this less interesting, but accommodated me. I'd ask him to *find the mushroom*, and he'd wander over and point at it. Then, he'd get distracted by a more interesting odor.

The scent-tracking skills had a lasting influence on Sugi. Even today, on our walks in the neighborhood, he'll take his time sniffing every little thing along the way.[66] His focus on the immediate world was a lesson for me in mindfulness. It taught me to slow down, take time, and enjoy the journey. It also helped me understand that dogs also enjoy the present, not only the anticipation of the destination.

Our walks became teaching moments. I learned that dogs like to walk off-leash. It gives them the ability to travel at their own speed, to stop and sniff things that might interest them. We taught Tom and Sugi to walk responsibly off-leash. They'll stop at the corner, and wait until I gave the *OK*. They'll respond to *nice walks* by walking at my side. Tom became a more responsible off-leash dog, so sometimes I'd ask him to *help Sugi* by walking cooperatively. This involved connecting them to each other with a short lead. Tom takes charge, walking slightly ahead of Sugi, stopping at the street corner and waiting for my *OK*. Tom gets satisfaction from this job, and Sugi enjoys walking with Tom. It took a few months to develop the cooperative walking, but it paid off. The dogs were able to travel without being attached to me, and they could better investigate their interests along the way. This gave them a sense of autonomy.

[66] Horowitz argues that dogs are not necessarily inclined to be scent-trackers without training.

Fig. 4. Sugi and Tom walking cooperatively together on their own lead. Photo courtesy of the author.

The early experiences with Tom and Sugi were lessons on understanding their emotions, their thoughts and intentions, and how they communicated their inner lives. The dogs, in turn, learned about my intentions, emotions, and how I communicated them. This communicative reciprocity influenced the depth of our companionship, and led to a meaningful working relationship. We began collaborating on numerous projects which developed into art processes carried out in my studio, motion capture, sound recording and TV studios, in the urban streets, and in forest environments. Later in the chapter, I'll narrate some of our most significant collaborative events. But first, I'll give a context for our relationship by detailing what is known about canine-human communication capabilities. This knowledge helped lay the foundation for our interspecies creative work.

Dog communications

Dogs originated from wolves around 15,000 years ago, during the Mesolithic period.[67] We know this because dog remains have been found in human settlements of that period. One theory about dog evolution suggests that they adapted from wolves through incremental stages of

[67] Coppinger and Coppinger.

cohabitation with humans, over generations.[68] Initially, groups of wolves took advantage of human refuse dumps as places to find food. They developed a commensal relationship with humans, living in proximity, but far enough away to maintain autonomy.[69] As humans began to understand the benefits of these animals, they brought them closer into the human settlements, for companionship, work and security. Cohabitation would have required two-way communications in order make requests of each other and to develop social bonds. The dogs, and the humans, would have adapted to accommodate this relationship. Over time, the animals would have undergone physical and cognitive changes, eventually resulting in today's dogs who are quite different in their behaviour from their wolf ancestors. Living together would also have necessitated humans evolving cognitive changes that would allow for interspecies interactions. Contemporary dogs are excellent readers of human communications, and humans are not bad at reading dogs. Because of this, the human-canine bond like no other interspecies relationship.[70]

Dogs are keen observers of humans. They pay attention to gestures, facial expressions and scent in order to understand human intention and emotion. Dogs even understand hand gestures, such as pointing. They're able to interpret a human pointing at an overturned cup that has a food treat inside, something wolves can't do.[71] They're also able to anticipate human mind. One study tested individual dogs and their human companion's ability to understand each other. Each dog witnessed a researcher hiding a treat beyond the dog's reach, and then leaving the room.[72] The dog's human companion then entered the room. In each instance, the dog used pointing communications—vocalizations and body gestures, such as running between their human and the location where the treat was stashed—to direct the human's gaze towards the location. In other words, each dog anticipated that their human would understand their communications and be able retrieve the treat for them.

Tom and Sugi became great communicators, and they used pointing skills. After a meal, if he was still hungry, Tom would sit with his body clearly visible to me, pointing his nose at the kitchen counter. If he wanted to be covered with a blanket while we watched TV, he'd sit within

[68] Ibid.

[69] The Oxford English Dictionary defines commensal as 1. Eating at, or pertaining to, the same table. 2. Biol. Applied to animals or plants which live as tenants of others (distinguished from parasitic).

[70] Coppinger and Coppinger, de Waal 2016, Horowitz.

[71] Horowitz.

[72] Ibid.

my view and stare at the blanket. He'd know I'd understand his gestures and follow through with his requests.

Dogs are keen observers of human facial expression. Dogs read human faces in the same way that humans do. They use "left-face bias" looking leftward at the right side of the face being observed.[73] This is because the right side of a human face is where emotion is most clearly expressed. The left-face bias technique is unique to the canine-human relationships; dogs do not use it when looking at other dogs faces, nor at any other animal's face. If that's not amazing enough, then consider this: in the study that determined left-face bias, the participating dogs showed even more communicative resourcefulness. They used left-face bias on *photographs* of human faces shown to them on *computer screens*! And even when shown inverted images of human faces, dogs continue to use left-face bias, still looking at the right side of the human face. (Humans lose the ability to read emotion on an upside-down human face.) Why have dogs evolved this ability? Maybe it's because their point of view often includes looking at us when we're behind them. When dogs look behind, at their human, they sometimes tilt their head back, and this creates an inverted image of their human's face. I've seen Sugi looking at me from an inverted point of view as I stand behind him or if he's playfully laying on his back (see Fig. 5).

[73] Racca et al.

Fig. 5. Sugi looking at me from an inverted point of view. Photo courtesy of the author.

Dogs also use their highly refined scent-perception to understand humans. They can sense human airborne pheromones associated with psychological states released through glands and the skin.[74] Pheromones are produced by humans and other animals in response to situations that cause alarm, fear, happiness and pleasure. It's likely that dogs can detect these pheromones and understand their human's emotional states even without looking at their faces. In one study, scientists looked at levels of cortisol in dogs (cortisol is a hormone associated with stress) produced in response to stressful situations for their humans. The study looked at dog agility trials, a particularly competitive human-canine sport. When the dogs' male human companions had elevated testosterone (a hormone associated with dominance and aggression) the dogs had a higher cortisol level at the end of the trials if their team lost.[75] This suggests that the dogs sensed the heightened competitiveness of their human and their disappointment at the loss, and were stressed about it.[76]

Dogs have the ability to read human emotions. But how well do humans read canines? This can be answered by looking at how dogs express themselves in certain situations and how humans interpret these expressions. Focusing on vocalizations for a moment, dogs use barks, whines, sighs, laughs, and growls to express a range of emotions—anger, frustration, sadness, contentment, happiness, fear and aggression. Studies looked at how dogs use different kinds of barks, depending on the context, in order to express emotion and relay information about the situation to their humans. One study looked at how dogs bark in three different settings: when the doorbell rings, when the dog is accidently locked outside, and when dogs are playing. In the first situation, when they hear the doorbell dogs will use a low-pitch, loud, harsh-sounding repeated bark. This is a territorial bark used to warn the person at the door, and to alert their human. When a dog is locked outside, they'll use a single high-pitched bark, repeated with long pauses in-between, in order to politely communicate the situation to their human. When dogs play, they'll use high-pitched frequent barks.[77] The studies found that when humans listened to recordings of these barks, they're able to identify the situation. Studies also determined that

[74] Horowitz.

[75] Ibid.

[76] Interestingly, cortisol is also elevated in dogs after playing games that involve human voice commands, but they have lower cortisol levels when engaged in free-form play with their humans. Jones.

[77] Horowitz.

humans who listened to dog barks recorded in varying situations are able to accurately identify the dog's emotion, even if the dog wasn't their own.[78]

Growls, whines and sighs are also used by dogs to communicate. Soft growls are used to express playfulness; firm loud growls are used to correct the behavior of a younger dog, to object to a situation, or to signal aggression. Whining is used when something is wanted or if the dog is in discomfort. Tom combined barking and whining when he was annoyed, or desperately wanted something, such as lunch. Tom developed the ability to modulate his voice, in a way similar to human speech. We explored his vocal creativity in the recording studio for three of our collaborative projects *Aria*, *EPIC_Tom*, and *Rockstar*.[79] At the end of the day, both Tom and Sugi would let out a sigh of contentment as they're tucked in bed.

Dogs are good listeners, and can understand human vocal communications. They can hear a broader range of sounds than humans. While humans hear sound between 20 hertz and 20 kilohertz, dogs can hear higher frequencies, up to 45 kilohertz—well beyond our detection. These high frequency sounds are all around us, and dogs can hear them. For example, they can hear the hum of a fluorescent lightbulb and the ultrasonic vibrations of termites. When listening to humans, dogs pay attention to the modulation of a human voice, more than to the specific strings of words. For instance, dogs listen carefully to a statement with a pitch-shift to a higher-frequency at the end of it, like we use in questions—*do you want to go for a walk?* Dogs learn to understand human words, to a degree, but they depend on the voice modulation to interpret the meaning.[80] When listening to our questions or statements, dogs will give us feedback through ear and head gesture. They'll point their ears forward, and may tilt their head, letting us know that they're listening. Some dogs, like Tom, are better able to understand human language. This is probably due to training. Tom would know many more words for toys, people and locations than Sugi, probably because I spent many more hours teaching him those words when he was young.

Dogs are masters of gestural communication, and use these to signal their emotions and intentions. They use their ears, mouth and eyes, and full body. The ears may be the most expressive part of their faces, and they use various ear positions communicating ranges of

[78] Pongrácz et al.

[79] Please see my website for documentation of these projects at www.animallover.ca. Andreyev.

[80] Horowitz.

emotion, from fear to curiosity.[81] Understanding canine ear gestures in combination with other gestures, and the context in which they are used, is a significant step in understanding what they are thinking or feeling. For instance, ears pulled back against the head can indicate submission if the dog also looks away; and the same ear position, combined with a quick retreat can indicate fear. They also use ear gestures to communicate responses to human vocal requests. Ears pointing forward, combined with an intent gaze, indicate that they're listening; ears pointing forward combined with a head-tilt, indicates *I'm listening and trying to understand*; ears moving back and forth, back and forth may indicate uncertainty.

Dogs combine ear movements with other facial expressions. Ear and mouth gestures are used together to express different emotions.[82] Ears back against the head with teeth bared expresses fearful aggression; ears perked-up with teeth bared expresses dominant aggression. Wide-open round eyes indicate excitement or anticipation; slightly closed relaxed eyes express calmness. An open mouth, relaxed with some teeth showing expresses happiness or contentment; an open mouth with lips pulled tightly away to reveal all teeth indicates anger. Dogs will make little licks at the tip of the mouth to express contentment, to acknowledge *I understand*, or to ask for something. Tom and Sugi would use little licks to acknowledge that they understand when I'm telling them something, including *Greg's going to take you for a walk*. They'd also give a series of little licks, with closed eyes when they're laying down and relaxing after a work day—*I'm content*.

Dogs are not timid about using their whole body to express how they feel. These gestures include tail positions, raised hackles, crouches, play-bows and paw-slaps, standing up on tip-toe, or rolling on their backs. A wagging tail is a complicated affair which doesn't necessarily mean a happy dog. The context, and a combination of other gestures, must be taken into account in order to interpret tail-wagging. A high stiff wagging tail with an angry face and raised hackles signals aggression. A dropped tail with a quickly wagging tip, along with a crouched posture, expresses submission. A tail that's relaxed, hanging down or sticking straight-out the back indicates a neutral or calm demeanor. Tom would use a high still tail, and taut body standing on tip-toe to signal his anticipation when I was going to throw the ball. Most dogs wag

[81] Coren.

[82] ibid.

their tails with a right-sided bias when they're greeting their humans, or someone else of interest, and wag with a left-sided bias when greeting an unfamiliar dog.[83]

Play is a good context in which to examine full-body dog communications. During play, communicative gestures can be subtle and quick as the dogs move. Some gestures are only discernible to human observers through close observation of a video recording of the play.[84] The play-bow is used by dogs to initiate play with another dog. This is a full body position where the front end of the dog is on the ground while the rear is elevated. A shorter version of a play invitation is the paw-slap where the inviting dog will briefly slap both front paws or forelegs on the ground in front of the other dog. During play, dogs use nips, shoulder-bumps, hip-checks, and full body slaps against each other. They'll continually remind their partner that these touches are in the context of play, by following up with a play-bow or paw-slap. Play can be intensely physical, where dogs jump and tumble over each over, and chase at top speeds knocking against each other's flanks as they run. In play situations where one dog is much larger than her playmate, the larger one will handicap her play in order to account for the greater risk to the smaller dog. When Tom was only a year old, he'd love to play with big dogs. He was fearless of great Danes and pit bull terriers. They'd rough and tumble, but the big dogs would always take into account Tom's smaller size. A favourite playmate was a tall rescue dog from Mexico called Frida (after Frida Kahlo) who would humour little Tom by gently mouthing his body while he jumped all over her.

Dogs also use a play-bow or paw-slap to invite their human companions to play. But playing with dogs poses potential harms to humans who have thinner skin. Puppies learn to modify their play bites to a *soft mouth* with their human playmates. When Tom was a pup, he'd sometimes get so caught up in the play moment that he'd bite me too hard. I'd reply with a yelp. He'd stop for a moment to communicate his understanding, and then proceed with a softer mouth.

Dogs use other full-body gestures to communicate their emotions and needs to their humans. These may be communication that they've come up with as individuals within the culture of the companion species relationship. Tom would sit on my foot when he would wait for me to do something for him. He'd also do this when he felt insecure, like when he'd see me packing my suitcase to go out of town. Sometimes when I was upset, Tom would come over and gently lean

[83] Horowitz.

[84] Bekoff 1995; Horowitz.

against me—*I'm with you*. Sugi has his own particular repertoire of communication gestures. When we're standing at a crosswalk waiting for the light to change, he'll poke my right calf with his nose—*move along*. As a young dog, Sugi would come and sit near me if he was fearful, and use his paw to gesture that he wanted me to pick him up. I'd hold him in my lap and gently stroke his back, kiss his cheek, and whisper reassuring words. After a few moments, he'd calm down, his body would stop shaking, and he'd settle into my lap.

When Sugi got older, he started using an experimental communicative gesture. I'd be working at my computer, he'd come over and sit facing me and look me in the eye with striking intensity. It seemed as though he was trying to communicate with me through thought alone. At first, I didn't understand this and got annoyed. It took me a while to clue-in that his stare coincided with key moments in the day. I'd check the time and realize I was late giving them lunch, or taking them for the afternoon walk, or giving them their five o'clock treat time. I've come to understand that Sugi maintains a precise internal clock, and prefers to keep a schedule.

Fig. 6. Sugi staring at me, attempting to communicate through thought alone. Photo courtesy of the author.

Dogs and humans are not the only animals that have emotions and intentions, and ways of expressing them. In the nineteenth century, Darwin conducted extensive observation of other

animals. He wrote about human and other animals' emotions, arguing that nonhuman animals also experience anger, happiness, sadness, disgust, fear and surprise.[85] Later, evolutionary biologists added empathy, envy and indignation to the list of animal emotions.[86] Emotions are important adaptive traits for social bonds and survival fitness. For instance, happiness, disgust, empathy, and sadness help create cohesion between individuals and groups. Fear and surprise allow animals to respond quickly to potentially dangerous situations. Empathy, a more nuanced emotion, has been researched in apes, canines, rats, whales, and elephants who all use it in cooperative instances.[87] I know that dogs use empathy, as exemplified by Tom when he modified Sugi's charge at an unfamiliar dog, and when Tom and Sugi walk cooperatively off-leash.

Empathy is an interesting emotion because it happens on subtle levels. An individual can feel empathy for another just by witnessing the other's physical actions. Empathy, like all emotions happens immediately, regardless of rational processes. Empathy even happens across species. The discovery of interspecies empathy occurred inadvertently, between macaque monkeys and humans. The original study was designed to detect the monkeys' brain activity that corresponded to their movement as they reached for a piece of food.[88] They found that the monkeys' premotor cortex area of the brain activated just before they reached for the food. Accidentally, the researchers noticed that the monkey's premotor cortex also fired when they saw one of the human researchers reaching for the food. This empathic phenomenon involved cells that were later termed *mirror-neurons*. [89] They're called this because they mirror the neurological action preceding movement in one individual, in the brain of the observing individual. Just by observing a human's actions, the monkey experienced an empathetic response. While the findings from these studies have advanced empathy studies, it is important to acknowledge that the majority of them were carried out using techniques on captive lab animals. However, the point being that empathy involves *felt* communications, even across differing bodies.

Like the macaque monkeys, I also experience interspecies empathy as a *felt* phenomenon. For example, when Tom would play, he'd express his pleasure by laughing: a kind of breathy pant.

[85] Bekoff 2007b.

[86] Damasio; Walton.

[87] Bekoff 2007b; de Waal; Poole.

[88] Gallese et al.

[89] Rizzolatti and Craighero.

When I first observed this in Tom as a pup, I didn't know it was a laugh. Regardless, as I watched him, I felt his happiness—it was contagious—and I laughed too. Empathy happens in this immediate way for humans, even in relation to other animals. I believe we need to hone our capacity for feeling empathy with other lifeforms in order to develop better relations with them.

Canine empathy and their other emotions have recently been studied in some remarkable experiments. It's worth detailing these, not only because they produced knowledge on canine capabilities, but also because they were carried out with the *willing* participation of dogs (in contrast to the captive monkey experiments above). The methods provide insight into interspecies processes—even interspecies art making—where the animal's autonomy can be respected. I'll describe these studies and how I applied similar methods in my collaborations with Tom and Sugi.

The studies with dogs were conducted by biologist Gregory Berns and his team, using fMRI technology. The researchers intended to collect data on what the dogs were experiencing when they saw human gestures, or smelled the scent of humans.[90] In the first study, the researchers looked at whether dogs understood human gestures as modes of communication, and how the dogs felt about the information in the communications. The processes used training trials (I'll elaborate on those later), and food rewards. The dogs were taught two hand gestures that communicated information: one signaled that *a hotdog will be given to you in the next 15 seconds;* the other signaled that *a hotdog will not be given to you*. While the dogs were in the fMRI scanner, researchers recorded their brain responses to the hand signals. They specifically looked at the caudate area, a part of the brain associated with the expectation of something good. The scans showed that there was significant activity in the caudate when the researchers gestured about giving the hotdog, and no significant activity when the researchers gestured about not giving a hotdog. The dogs understood the researchers' gestures, and they used this information to anticipate pleasure.

In addition to this discovery, the researchers found unexpected data. The dogs' premotor cortex area was also activated when they watched the researchers' hand gestures. Like in the monkey research, when the humans gestured, the dogs' mirror neurons were activated. This indicated that the dogs were interpreting human hand gestures in relation to their own canine body. They

[90] Berns.

were mapping the human gesture onto their body—hand to paw. Like the monkeys, the dogs were having an immediate physical empathic response to the human's actions.

Another study by the same research team looked at the dogs' responses to memories of their companion humans. The researchers presented the dogs with pieces of material, one previously rubbed with the scent of their companion human, and others with scent of unfamiliar humans. While the dogs were in the fMRI, they were presented with these materials, one by one. The scans showed that there was greater brain activity when they sniffed the scent of their companion humans than when they sniffed the scent from unknown humans. In addition to the caudate area lighting up, the inferior temporal lobe—an area associated with memory—was also active. It suggested that the dogs felt good about the familiar scent of their human; they are able to recall memories of their human, and feel pleasure. Maybe this is the neurological pathway of canine love?

It's important to point out that the methods used in this research were significantly different from conventional animal research in the laboratory, such as with the monkeys. Berns believed that it was crucial to create conditions for the dogs to respect their right to refuse. This contrasts with the conventional lab research methods where lab animal autonomy is not taken into consideration. Berns based his canine model on standards of research ethics with humans. University research involving humans typically adheres to strict ethical guidelines, including respect for the participants' autonomy. For example, in research at my Canadian university, respect for autonomy is a "Core Principle" defined by the *Tri-Council Policy Statement*: "Respect for Persons incorporates the dual moral obligations to respect autonomy and to protect those with developing, impaired or diminished autonomy. Autonomy includes the ability to deliberate about a decision and to act based on that deliberation."[91] Berns applied a similar ethical standard, set by his American university, for his canine participants. The method included analyzing the canine participants' deliberations about the situations proposed to them, and respecting their willingness, or unwillingness, to participate. If a dog demonstrated an unwillingness, communicated by a refusal to enter a trial stage, or the fMRI device, or by pulling away from a situation presented to them, Berns eliminated the dog from the trial, or modified his team's approach. A key aspect to this process involved working with companion dogs, rather

[91] Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 8.

than dogs bred for laboratory conditions. Berns believed that involving dogs who lived in respectful and loving situations with humans was key to his research ethics.

Berns' laboratory processes involved developing trial situations, as step-by-step sessions with the dogs in order to gain their trust. These trials took place before using the real fMRI sessions with the dogs, and were time intensive.[92] For the trials, the researchers built a prototype of the fMRI machine that the dogs could enter and gain familiarity. The dogs were asked to willingly position their head on a custom-built head support, and were rewarded verbally, and with food treats, when they held their head still. Sound trials were used to replicate the loudness of the fMRI environment. Because dogs have sensitive hearing, the team created a set of canine hearing protectors to shield them from the noisy fMRI environment. The researchers analyzed the dogs' stress levels and watched their gestures to see what the dogs were communicating at each stage. The researchers agreed that the dogs were permitted to leave the processes at any time. They were never restrained or forced to do things they didn't want to do. Some dogs enjoyed the challenges becoming excited when they began their research day. At the end of each day, the dogs returned home to their human companions. These methods were revolutionary because they involved interacting with the dogs in respectful and meaningful ways, through ethics of autonomy.

At the core of this research is an ethics of autonomy with participating animals, on their terms. It involves learning to understand the communications of the dogs, and respecting that *no* means *no*. The success of the studies suggests that research ethics for animals can be as robust as ethics for humans. I want to be clear that I'm not advocating for the continuation of lab animal use in exploitive situations, such as in pharmaceutical testing. Even with improved ethics, including autonomy, there's still the potential for harms because of the captive situation, and the unknown risks of the materials involved. Instead, I'm arguing that exploitive environments which use lab animals are not only harmful, but also outdated. I'd like to see more researchers come up with ethics of autonomy for animals in research by examining Berns' model, and developing better research questions that don't involve exploitation and harm.

I was inspired by Berns' methods and decided to integrate them into my own interspecies processes involving Tom and Sugi. We were able to refine the methods, specifically in the production stages of our performance art project *EPIC_Tom*, where we used advanced

[92] Berns, Brooks and Spivak.

technologies, such as motion capture and sound recording, to record their gestural and vocal communications. The dogs' willing creative contributions meant that I could truly call our work collaborative.

Communication ethics

The environmental philosopher Val Plumwood was one of the first thinkers to articulate the need for humans to "study-up" on the communicative modalities of other animals, to learn their communications, and to engage with them on their terms.[93] She proposed communication ethics as a means to enhance relations with other lifeforms. This involved respecting their differing communication modalities, using a biocentric point of view. Her communication ethics are a powerful critique of anthropocentric beliefs in the exclusivity of human language. She proposed a biocentric look at communication by taking into consideration chemical, pheromone, scent, and vibration forms of communication which may be outside the primary human modality of communication with its focus on oral and written language. Just because we don't understand these modes of communication now does not mean that they are less important or inferior to human communications. Nonhuman communication modalities may be unfamiliar, and even unthinkable, for humans but their differences draws attention to the limitations of humans, not the limitations of nonhuman life.

When communications are examined from a biocentric point of view, it becomes clear that the belief in human exceptionalism with regard to language is biased. All beings have evolved necessary modalities for exchanging information within their communities, creating meaning to assist in social coherence and survival. The communicative modalities of each species and communities are, evolutionarily speaking, the most appropriate ones for them, and are no less valuable than those of humans. By examining communication from biocentric viewpoint we encounter strangeness, and perhaps even feel a sense of wonder for the inner lives of other lifeforms. Knowing that nonhuman communications are happening all around us, despite our inability to understand their signals, can give us pause. It's a game changer. Human signals are no longer the centre of attention, but only a strand in a complex web of communications.

Canines rely primarily on scent perception for communicating between themselves. They use scent when in direct, and even indirect, contact with other dogs. This helps them gain information about individuals in their community. They deliberately distribute scent-markings to

[93] Plumwood, 156-178.

communicate with other dogs and they smell the markings of other dogs to know who's been there. They leave the markings through urine and feces, and by rubbing scent from parts of their bodies onto objects. Dog urine has chemicals that distinguishes the marker's sex, sexual readiness and social confidence. The markers are perceived by other dogs, and analyzed to understand the characteristics of individuals, even those who marked some time ago. Dogs also use markers in their feces that include secretions from glands near the anus. Plus, they use scent-markers excreted from glands in their paws and cheeks. You can witness this when a dog digs on a rug or couch—they're depositing their scent onto the furniture as a way to claim it. Tom would do this when he was happy, using rapid scratching motions with his forelegs as though he's digging a hole in the rug. He'd also rub his cheeks against the rug and quietly growl with pleasure.

Scent perception in dogs is a complex physical and cognitive activity. Muscles in the nostrils draw air in, including the airborne particles of a scent, and simultaneously displace air already in the nose.[94] The old air is either moved further into the nose cavity or expelled via the side-slits in the nostrils. The simultaneous inhale and exhale, or displacement, creates air turbulence and helps pull in more new air and scent particles. The air that's pulled deeper into the nose passes by skin tissue lined with tiny receptor sites that sense the particles. Human noses have *six* million of these receptor sites while dog noses have *three hundred* million! In addition to the greater number of receptors, dogs also have more genes in the olfactory cells, more olfactory cells, and they have more direct connections from the receptors to the olfactory bulb. This allows dogs to have almost an immediate perception of their environment, in contrast to humans who primarily rely on visual perception which uses a physical route that is longer from eye to brain.

Canine scent-perception involves a highly developed vomeronasal organ, a body part that sits above the mouth in the nose and has receptor sites for odors.[95] Other animals, including humans, have this organ. Lizards use it when they lick the air to bring airborne scent particles into their mouth where they're shuttled to the vomeronasal organ.[96] Dogs use the vomeronasal organ when they lick or eat substances, including urine and feces (*ack*!). They do this because urine and feces contain pheromone particles that can be analyzed using the vomeronasal organ

[94] Settles, Kester and Dobson-Dreibelbis.

[95] Adams and Wiekamp.

[96] Rhinos, elephants, bats, cats, and humans also have the vomeronasal organ. It is speculated that this organ is used by humans to detect pheromones from other individuals. McClintock.

and provide information about the marking animal's psychological state and health. The combination of more receptor cells, genetics, and shorter neurological connections affords dogs an estimated one million times more sensitivity to scent than humans.[97] To demonstrate their abilities, dogs have been trained to detect a teaspoon of sugar in one million gallons of water.[98] They can also detect diseases. Dogs can smell the volatile organic disease-maker particles diffused in the human blood stream and excreted as urine or as exhaled breath, at a concentration of 0.001 parts per million.[99] Dogs trained to detect cancer markers are best able to do so from exhaled human breath, and they can detect some cancers with up to 99% accuracy.[100] I suspect that Sugi would be an excellent disease detection dog. Even without being trained, he has given us clues into Tom's health. He sniffs Tom's underside at times when Tom has a urinary tract infection. When we see Sugi doing this, we say he's "doing a diagnostic." If we haven't yet noticed that Tom is uncomfortable, we'd start paying better attention, and treat him if needed. Last year, Sugi began sniffing Tom's breath. This coincided with a recent ultrasound that found Tom had an intestinal tumour.

Understanding scent-perception also provides thought on dogs' relationship to time. Dogs can detect how odor dissipates over time and space, such as in the quality of scent from a series of footprints along a path. They can tell which way a person went based the character of the odor's dissipation. In other words, they can understand another's past movements. Dogs can also smell the future. Other beings who are approaching but out of sight, can be detected through scent. This allows dogs to anticipate what is to come. I have seen Sugi do this. A few years ago, when we were at an outdoor farmers' market, Sugi began to communicate excitement by pointing his nose, sniffing the air, and pulling on the leash. A few moments later, from the direction he was pointing, Judy—our dog-walker—appeared. Sugi greeted her with jumps of joy and excited barking. He wouldn't have been able see Judy because of the throngs of people, but he would have caught her approaching scent, and this allowed him to anticipate her arrival. Sugi loves to encounter familiar people this way, in unexpected situations.

The examples with Tom and Sugi provided a glimpse into interspecies communicative events. These had a transformative effect on me. They pointed to how interspecies communication can

[97] Horowitz.

[98] Ibid.

[99] Waggoner et al.

[100] Moser and McCulloch.

generate respect and love. Some of the early communications failed because learning to respond appropriately was an incremental affair that took time. On top of this, each dog expressed some of their individual needs and desires in specific ways. So, responding appropriately included adapting the general communications with each dog to suit each one. Early on, I was able to recognize Tom's requests and expressions by getting to know his gestures, pointing and vocalizing. I had more difficulty understanding Sugi. But he taught me to be open to unexpected communications, and the excitement and love that can accompany these.

By taking time to understand the complex communication modalities of other animals, we can gain a new sense of awareness and humility. When we learn about other beings' communications, we are faced with a dilemma. We are forced to reconsider how we think about them and can no longer make limiting assumptions about them just because we humans are too limited to understand an other's communications. Humans may not be able to perceive the communications of other species, but this only indicates that their communications are different. It suggests that they may be more complex than we've previously been willing to admit. And this leads to a humbling thought, that other lifeforms are more consciously active in the world than humans have historically allowed. I believe that we need to expand the way we sense, feel and think about other beings' communications. There needs to be more research, both scientific and anecdotal, into interspecies communications because finding ways to communicate with other beings can help us expand our own thinking and doing in the world. It offers potentials for information exchange, and more-than-human ways of knowing how to be.

Transformation

After two years of getting to know Tom and Sugi—their joys, pleasures, pains and fears—I began to think more about other animals. Wild and domestic animals have emotions and experience pain. What do they feel? Wild-living animals are challenged by diminishing natural habitat because of human development, predominantly from agriculture. What do these animals feel when their homes were destroyed, when their families and communities were torn apart, and their offspring were not able to survive the challenges of shrinking habitats? Likewise, animals in industries suffer under severe conditions at the hands of humans. Mice, rats, rabbits, and other animals suffering in laboratories; cows, goats, pigs, lambs, chickens, steers and bees exploited and killed in agriculture; sheep, ducks and geese used for the textile industry; horses and calves harmed or killed in rodeos; and countless animals captive in zoos, aquariums, and

circuses. What kind of physical and psychological suffering do these animals endure? Their pain was beyond what I could imagine. As I began to learn more about human stresses imposed on other animals, I was presented with a moral dilemma. On the one hand, I was caring for my lovely companion dogs, providing for their needs and wants; on the other hand, I was participating in the suffering of other animals through choices I was making in what I ate and what I purchased. This was a turning point for me, a pivotal transformation in how I would live the rest of my life.

I began shifting my choices away from meat-eating, dairy, and other animal products, becoming vegetarian and, later, vegan. The changes were incremental as I researched ways to get nutrients from plants, while taking into account my extensive list of food allergies. I never felt like I was missing out or had compromised convenience or pleasure. I became a more creative cook and enjoyed experimenting with new foods and ways to prepare them. I felt like I had joined a movement of change. It felt better to be in solidarity with friends and communities who were raising awareness and reducing harm. It took a bit longer for Greg but he eventually joined in and now he's a hardcore vegan!

Becoming vegan meant experiencing more empathy and heartache as I dug into information about manufactured products, finding the deeply entrenched systems which exploit animals. The examination meant that Greg and I had to also consider what we were feeding the dogs. Changing the dogs' diets to plant-based was probably the biggest challenge. At the time, veganism for humans was not widely accepted, and for dogs it was almost unknown. So there weren't many options in terms of manufactured dog foods. We had to figure out ourselves how to prepare homemade food that provided nutrients and that they could easily digest. Transforming the household took time, but once we settled in, we all felt good. Even the dogs' health improved. Schnauzers have a predisposition to pancreatitis, so eliminating meat, which is higher in fat content than plants, can be a better diet for them.

Even with all the knowledge about the health benefits of plant-based diets, and the information about the significant ecological consequences of meat agriculture, carnism continues to dominate this culture. I believe it's because of entrenched mystical thinking about meat, particularly around notions of fitness, masculinity, and what is considered normal. It's important to unpack the ideology of carnism because it reveals the colonial viewpoints at the core of the anthropogenic degradations of natural systems and nonhuman lives.

The ideology of carnism has its foundation in the construction of human identity which is largely based on the domination of other animals and nature. Carnism has been theorized by the critical animal studies scholars, Melanie Joy and Adam Weitzenfeld, as the "3 Ns"—*normal, natural, necessary*.[101] Carnism includes accepted forms of domination over other animals, such as in meat-eating, rodeos and zoos and other systems of domination. It's so widely accepted and normalized within cultures where its validity is not questioned by the majority of the population. Because of this, each year *56 billion* animals are killed for the food industry (excluding the fishing industry), which uses inhumane techniques carried out in horrific conditions.[102] The chicken industry alone inflicts harms throughout the lives of the birds. It uses hot-wire debeaking for all chicks; day-old male chicks are gassed or minced because they're considered useless; egg-laying hens are crammed in wire battery cages, kept alive only as long as they lay eggs; free-range chickens are slightly better off, but they suffer overcrowding, kept in large barns without natural light, slaughtered after one or two years. Dairy cows are subject to constant harms in their short lives. They normally live only as long as they are able to produce milk—5 years. Many suffer mastitis from overly full utters, and lameness from standing on concrete floors or the mud of feedlots. They're subject to forced impregnation each year in order to maintain constant milk production. Their calves are taken away shortly after birth, the females raised into the dairy industry, the males killed or raised for the veal industry where they're kept in small pens for months until killed. Female pigs suffer gestation crates, pinned down on their sides while suckling their babies who are removed after a few weeks.

Carnism includes an arbitrary view on which animals are edible and which are not, and this creates a naturalized belief in exploitation of certain animals but not others. For instance, in Eurocentric cultures, cows, pigs, sheep and fish are edible, dogs and cats are not. Carnism is a form of speciesism which delineates who is owed our respect and care, and who may be exploited or killed. The *naturalization* of certain animals for meat-eating is harmful not only for the exploited animals against other animals and ecologies.

In 2011, the Food and Agriculture Organization estimated that, internationally, commercial fisheries had caught 100 million tons of fish for that single year—an estimated 157 billion individual fishes.[103] Recreational fisheries caught 47 billion fishes with 36 percent killed, the

[101] Weitzenfeld and Joy, 23.

[102] Animalequality.

[103] Some researchers suggest that this number is underestimated by more than half over the last half decade because of poor monitoring of the industry. Balcombe.

remainder returned to the water.[104] All fishes suffer in the processes used by fisheries. Once caught and brought onto the ship, they die from suffocating, being crushed to death by the weight of the netted catch, or by being frozen alive in the boat's refrigeration units. Fishing also causes wide-spread suffering and ecological devastation through by-catch—un-targeted fishes and other animals who are caught by the nets and lines. By-catch includes sea birds, sea turtles, sharks, dolphins, whales, and other fishes such as halibut, flounder, cod. By-catch results in the death of billions of pounds of marine animals every year. Some studies estimate that the amount of global by-catch is 63 billion pounds per year—*40 percent* of all fish caught.[105] Fishing has detrimental these effects on the species populations caught, on by-catch, and for those scavenger species whose numbers increase as a result of discarded by-catch.[106] Not only that, but fishing gear losses can subsequently harm marine life and their environments.[107]

Carnism perpetuates mis-information about what is *necessary* with regards to the health benefits of meat-eating. Until recently, meat was promoted as being a better source of protein, providing more energy, etc. than plant-based diets. But recent science has disproved these claims. Plants have the same proteins that meats do, plus they are less likely to cause inflammation, cancer, gastrointestinal disorders, heart and other diseases.[108]

Another ongoing argument for meat-eating is based on the false claim that prehistoric humans predominantly ate meat.[109] This has been called into question through research into human physiology which reveals that our teeth have been adapted for chewing plants, and the length of our intestinal tract corresponds to the capacity to digest plant material. Current archeology finds that ancient humans ate predominantly plant-based diets. Roman gladiators were vegetarian! With this knowledge, it becomes evident that meat-eating is a cultural choice, not a physical necessity. To understand it more fully as a cultural choice, we can to look nonwestern cultures that have been plant-based for centuries. For example, Jainism, one of the oldest philosophical systems in the world, originating in 7th–5th century BC, includes abstinence from eating animals and care for life in all its forms. Jainism incorporates *ahimsa* (non-violence), as the foremost Jain vow involving critical practice in thought, speech and action to minimize harms against

[104] ibid.

[105] Keledjian et al.

[106] Garcia.

[107] ibid.

[108] Wein; Thompson.

[109] Dunn.

other beings.[110] Jainism extends *ahimsa* to plant-life, where only those plants that regenerate may be consumed. Jainism is still practiced today, largely in India, but with communities in Canada, USA, Africa and Europe.

Vegan practice is not only a way to take direct action against animal suffering, but also to reject large-scale agricultural practices for their detrimental effects. In 2012, the United Nations Environmental Programme released information on the ecological degradations due to meat industries.[111] The livestock industry alone was found to be amongst the top two leading contributors to climate change because of deforestation, intense water use, fodder crops, fertilizer pollutants, as well as methane and nitrous oxide emissions from feedlots.

But green-washing by the meat industry perpetuates carnism through misinformation. So-called 'sustainable' practices, such as free-range, are not viable ecological solutions because they require increased land use, resulting in more deforestation and wild habitat degradation.[112] Likewise, ocean fish-farming is not a more sustainable industry because it increases pathogens for wild fish.[113] Shellfish farming is also a big problem because the land needed for shrimp farms reduce lowlands, marshes and mangroves of the Asian coastal areas,[114] and the industry produces waste that causes eutrophication—plant and algae blooms that decrease oxygen, leading to the death of other marine life.

Moving to a plant-based diet is the single most-important change an individual human can make to reduce their carbon footprint, and reduce the destruction of wild habitat. This is because growing protein from plants uses less land and reduces the direct harms against animals associated with the meat industry.[115] But veganism should not be seen as a means to achieve a good conscience.[116] Further examination into other normalized forms of abuse—both physical and symbolic—is needed. For example, vegan-leather shoes and bags are made of vinyl that relies on oil extraction. Consuming fossil fuel products perpetuates a cycle of harm against ecosystems and wild-living animals. Also, scrutiny into the indirect harms resulting from culture

[110] Sagarmal.

[111] The report states that most studies attribute 10-35 percent of global greenhouse gas emissions to meat production; differences are due to excluding or including deforestation. Schwarzer.

[112] Nibert.

[113] Morton.

[114] Páez-Osuna.

[115] This is a finding from the Intergovernmental Panel on Climate Change report of 2018. Masson-Delmotte, et. al.

[116] Calarco on Derrida.

industries is needed because they can reinforce detrimental thinking about animals, or hide truths about exploitation.

Popular culture, such as movies, animations, nature programs, books, newspapers, magazines, social media and advertising, tend to mask the realities of exploitation and harm. For example, advertisements from the dairy industry often portray cows in pastoral fields, a fictional environment far from the hard reality of feedlots. A prominent Canadian telecommunications company Telus creates ads that depict wild animals smiling against a white backdrop, fabricating wildlife contentment in the midst of technological advancement. Not only do these representations undermine the public's conception of reality, but real animals are used in the production of their images. Some cultural theorists are doing the work of critically examining representations of animals in popular culture.[117] However, contemporary artists can also engage with the issue by providing improved depictions. Both interspecies art and ecoart practices can take a lead in critiquing the falsehoods of popular culture by representing contemporary material realities.

EPIC_Tom

In 2007, three years into my companionship with the dogs, I began a new body of work called *Animal Lover*. It grew out of my personal transformation to veganism, a result of getting to know Tom and Sugi, and out of a need to find more social and ecological meaning in my art practice. *Animal Lover* was inspired by the dogs, but it has since expanded to include salmon, birds, trees, forests, and even other humans. One of the last collaborative projects with Tom and Sugi was *EPIC_Tom,* a performance project that explored canine expression, specifically gesture and voice. The research stages with the dogs informed the project's final outcome as a performance with participating musicians who provided sonic responses to a score produced from a recording of Tom's voice. The research involved developing an ethics of engagement for the dogs and this helped establish methods for subsequent interspecies work, and critical thinking about nonhuman representation.

As mentioned previously, a key feature of an ethics of engagement with the dogs was our two-way communications. It provided a foundation for me to present situations to them, and for them to deliberate and decide whether to participate, and communicate to me their thoughts and

[117] The use of animals in popular culture is well-critiqued in the smart Animal Series books by Reaktion. See Burt, Jonathan (ed.) See also Berger; Burt; Sorenson.

feelings. Like Berns, I wanted to provide a fun, safe working environment for the dogs so that their creative output could emerge without duress. How the dogs were treated during the processes would have consequences for them, for myself, and for public audiences who would eventually receive the work. This interconnection of material ethics with live nonhumans, combined with ethics of representation can be described as an interspecies ethics of engagement. This ethics of engagement can be approached through the exploration of three interconnected research questions as a framework to apply to interspecies encounters. (This ethics of engagement was subsequently used in the interspecies processes with the other animals in the remaining chapters):

- *What methods are needed to enact respectful processes for the animals involved?* This is the most complex portion of the research ethics and involves examining existing knowledge from cognitive ethology, biology and naturalist methodologies about the animals who may be involved. Additionally, knowledge about the individual animal is important, and this can be gained through careful direct observation. This stage should incorporate interspecies communication modalities in order to understand the expressions and responses from the nonhumans involved.
- *How are the respectful processes evidenced in the artwork, in order to model improved conditions for nonhuman animals?* The processes developed in the research stage above need to be evident for publics, and this includes the specific processes of engagement. This can occur through documentation and dissemination of the processes, an artist statement, or the processes being apparent in the final form of the work.
- *How are the animals' creative outputs depicted in the artwork, thereby contributing improved cultural representations of animals for publics?* This involves creating representations that respects the real-world creative input from the animals generated using the respectful processes in from stages above.

The *EPIC_Tom* project provides a working model to exemplify how each of these questions are addressed in the various stages. The project was originally inspired by the dogs' gestural communications and vocal expressions. As I got to know more about canine communications, and the specific ways each of the dogs expressed themselves, I was inspired to record them in some way. At the time, I didn't have a preconceived idea about the art outcomes of the research (I'll describe more about this indeterminacy method later). Luckily, I was able to get an art grant from The Canada Council for the Arts and this allowed me to focus on exploring canine gesture

and communication in art making processes. I decided to use the motion capture (mocap) studio in the research facility at my university. Mocap allows for movement to be recorded in three dimensions through cameras surrounding a studio space that read marked points on a moving body within the space. Software accumulates the data points, and these are used to model and animate a virtual figure. I speculated that the dogs could be involved in mocap sessions and that the data from the dogs' movements could be used to create animations of the dogs articulating their expressions and communications.

Like in Berns' trials with the canine fMRI research, I had to test the dogs' willingness to participate in the mocap sessions. To gain their interest, I used knowledge from previous collaborations with them in projects carried out between 2007-2011 which used video and sound recording techniques. [118] In those sessions, I was careful to provide safe and fun working conditions, and I set the condition that Tom and Sugi could withdraw from the situation at any time they liked. I used two-way communications to evaluative their comfort levels in each stage. This involved presenting situations to the dogs and paying attention to their responses. If the dogs responded positively, I would proceed to the next stage; if they responded negatively, I would modify my approach, or eliminate the stage. I'd present a situation to the dogs, using a calm and confident emotional state, incorporating hand gestures, facial expression, and vocal language. This allowed the dogs to read my emotions for clues, and to understand what was being asked of them. For example, if I wanted to video-record Tom playing with a ball, I'd set up the camera with a point of view that frames the ball and Tom within the studio. I'd vocally ask Tom to *go get the ball*, combined with a pointing gesture at the ball. Tom would communicate his understanding by moving towards the ball, and grabbing it in his mouth. I gave him positive feedback with voice, *good boy!,* and treat rewards. This was a pretty simple trial, but it did indicate that I may be able ask Tom to participate again, in front of a recording camera during an actual production stage. Negative responses were indicated by the dogs displaying boredom or indifference, communicated by their attention directed elsewhere, such as listening for sounds outside, sniffing the floor, or generally not paying attention. Strong refusals were clearly communicated using full-body movements away from the situation. I eliminated these trials that evoked negative responses, or modified the approach to be more pleasing to the dogs. The dogs' responses could be more nuanced. For instance, if they responded with a raised paw and

[118] *Aria* (2009); *Bikeride* (2009); *Screen Tests* (2009); *Rockstar* (2010); *Wait* (2011). For documentation of these projects, see my website www.animallover.ca. Andreyev.

ears slightly lowered or their heads tilted to the side, I knew they were communicating uncertainty. So, I learned that I had to clarify my communications.

Through these early trials, I developed a verbal cue that communicated to the dogs the kind of activity they could expect: *do you want to go to work*? I asked it with a pitch-shift emphasizing the word *work*. For them, it came to signify a type of fun and challenging activity to come. On the morning of the first mocap session, I asked Tom and Sugi if they *want to go to work*? They both communicated their enthusiasm using a full body expression; bodies angled towards the door, legs tensed in an taught upright stance, heads held up, ears forward and up, tails up, eyes wide and round looking into mine—*they were ready*. They eagerly got into the car, understanding that the work would occur at a location other than our home studio. The next stage involved inviting them into the motion capture studio at the university in order to familiarize themselves with the space. They freely moved around the studio exploring its scent, sights and sounds. They met the mocap technician, animator, and my human collaborator Simon Lysander Overstall,[119] whom they already knew. Once they became familiar with the space and its humans, they communicated that they were interested in what would happen next: they stood in front of me and looked into my eyes. At that point, I asked them to walk around the space with me and then, later, to play with a few toys. This trial created an impression for the dogs of what kind of activity typically happens the space. The dogs eagerly engaged in these activities. We ended the session on a positive note, before fatigue or boredom set it. These successful trials meant that we could proceed with the production stages, and present the dogs with similar activities in that space.

A practical challenge for the production stages was to design a way to accumulate data from key points on the dogs' moving bodies. Our industrial design consultant[120] created customized, flexible canine mocap suits that allowed freedom of movement. Tiny reflective balls were attached by Velcro strips to the suits, and placed at key movement points on their bodies, such as on their joints. The reflective points would be detected by the cameras, and provide data on how they moved in space over time. In my own studio, we created a trial stage to fit the suits on the dogs and find out if they tolerated them. This was the most contentious stage of the the whole project. We started with Tom, but he growled and pulled away as we tried to put one of his forelegs into a pant leg. So, we stopped working with Tom for the moment, and tried it with

[119] See Simon's website for more information. Overstall.

[120] Hyuma Frankowski, an ECU industrial design student at the time.

Sugi. He demonstrated willingness and even enjoyed the attention (see Fig. 7). He communicated this by not pulling way, and by presenting each leg as they needed to be put into each pant leg. I responded to Sugi's cooperation with vocal rewards, *good boy!,* and food treats, all the while with Tom observing. Seeing the lovely treatment Sugi was getting, Tom agreed to try again. He communicated this by cautiously moving towards his suit when I held it out to him. A similar negotiation was described by biologist Irene Pepperberg in her interactions with her research participant Alex the parrot. The method is based on *model / rival* learning and involves a human interacting with another human in order to model an interaction for an observing animal.[122] In our case, Sugi took on the role of the rival for us model what we were asking of Tom. Eventually we got the full-body suits on the dogs without much more fuss. However, the head covering was not tolerated, and the dogs continually tried to remove these with their paws. Because they bothered the dogs, we decided to not use the head coverings. This meant that we would not be able to capture canine facial expressions, only full-body movement. With heads bare, and body suits on, we could begin the production stages in the mocap studio and start recording.

Creating an environment for the dogs to freely contribute their expressive movement was crucial. We applied a process of *indeterminacy,* a method initially developed by John Cage as an art process providing the deliberate diminishment of authorial control in favour of emergent results.[123] In our situation, indeterminacy allowed for the diminishment of human control in order to foreground the dogs' contributions. It meant that the dogs' movements could be freely carried out in response to their motivations. In the mocap sessions, they walked, ran, jumped, sometimes with me and sometimes on their own. By creating the conditions for their movements to be recorded, their creative contributions could emerge.

[122] Pepperberg.

[123] Jaeger.

Fig. 7. Sugi helping to model for Tom how to put on his mocap suit. Photo courtesy of Elisa Ferrari.

Fig. 8. Tom and Sugi in their mocap suits, with me attaching the reflective nodes. Photo courtesy of Elisa Ferrari.

During the sessions, I paid attention to the dogs' communications of fatigue, boredom or frustration. When tiredness set in, we'd end a session, usually lasting only two or three hours. Over a few short working days, the dogs contributed a variety of movements which provided a variety of potential animation data. The best came from Tom who ran and jumped for a ball which he had asked me to toss. (This was only one of two small jumps in the whole session, being careful to not exacerbate his back condition.) The data was good because it showed a complete sequence of movements depicting Tom's motivation and his range of physical capabilities. After analyzing the sequence, we agreed that it could be used by the animator[124] to model a virtual body of Tom as he jumped for the ball. With the animation stage underway, I could focus on imagining what Tom was thinking and feeling when he jumped for the ball. This process would help me consider the next stages, and the specific forms of representation. Observing him in previous similar situations where he ran and jumped for the ball allowed me to speculate on his experience.

In the early days, when we'd play ball, I'd marvel at Tom's athleticism and focused concentration: his highly coordinated movements, his compactness as he chased the ball, his speed and attention. These full-body movements clearly communicated his intention and motivation. If the ball was airborne, he'd launch himself to meet it, perfectly aligning his body for interception. He could expertly anticipate where the ball would be when he got there. After he'd grab the ball in his mouth, he'd relax his body and gracefully return to the ground on his feet. Catching it was clearly satisfying for him, and this was communicated by how he held himself as he trotted back to me. He projected happy pride with head and tail up, gently rotating the ball in his mouth, massaging it with his teeth. The happiness after he caught the ball was clear, but what was he experiencing just before he caught it as he jumped? The moment seemed packed with anticipation, a sort of proto-euphoria. For me to speculate on that moment, I looked to a method of critical anthropomorphism.

The cognitive ethologist Marc Bekoff theorized a form of attention called "biocentric anthropomorphism," as a way to consider a nonhuman animal's point of view.[125] He developed this for his field studies in order to get a sense of what was happening for the animals being observed. For instance, thinking-like-a-wolf or feeling-like-an-dog, was a way for him to imagine what those animals were thinking and feeling. To do this, he relied on knowledge about the

[124] Jay White.
[125] Bekoff, 1995.

animals from previous research, and on what he knew from observing the individuals under study. Biocentric anthropomorphism can be applied to interspecies art processes in order to consider the other animal's states of mind and emotions. In my collaboration with Tom, feeling-like-a-dog was an important technique that helped me imaginatively consider what he was experiencing just before catching the ball. Imagining relied on knowledge about canines in general, and about Tom in particular. Remember the hot dogs? We know from Berns' experiments, that dogs do anticipate something good. Using biocentric anthropomorphism, I could gain insight into his state of mind as anticipating the euphoria of the catch. I concluded that this must be *proto-euphoric*—potent with expectation of something good. This realization, presented a problem as to how to represent his state of mind. I looked to my own experience, and to signifiers from film for techniques that could be understood by viewing audiences.

We humans tend to experience a prolonged sense of time when anticipating something good. Perhaps dogs experience a similar feeling? Maybe Tom was experiencing a slowed down sense of time just before catching the ball. I looked to film techniques to find a way to depict this modified temporal sense. Contemporary film sometimes uses slow motion to depict a sense of extended time. For example, in the popular film *The Matrix*,[126] slowed down action, combined with a circling camera point of view, served to represent extended temporal experience felt during the cognitive focus and intense physical activity of the hero, Neo. Inspired by its use in this film, we treated the animated figure of Tom as a slow motion loop depicting his airborne jump for the ball which also demanded physical and cognitive focus. This was represented through a circling (virtual] camera point of view around our hero, Tom (Fig. 9). We created the animation as a continual loop, without beginning or end, thereby making a visual document that could be used at any length for the project.

[126] Andy and Lana Wachowski.

Fig. 9. Production still from the animation loop of Tom. Image courtesy of the author.

What about his proto-euphoric moment? How could his expression of eagerness and anticipation be represented for viewing and listening audiences? For this stage, I involved Simon Overstall, my human collaborator, in order to see if additional computational visual treatments and sound could be created to signify what Tom was experiencing. We modeled an animated tennis ball—the object of Tom's motivation—orbiting the virtual space, just out of reach of Tom's mouth. We created a circling halo of leaves around the figure of Tom, that had a quick movement to counterpoint Tom's slowly moving body. We included an animated aura surrounding the figure of Tom suggesting his excited emotional stage. All of these were combined against a live abstract backdrop that also contributed an energetic look and feel (Fig. 10 and 11.

Fig. 10. Still from live animation output of *EPIC_Tom,* movement 2, performance at Neutral Ground, Regina, Canada, 2016.

Fig. 11. Still from live animation output of *EPIC_Tom,* movement 5, performance at Neutral Ground, Regina, Canada, 2016.

We experimented with how his vocalizations could play a part in sonically communicating his emotions. I knew from past experience that Tom could be exquisitely articulate with his voice.

So, we needed to involve Tom in a sound recording session. Like in the mocap studio trials, I invited Tom to get familiar with space and equipment before beginning work. He seemed fine with everything, so we started the recording session, and I encouraged him to vocalize. I communicated this by pointing at my mouth while asking him questions, signifying that I was requesting his responses as vocalizations. He understood this communication technique from recording sessions for our previous projects *Rockstar* (2010) and *Aria* (2009*)*.

Fig. 12. Tom and Sugi recording their vocalizations in my studio, with me prompting them using my own vocalizations and hand gestures. Photo courtesy of the artist.

When I reflect on the Berns experiments, I understand now that Tom was probably experiencing empathy in the sound studio. He was mapping my oral articulation onto his body and responding with his own—human voice to dog voice. During these sessions, I used positive vocal rewards, happy facial expressions, and food rewards to communicate my appreciation of his responses.

As in the mocap sessions, we used indeterminacy methods to relinquish our expectations of what he might contribute. Tom freely vocalized as he saw fit, and these were recorded. We worked only as long as Tom was interested. Once we accumulated a few hours-worth of recordings, we went back to my studio to listen.

During the listening stage, I kept in mind what I imagined as Tom's emotional state before catching the ball. This helped me evaluate which sequence of recorded vocals may evoke these emotions for listening audiences, and compliment the animations. We identified a twenty-five-second sequence, consisting of five vocal utterances that communicated wonder, desire, excitement, anticipation. I felt these emotional qualities based on evaluating them in terms of pitch, pitch-shift, amplitude, and the dynamic changes over time, and what I knew about Tom's vocal expressions in previous situations.

Once we determined the vocalizations we'd use, we experimented with extending the duration of this recording to compliment the extended time depicted in the animation. We used granular synthesis techniques that afforded durational manipulation without changes in pitch. In this way, we were able to extend the twenty-five second recording to twenty-five minutes. This complimented the extension of time depicted in the looping animation, but without losing the expressive quality of Tom's untreated vocalizations. The process revealed new potentials about the project's final form. We could consider the five utterances—now each five minutes long—as movements, like in a music composition. And this helped us determine the project's final form—a live animation and sound performance.

Not only can granular synthesis be used to modify the duration of a sound file, but it can be used to emphasize characteristics of the original sound recording. It does this through constrained randomness programmed into a piece of granular software, which can play large numbers of tiny individual elements in a sound recording—some as small as a few milliseconds—from various parts of a recording. We listened and analyzed the qualities of Tom's vocal recordings, and used this granular technique to emphasize the qualities of each movement, and the shifting complexity of the whole. For example, the first movement uses

granular techniques to emphasize the wonder Tom feels for the ball; the second movement emphasizes his focused attention; the third movement builds excitement; the fourth movement builds anticipation on top of the excitement; and the fifth movement has a climactic euphoric quality. Simon developed custom software that allowed him to play these sonic treatments, live, on the original sound file. Through this process we gained insight into the final sonic form of the project. The live soundscape of Tom's voice could be heard as a score, and responses could be improvised by participating musicians who played along with it.

In the next stage, we needed to integrate the live animations with the live sound. We re-examined the animation in order to design visuals to complement each sonic movement. Simon developed software to generate visual qualities on the animations to work with the emotional feel of each sonic movement. For instance, the circling colourful aura around Tom's animated body was treated differently for each movement. The background behind Tom is similarly treated, using a set of constraints in the software, to create a pattern that shifts, in terms of colour and shape with each movement (see IMAGES 1-5). Simon designed the visual software so that I could manage it in the performance, and the results could be projected onto a screen situated behind the musicians (see Figs. 13 and 14).

To further develop the performance stage, we experimented with participatory methods for the invited musicians. We decided to use a music method, *call and response,* as a technique to produce patterns of interacting between Tom's vocal soundscape and the musicians' soundings. We conceived that the live soundscape could be thought of as a durational call that invited participating musicians' responses. A phrase sung or played—*called*—by Tom was responded to by the musicians in the form of another phrase, thereby demonstrating an interspecies relationship of calling, listening and responding. This approach incorporated methods of deep listening, improvisation and musicking.

In 2016, we were invited to perform a number of instances of *EPIC_Tom.* For each one, we invited local musicians from the host cities to participate. For Neutral Ground Contemporary Art Forum in Regina, we worked with members of the Regina Symphony Orchestra (RSO) who contributed violin, cello and flute;[127] for Pixelache 2016: Interfaces for Empathy Festival, Helsinki, we worked with a jazz duo Erkki Joutseno on percussion, and Grisell Macdonal on

[127] Neutral Ground.

stand-up bass;[128] and we worked with the VOICE OVER Mind Choir in a performance at Emily Carr University (2019).[129] In all performances, I participated as one of the responding musicians, using my theremin instrument. The rehearsal processes used methods of indeterminacy; we did not determine in advance what sonic details the participating musicians will provide. Instead, Simon and I described each movement in terms of its emotional character, and instructed the musicians to respond to the generated soundscape of Tom's vocals as a score. The live animations, customized for each movement, provided visual cues for the musicians to follow to build a sonic narrative. The musicians could also take cues from my theremin playing, where I tried to align my sounds, in terms of pitch and intensity, to those of Tom's treated vocals. Other than those performance instructions, we did not have any additional performance notes for the musicians. We wanted to experiment with this indeterminant method in order to relinquish our authorial control, in favour of participatory sonics.

For each of the performances, we had one or two rehearsals in order to agree on approaches. Because the processes were somewhat unconstrained (in contrast to more conventional music-making situations) the rehearsals and performances became unique sonic events. Each performance was toned by the specific instruments used by the participating musicians, by the skills they developed in their preferred music genre, and by the approaches generated from the rehearsal discussions. For example, in discussions with the members of the RSO, we learned that they normally perform under highly constrained conditions set by the music score and by the conductor. For them, improvising in performance was an unfamiliar process. Regardless, they were open to experimenting with this novel approach, and combined this approaches they used in more conventional settings. They suggested a new music method using a building pitch-shift—low to high pitched notes—as a musical phrase to build emotional tension representing Tom's building emotion. This phrasing enhanced the emotional character of Tom's vocals, and emphasized the tension between Tom and the ball depicted in the animation.[131] Similarly, in Helsinki, we had discussions with the drummer and bass player about Tom's experience, and the cumulative emotional character of the movements towards a whole. They suggested a jazz approach that supported the soundscape's anticipatory trajectory. The drums in particular were used to build sonic speed and complexity over the duration of the whole performance. Overall,

[128] Pixelache.

[129] *EPIC_Tom* with musicians DB Boyko and the VOICE OVER mind Choir was performed as part of the "Time, Light + Sound Series", Emily Carr University, Vancouver.

[131] See video documentation on my website, www.animallover.ca. Andreyev.

the participating musicians provided crucial sonic support to evoke the emotional quality of Tom's experience. In each instance, improvisation was used, and this involved listening and interacting with the emerging sonic moment. Each performance involved asking the musicians to feel-like-a-dog.

"Deep listening," a technique first developed by Pauline Oliveros in 1979, involves paying attention, as thoroughly as possible, to the sonic characteristics of a given moment. Deep listening processes support a form of democratic listening.[132] Similar methods were proposed by John Cage who emphasized the importance of making an "identification with what is here and / now." [133] Deep listening can be applied to the *EPIC_Tom* performances where we use call and response methods. In order to respond to the sonics unfolding—the emergent soundscape from Tom's vocals—a listening musician must enact two forms of attention. One involves focusing on the details of the immediate sonic event, such as the changing pitches; the other involves paying attention to the sonics of the total soundscape. These forms of attention were applied in the performances of *EPIC_Tom* where the participating musicians listen to the emergent characteristics—texture, pitch and rhythm—of Tom's call, and used this to model their sonic responses. They also know the overall structure of the soundscape based on its five movements and the unique treatments in each movement. So, the musicians have an idea of what is to come, and how they can respond during each movement. Overall, these listening and improvisational methods model a form of ethical listening and responding to nonhuman expression. The methods propose a novel process for participating musicians, and for audiences, to witness and listen to a nonhuman animal's point of view.

A performance of *EPIC_Tom* is not a musical work *per se* but, more crucially, an art action. This can be detailed using the idea of *musicking*.[134] In contrast to music, musicking describes a social act establishing relationships between performers, with an audience, and with larger societies. *EPIC_Tom* is a form of musicking where canine expression and voice are the focus of a social sound-making event. It's interspecies creativity on the fly, in front of public audiences. However, the project takes on larger societal aims than merely visual and sonic pleasure, it draws attention to other-than-human expression and creativity. Also, *EPIC_Tom* experiments

[132] Van Nort, Oliveras, and Braasch.

[133] Jaeger.

[134] Small.

with uncertainty, the tenuous relationships between humans and nonhumans and, in doing so, undermines normative forms about human mastery and control.

Fig. 13. *EPIC_Tom* performance with members of the Regina Symphony Orchestra—Simon MacDonald on violin, Simon Fryer on cello, Marie-Noelle Berthelet on flute—performed for Neutral Ground Contemporary Art Forum, Regina, 2016. Photo courtesy of Gail F. Chin.

Fig. 14. *EPIC_Tom* performance with DB Boyko and the VOICE OVER mind Choir, for "Time, Light + Sound Series", Emily Carr University of Art + Design, Vancouver, 2018. Video still courtesy of Teejita Gupta.

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Crows and Stones

What a delicious sound! It is not merely crow calling crow, for it speaks to me too. I am part of one creature with him; if he has a voice, I have ears. I can hear what he calls… [135]

—Henry David Thoreau

The moving rock is a participant in the practice of extended cognition as well as an agent of world building. [136]

—Jeffrey Jerome Cohen

[135] Thoreau quoted in Kilham 1989,107.

[136] Cohen, 138.

A gift from a crow

Fig. 15. Pebble gift left by my crow neighbour. Photo courtesy of the author.

I sat in one of the chairs on our roof deck, under the canopy we just bought. I was testing the position of the canopy, and how much shade it created. It was good, we could finally relax out of the hot sun. I was facing north, looking at the distant Grouse and Seymour Mountains on the far side of Burrard Inlet. Today they were gray outlines, hazy from the wildfire smoke, a reminder to coastal inhabitants of the conditions in the province's interior. Below the mountains, the Vancouver Port Terminal, with its giant slow-moving cranes, emitted a constant industrial hum. My eyes moved and focused on the foreground. Something on the deck's railing, caught my eye. It was a tiny pink pebble. I recognized it as one of the stones I'd put in the water plate for the birds. *That pebble on the railing. Did you put it there?* I asked Greg who was securing the cables of the canopy. *What?…No,* he replied. The pebble was positioned exactly in line of sight as I sat in the chair and looked at the view. And then it struck me—it was *placed* there, deliberately, to get my attention. Could it be a gift from the crow?

The summer of 2015 was one of the warmest and driest on record for Vancouver. It was only mid-June, and the days were already much hotter than summer normal. On the roof deck, the sun's heat affected the potted plants and vegetable garden. The azaleas were turning yellow, and the young sprouting veggies needed water twice a day. In the afternoon, the sun was too

hot for anybody. But the new canopy offered a solution, creating light shade and coolness for the plants and us. I wondered how other animals were surviving. Urban-living birds, raccoons, coyote, and bees all need water to survive. Where did they find a drink?

Down below, in the small shaded Japanese garden at the back of the house, I'd routinely fill two granite bowls with clean water. Occasionally, I'd see a house finch, wren or sparrow flutter down and take a quick drink. I watched a bee on the edge of a bowl, bowing her tiny head to take minute sips of water. The bee seemed ok in the garden, but the birds were uncomfortable with its enclosure. Its small size meant that was too fenced-in to afford a quick escape if needed. I wondered if the roof deck would be a better place to provide water for the birds. I suggested to Greg that we move one of the bowls up there. But he preferred to leave them as is because they'd grown into the space of the garden. The sides of the bowls attracted algae and moss, and this contributed to the garden's calm aesthetic. I'd have to come up with a different solution for the roof deck.

Traditional birdbaths are used by urban birds to drink, bathe, and soak food. They have a rim where birds can land, and a gentle sloping surface which birds can use to safely access the shallow water. I didn't have a birdbath, but I did have a shallow ceramic plate with the right shape. It had a two-inch flat rim surrounding a bowled interior that could contain a small amount of water. I set up the plate on one of the benches on the roof deck, in the shade of the canopy. I gathered a few pebbles from the Japanese garden below, where they served to represent a dry streambed, and placed them in the water plate (Fig. 16). I imagined the pebbles might appeal to the birds. They could stand on them or enjoy looking at them while they drank or bathed. I checked the plate every morning and filled it with fresh water. I didn't directly see any birds using it. But a few times, as I opened the hatch to climb onto the roof deck, I caught a glimpse a female house finch perched in the red maple beside the plate. She'd fly off as soon as I stepped onto the deck. I figured she, and other small birds, were using the water when I wasn't there.

Fig. 16. My first water plate for the birds, with pebbles. Photo courtesy of the author.

After a few days, I noticed some white stuff amongst the pebbles in the plate. At first, I thought it was pollen from cottonwood trees. But the closest cottonwoods were a few kilometers away in Strathcona Park. I cleaned out the plate and filled it with fresh water. A few days later, I found half a bun on the plate's rim. It was the type served in restaurants as a free side-dish. I realized that the previous white stuff must have been bread crumbs. Later, I phoned my mother and told her about the bun. She said, "I have a crow that comes to the backyard and soaks bread in the birdbath. The crow uses the water to moisten the bread and feed it to the young ones. I think they have a hard time swallowing dry bread."

At the time, I didn't think much about the traditions of crows or other urban wildlife. That was about to change. I suddenly became intrigued by the possibility of the crow parents and youngsters using the water plate, and I began to wonder how they managed to live in the city. Turns out, urban-dwelling crows have a lot in common with urban-dwelling humans.

Urban crows and humans have similar daily migrations and social traditions. Except during the summer when they're nesting, crows are daily commuters, like humans. Each morning, they travel from their communal roost into the urban areas where they work their home territories. In the evening, just before sunset, they return to the roost to congregate for safety, rest and share information about the day.[137] Crow couples usually inhabit the same home territory for their entire lives. From my local observations, this is an area of about a quarter to half of a city block. Some parts of the city are communal, where crows gather in groups to forage, such as on the lawns of parks where they hunt for worms and beetle larvae, or in select trees where they get together to chat and play. It's my belief that most parts of the city are defined territories, and these are defended by the resident couple especially during nesting periods. Like in traditional human societies, crow couples mate for life, and develop strong emotional bonds. They collaborate on nest-building, and caring for family and non-family members. They share feeding responsibilities, teaching and protecting their young. Crows have a well-developed sense of curiosity and regularly engage in play. They also form relationships with individual humans.

Good neighbours

One afternoon, before that hot summer of 2015, I was working in my studio on the second floor of our home. From the window, I could watch crows fly from the park across the street, and land on our roof. I could also hear them; sometimes they'd pound and knock over my head. I imagined they were hammering a large piece of food they'd found it into smaller pieces to eat. Back then, I found the sound annoying. I'd go up to there with Tom, and he'd excitedly bark and scare the crows away. I didn't think much about it until later when I realized these scare tactics created a lasting impression on the crows. When I'd leave the house to go for a walk with Tom and Sugi, the crows nearby would spot us, swoop down and angrily call out. I assumed they were nesting, and that this was regular behaviour used to defend their nests. It didn't occur to me that these were the same ones that were using our roof, and that Tom and I had scared away. I didn't understand that their scolding was a response to *my* bad behaviour.

Scolding is an alarm call used by crows to draw attention to offending animals. It includes outspread wings and tail flicks that accentuate the drama. If the situation warrants, scolding by an individual crow will escalate into mobbing, where other crows join in and dive and swoop at

[137] The crows of Vancouver have a roost with an estimated three to four thousand individuals, located in an industrial park on Still Creek in the nearby municipality of Burnaby. The crow commute is well known by Vancouverites, and is commemorated in public murals around the City's eastside.

the threatening individual. Scolding and mobbing are often directed toward raccoons who predate on eggs and nestlings. But in the city, it's also a defense against humans.

When we'd continue our walk and reach the playing field a few hundred metres away, the crows of that home territory would also scold us. We'd walk along the track, and they'd follow, angrily cawing and hopping along the chain link fence beside us. As we'd exit the other side of the field, they'd fly from tree to tree, tracking us until we were a comfortable distance away from their homes. As we got further away, the crows of those territories didn't bother us. They were aware of our presence, but not angry about it. Sometimes, they were even playful. On a couple of walks, I heard an *ark ark*, like a small dog barking at us from a distance. I'd locate the direction of the barking and realize it was coming from a tree. I'd look up to see a crow watching us, and mimicking the dogs. Tom would hear this, and bark back in protest.

The American crow is the species that inhabits most of North America. But the slightly smaller conspecific northwestern crow lives in the coastal ecosystems of the Pacific Northwest which includes Vancouver and my home. [138] The ones that live in urban areas have communication systems and social traditions they've adapted for city life. These include an outstanding ability to recognize human individuals. Crows remember humans in two ways: through direct contact with those humans, and through peer-to-peer communications. [139] Crows with direct experience will share their information with other crows in the area, and even with future generations. This includes information about threatening humans, and the ones that show kindness.

Communications about threatening humans includes scolding or mobbing in front of other crows. The observing crows witness these actions and will remember the human individual.[140] Crows remember humans by their facial features, and will continue to scold or mob that individual in future encounters—*for years*.[141] Crows who've not had direct mistreatment, but gained knowledge through peer communications, may themselves initiate scolding towards the humans they've learned about.[142] Knowledge about a threatening human is also shared intergenerationally. The crows who were subject to an injustice, and those who observed it, will teach their young about the perpetrator. In future encounters with that human, the offspring will

138 Patterson; Scott.

[139] Cornell, et. al.; Marzluff 2012.

[140] Marzluff 2012.

[141] ibid.

[142] Ibid.

respond similarly, with scolding and/or mobbing behaviour. The crows who scolded Tom and I were simply responding to our threatening behaviour. Not only that, but when we scared them away, we were chasing them from *their* home territory. The crows in the playing field probably learned about us indirectly, from observing our crow neighbours berating us. The ones further away from our home, who likely did not witness any scolding or mobbing, left us alone and were curious and playful. In the summer of 2015, I decided to try to make it right with the crows neighbours. I hoped that the water plate could serve as gesture of reconciliation. Maybe we could turn over a new leaf.

During those hot summer days, the water in the plate would evaporate in a few hours. I realized I needed a larger one that could hold more water and not dry out so quickly. Reluctant to spend a small fortune on a concrete bird bath, I looked for an inexpensive large glazed ceramic dish, the kind used underneath potted plants to catch excess water. The one I found was twenty inches in diameter and two inches deep with a small lip that crows or other birds could perch on. I imagined they'd prefer this larger dish for soaking food and bathing. I placed it on the roof a few metres beyond the deck, to provide the birds with some privacy (Fig. 17). The crows adopted it right away. I kept the small plate with the pebbles on the bench beside the maple in case any other birds wanted to drink from it.

Fig. 17. The water bath as a larger second water source I provided for the crows for food soaking, bathing and drinking. This photo shows bread being soaked by the crows to soften and feed to their youngsters. Photo courtesy of the author.

Each morning, I'd fill the water bath and the small plate. The bath would almost always have crumbs or bits of bread in it from the previous day's food soaking. I no longer found food in the small water plate. Sometimes I'd open the hatch to the roof and catch a glimpse of the crows. I saw the adults taking drinks from the bath. A parent would give water and food to a fledgling by picking out a piece of soaked food and placing it in the young crow's open red mouth. I came to understand these crows as a family. My new relationship with this family helped me become more curious about them as individuals. I learned to recognize the adults from the young ones, and the males from the females. The adults were my neighbours whose home territory includes my home and the youngsters where their offspring born that summer.

Crow age and gender can be identified by size, colour, voice and behaviour. Adult crows have purplish-black feathers and brown eyes, while fledglings have brownish-black feathers and blue eyes. Their blue eyes change to brown a few months after birth. Fledglings vocalize with higher-pitched insistent *maws*, while the adults use lower-pitched *caws*. The adult male is larger than the adult female and the youngsters. Young females are the smallest. The adults have confident movements, while the young ones are slightly awkward while they're still learning to fly, perch, hop and walk. Reading up on naturalist observations, I began learning about the processes of raising a crow family.

In the early spring months, mated couples re-establish their bonds. You can see them perched side by side on telephone lines and in trees. Sometimes one will bow their head down, asking to be preened by the other who will tenderly clean the feathers on their partner's face, head, neck, breast. Crow couples start nesting just before the leaves emerge on the trees. They may try to refurbish a nest they'd built in previous years in the home territory. But if the old nest needs too much repair or is infested with mites, they'll build a new one. Both crows do the twig collecting, but the female does the actual nest-building. She uses thin crooked sticks about 30cm long, stacking them in a way to allow their crookedness to form a bowl shape appropriate to her size. She presses the inside of the nest with her breast to shape it to her body.[143] After building the general shape and size, she'll insert more twigs to give it strength. While she's working, particularly if the stick gets jammed in an unsuitable position, she may make a growly vocalization in frustration.[144] Sometimes she'll be assisted by 'auxiliaries'—offspring from

[143] Kilham 1989.

[144] One naturalist describes it as "…an almost human tone of exasperation and complaint." Goodwin quoted in Kilham 1989, 66.

previous years, or unmated adults in the area. These helpers assist with the nest-building by collecting twigs and passing them to the female.[145]

After the nest building is complete, the couple will take a week or two off before the female lays her eggs. Our crow neighbours go on vacation for about ten days. During that time, I don't see them around here. But, as the leaves on the trees emerge and provide cover for the nest, the couple will have returned and the female will have laid her eggs. The male takes on the role of guarding the female and the new eggs, and feeding his mate. He has to find food for both of them. She will take breaks from the nest, make short flights for exercise, sit on a telephone line in the sun, or momentarily forage on the ground for grubs. Auxiliaries may also help by foraging and feeding the female while she's on the nest.[146] Sometimes they'll even ask for food from other crows, and bring it to the nesting crow.[147]

When the young hatch, there's a flurry of activity. The previous year's youngsters, and other crows in the area, may visit the nest to see the babies.[148] For the first nine days, the babies' eyes are closed, and they'll need a lot of feeding and attention. Both adults are constantly looking for food and preparing it for the babies. I've watched our neighbours create special food pellets to feed the newborns. They use moistened food from the bath mixed with saliva, and sometimes dirt from our planters, repeatedly turning this mixture in their mouths and crop to blend it for the young ones. The parent repeats this process for each meal and each baby, numerous times a day. Auxiliaries may also visit the nest to feed the babies.[149] They give a few quiet *caws* before approaching to alert the blind babies and not startle them.[150]

After the young ones fledge, they stay with their parents for the summer and into the fall. They learn about being a crow, about their local culture, and about the urban area and community. They'll be taught food foraging, fending off predators, communication skills, nesting, and about the humans in the area. I've seen our crows each take on teaching one of their offspring. The father will spend time with the young male, and the mother will teach the young female. They'll go on short trips to teach their youngsters about good foraging areas, such as where to find water sources, and where to find shellfish.

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[145] Kilham 1989.

[146] ibid.

[147] Ibid.

[148] Ibid.

[149] Ibid.

[150] Ibid.

Based on the complexity of nesting, it seems that females have a lot to learn. I've noticed the female youngsters stay with the parents longer than the young males who seem more eager to be independent, sometimes leaving the family after only a few months. During the late summer and fall, the young gain more independence. Some of our neighbours previous year's offspring have gone to live in the territory down the street which is inhabited by a band of juvenile crows. These offspring greet me as I walk by with Tom and Sugi and, particularly in the winter when there's not much food around, they'll ask for a handout. I'll put a piece of rice cake or popcorn on a tree branch or fence and they'll swoop down to retrieve it. Sometimes they'll give a few quiet clucks. I've come to understand this vocalization as an acknowledgement of food. Spending time observing the crow couple, I've come to understand their love for each other and their babies. And, I've been able to sense their gratitude and growing trust towards me.

That summer when I started leaving water for the crows, I read about a girl in Seattle who provided food and water to the crows, and also received gifts in return—stones, flowers, or brightly colored bits of plastic.[151] Responding to this story, corvid expert John Marzluff said "there's definitely a two-way communication going on there…They understand each other's signals."[152] Gifts are a way for the crows to communicate their appreciation for the food and water. Marzluff elaborates, "…feeding or demonstrating kindness toward a crow might really be the key to winning it over. Doing so reduces a bird's stress…New memories of helpful people are formed, and memories of once-feared people are suppressed."[153] The Seattle crows were using gifts as objects of communication with the girl. My crow neighbours were also using this system of communication. The dependable water source, and the tiny pebble gift from them, marked a new understanding between us. This was a first step in a series of interspecies communications with these amazing birds. Some of these communications evolved into interspecies artworks.

It's important to develop good relations with urban-living wild animals. Improved relations can occur using knowledge from scientific or naturalist studies on nonhuman behaviour and cultures. However, it's crucial to understand how that knowledge is gained because this has implications for the animals involved, and affects how the animals are regarded in contemporary culture. How animals are perceived by the public, in turn, influences how they are treated in

[151] Stewall.

[152] Marzluff quoted in Stewall.

[153] Marzluff 2012, 191.

future encounters. Likewise, a critical look at representation is important because it can have consequences for the animals, and for audiences and readers. Representation has the ability to reinforce already-existing biases against nonhuman animals, or shift perspectives towards compassionate and ecological understandings.

Crow mind and narrative ethics

Improved relations with other animals, such as the ones with whom we share our urban spaces, depend on the choices we make about our physical interactions with them, and how we represent these. For instance, textual representations that objectify other animals, such as those used in mainstream science, have a distancing effect that reinforces the already problematic beliefs in the separation between humans and everyone else. In contrast, representations that acknowledge the relations between humans and other animals can help grow a sense of kinship and ecological consciousness.

In the section above, I included information on the crows' ability to remember human individuals. This knowledge was based on studies by John Marzluff, the biologist who commented on the Seattle girl and her crow neighbours. His research contributed to knowledge about crow cognition and culture, and the findings were shared broadly in popular media—television shows, books, newspaper articles, and social media. This knowledge helped shift public perceptions about crows, evidenced by how Canadian and American publics currently regards crows, usually remarking on how smart they are because they remember human individuals. However, the methods used in these studies needs to be critically examined because they've had lasting effects on the crows involved, and have reinforced problematic views on the ethics of animal engagement.

During the studies, Marzluff and his team used netting, capturing, handling and banding techniques on the crow subjects in order to mark them for identification. This is a conventional method used by biologists to track birds. Marzluff and his team intended to record data on the crows' memory of humans, and how they communicated this experience with others in their community.[154] During the process of capturing and handling the crows, the researchers wore a mask developed specifically for the studies. The mask was a way to standardize the facial features of the researchers and, therefore, to test the banded crows' memory of those facial features in future masked encounters. The processes were carried out in the urban area of

[154] Cornell, H. N et. al.; Marzluff et. al. 2009.

Seattle so that other crows in the community could observe the masked researchers and their handling of the crow subjects. The researchers hypothesized that the handled crows, and the observing ones, would associate the facial features of the mask with threatening actions. (It's important to note that the mask had particularly scary characteristics, such as exaggerated features). The studies demonstrated that the handled crows memorized the mask, and they passed this information on to other crows using scolding and mobbing communication methods. The information about the masked encounters continued to spread throughout the crow community. The masked humans were remembered for years, and the numbers of crows who scolded them in future encounters grew.

The studies were recorded in video and presented in a television special for general audiences.[155] The program showed the capture and handling of crows by the masked researchers. However, neither the researches nor the program critically reflected on the potential outcomes for the birds because of these methods. On the contrary, the television program reinforced, for viewing publics, the view that the instrumentalization of nonhuman animals through the use of fear and perceived threat is acceptable. Not only that, but the potential for lasting harm as a result of handling the birds was not addressed. It's known that capturing and handling can have a traumatizing effect on birds and other animals. Some birds, after they've have been captured, banded and released, can suffer a loss of social status, and subsequent ostracization or attacks by others in their community.[156] Ostracized birds have a greater risk of mortality than those who are part of an established cooperative group. Marzluff's research concluded that the crow studies had lasting effects for the bird community because they remembered the masked encounters. But what is unclear is whether the researchers considered the consequences of these long-term effects on individual birds.

In 2010, the same year as the television show, Marzluff published *Gifts of the Crow*. The book was marketed for a general readership, and described the studies above along with his additional neurological research on crows.[157] The other research included crows who were exposed to the mask with the aim was to collect data on residual neurological activity associated with the threatening actions of the researchers. This involved laboratory processes including injecting radioactive markers into the captive crows, exposing them to either a masked

[155] The episode "A Murder of Crows" in the series *Nature*. PBS. October 24, 2010. Clips from this episode are available on Youtube.

[156] Snow; Burley; Southern and Southern.

[157] Marzluff and Angell.

or non-masked researcher, sedating the crows, and putting them in a positron-emission tomography (PET) scanner. PET technology is used to track metabolic processes in the body. For the crows, the fear associated with the threatening mask left markers in their brains, and these were detected by the PET scans. The data from the scans suggested that the crows had memories of fear associated with the mask. While these studies suggest that crows remember fear, they also underscore the problematic methods used in the research which deliberately creates fear and the perception of threat in order to track memory.

If we consider what was at stake for the birds involved in the studies then we have to ask a few questions: What happened to the crows after the PET scans? Were the crows released back into their communities? Was there a follow-up study to see if the captured crows were able to integrate back into their families and groups? Answers to these questions were neither addressed in the book nor the television show. For viewing publics and general readerships, this relayed an implicit message which reinforces detrimental views of human relationships with nonhuman animals. The engagement with the birds served to promote the view that mistreating nonhuman beings for the sake of human knowledge is acceptable. The context of this knowledge is important to note. If we consider that the studies were carried out by a renowned researcher and shown on a respected television show, we realize that audiences are faced with a model that feeds into a normative authoritative system. The model that's shown strengthens the entitlements endemic to anthropocentric views—that humans, especially scientists, can do whatever they want with nonhuman beings.

Focusing on the book for a moment, we can gain additional insight about how textual representation can reinforce problematic views on animals for readerships. If we look closely at the type of language used in the book, we can see that it promotes outmoded views on nonhuman animals, such a mistaken belief in their lack of capacity for intentionality. In the book, mechanomorphic language is used to describe the biological processes of the birds. Mechanomorphic language originated in behaviorist methodologies from the early twentieth century, and is characterized by deliberate word choice describing living processes as mechanical.[158] It portrays living organisms as machine-like—without the ability to deliberate about their situation, to feel emotions, stresses and pain. Mechanomorphic language is also used to diminish empathic responses in researchers towards their subjects or participants. By depicting the living animal as mechanistic, researchers are less likely to feel empathy and

[158] Crist 1996.

emotions in response to the animals and their situations. In Marzluff's book, the neurological processes of the crows were described using typical mechanomorphic descriptors——*electrical signals, electrical commands, command muscles, neural loops, preprocessing of action commands, restimulating neurons*. These terms represented the crow subjects as made up of circuitry and computer-like functioning, and their behaviors as automated reactions. This dampens empathetic responses from the readers for the birds because it keeps the animals' experiences at an 'objective' distance. Readers are less likely to feel empathy for the birds if they're described as machine-like. Mechanomorphic language rejects everyday words, such as stress and fear, to represent nonhuman experience. The result was the negative experiences of the birds were not made evident for readers.

The use of mechanomorphic language with its highly technical jargon is widely used in science, and it is notable for its rejection of everyday language. Everyday language is avoided because it has anthropomorphic characteristics which can evoke continuities, such as stress and fear, between humans and other animals. [159] Everyday language has the potential to generate empathy in readers for the subjects being discussed. In my view, this is precisely why everyday language *should be* used, particularly in public dissemination—in order to improve understandings about other life. Everyday language can represent the ecological reality that humans and other animals have shared states—cognition, emotions, intentions. Fortunately, there are improved models of study with nonhuman animals, such as in cognitive ethology and naturalist methods that reject instrumentalization and problematic representational methods.

While the early twentieth century saw the rise of behaviourism and mechanomorphic language in research involving living beings, there was a concurrent, but largely suppressed, stream of research based on Charles Darwin's naturalist approaches. Naturalist studies were dismissed by science because they were regarded as unobjective. But later in the twentieth century through to today, the work of Darwin and other naturalists are making a comeback. Contemporary naturalist studies, and progressive scientists within the field of cognitive ethology, are developing methods that acknowledge the importance of treating other life with care, without the deliberate use of fear and threat. Additionally, affective representational techniques are used in order to create connections between the nonhuman animals under investigation, and the human researchers and publics.

[159] ibid.

In 1976, Donald R. Griffin proposed the study of animal consciousness in the new area of research called cognitive ethology.[160] Cognitive ethology differs from behaviourist methodologies because it's methods consider behaviors as flexible and adaptive—therefore creative—based on experience and learning. Cognitive ethology further contrasts with behaviourism because it researches animals using respectful processes in in the field.[161] Today's cognitive ethologists use methods of observing animals in their own territories and cultures, in contrast to conventional methods of capture and study in the laboratory. Cognitive ethology also acknowledges the importance of how these studies are narrated. For example, the objectives of the Ethologists for the Ethical Treatment of Animals founded in 2000 by Marc Bekoff and Jane Goodall describe their methods:

> "…ethological research will come to be conducted more ethically and responsibly, and alternatives to routinely invasive methods will be developed and implemented. Also, people will be made aware as quickly as possible of approved alternatives. We recognize that ethological research will continue in the future and that we are accountable for how we study other animals. As we learn more about the cognitive and emotional lives of other beings, and this information is shared widely, windows into their lives will be opened and a deeper understanding of their minds and emotions will help us develop more ethically sound, noninvasive methods."[162]

Cognitive ethology has its roots in naturalist methods developed by Charles Darwin and others in the nineteenth century. Their methods of representation demonstrate how text can depict the inner life of nonhumans under investigation, and the affective events of the observing researcher. This is critical to creating connections between humans and nonhumans, which in-turn leads to ecological understanding and compassion.

Darwin developed a research technique called anecdotal cognitivism that involved observing and recording information about individual animals. [163] He argued that anecdotal cognitivism can account for the character of individuals and their day-to-day interests and actions, and provide information on variation and creative responses by those individuals. The method involved

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[160] Griffin's research is described in Allen, Colin and Marc Bekoff. "Animal Minds, Cognitive Ethology, and Ethics." *The Journal of Ethics*, 11 (3):299-317, 2007.

[161] ibid.

[162] Bekoff, Marc and Jane Goodall. Ethologists for the Ethical Treatment of Animals. Citizens for Responsible Animal Behavior Studies. 2000. http://www.ethologicalethics.org

[163] Crist 2002.

studying how decision-making and creative processes are based on the here-and-now of the individual's situation, and their unique histories.[164] Additionally, Darwin's method integrated empathic textual representation using everyday language in order to engage readers. For example, Darwin carried out detailed studies with earthworms and documented these with descriptions on how they use leaf parts to construct tiny doors to close their burrows from outside predators, and to keep the worms warm and dry underground. Each earthworm constructs a specific door based on the availability of materials and qualities of the location. In some studies, Darwin tested the individual worms' creativity by introducing leaf parts from foreign plants. The worms used their tactile sense to understand the shapes of the unknown leaf parts, and orient them in the most effective way to close the burrow.[165] In other words, they creatively adapted foreign materials to suit the needs of the situation.

Darwin also studied the earthworms' tradition of constructing basket-like structures in their borrows as spaces of habitation. Typically, the worms would line their structures with materials at hand, such as their own castings and found leaf parts. Darwin experimented by introducing unknown materials, such as pieces of ceramics, beads, and foreign pine needles. The worms sensed the material qualities of the unknown items, and manipulated them in order to appropriately incorporate them into their basket-like structures. In one example, Darwin notes that the foreign pine needles have a sharp end, and the earthworms figured out how to orient and treat the needles in order not to injure themselves:

> "The pine-leaves had all been drawn in by their bases; and the sharp points of the needles had been pressed into the lining of voided earth. Had this not been effectually done, the sharp points would have prevented the retreat of the worms into their burrows; and these structures would have resembled traps armed with converging points of wire rendering the ingress of an animal easy and its egress difficult or impossible. The skill shown by these worms is noteworthy and is more remarkable, as the Scotch pine is not a native of this district."[166]

By studying the worms' responses to the foreign materials, Darwin suggested that the earthworms are sensing, thinking beings who creatively adapt their building techniques to

[164] In decades following, this method was largely suppressed by the emerging field of behaviourism which promoted study in the laboratory, and descriptions using mechanimorphic language.

[165] ibid.

[166] ibid., 6.

incorporate new materials. Importantly, Darwin used descriptive techniques to invite readers into the world of the earthworms. He used nontechnical, everyday language that created an imaginative picture for the reader. In the example above, the reader can imagine the worm's vulnerable body in contact with the sharp needles. Through a process of empathy, readers gain an understanding of the earthworm, who, like them, share a living body that experiences pain and takes measures to avoid it.

Darwin includes his own thought and feeling to lead the reader towards better understanding. In the quote above his response to the earthworms' skill includes the words "noteworthy" and "remarkable." In this way, he invites readers to share in his wonder. This creates a pathway for readers to connect with the nonhuman animals being described. Techniques like this are critically important to shifting public perception, because they can influence how readers think and feel about other animals in future encounters. Previous conceptions about the lowly earthworm are now transformed towards an understanding about their creativity and ingenuity, and how they share physical states with humans, such as a need for comfort.

Another example of naturalist representation methods is from George and Elizabeth Peckham who were working within a similar time period as Darwin, and likewise used anecdotal methods, everyday language, and recognition of their own affect. The Peckhams were known for their studies with wasp individuals. Here is an excerpt from their writing that documents how a wasp builds her nest:

> "In filling up her nest she put her head down into it and bit away the loose earth from the sides, letting it fall to the bottom of the burrow, and then, after a quantity had accumulated, jammed it down with her head. Earth was then brought from outside and pressed in, and then more was bitten from the sides. When, at last, the filling was level with the ground, she brought a quantity of fine grains of dirt to the spot, and picking up a small pebble in her mandibles, used it as a hammer pounding them down…thus making this spot as hard and firm as the surrounding surface. Before we could recover from our astonishment at this performance she had dropped her stone and was bringing more earth."[167]

The narration is relayed in the here-and-now allowing readers to experience the details of the unfolding encounter with the wasp. By focusing on the wasp's sequential actions, the

[167] Ibid., 820.

description suggests the wasp's conscious decision-making processes. Like in Darwin's narration this documentation takes into account the consciousness of the researchers, and how the wasp's actions lead to their astonishment. Overall, the descriptive techniques invite the reader to participate in observing the wasp's building project, and likewise feel amazed. The reader feels wonder through the realization that the wasp is motivated to create a built environment for shelter and security, and this aligns with the reader's own needs. This revelation leads the reader to feel a connection with the wasp.

Naturalist methodologies, inspired by Darwin's approaches, continue today. For instance, contemporary naturalists include methods that: "(1) … give accounts of animal life that are faithful representations; (2) relate their observations and findings in non-technical language; and (3) record behaviours after close and long-term observation of animals in their natural surroundings."[168] Faithful representations are based on an understanding that observational events are relational—they happen between the human observer and the nonhuman animals under investigation.

Naturalists use of everyday language was influenced by the method of *Verstehen*, an approach developed in the late nineteenth century by philosophers and social scientists, Max Weber, Alfred Schutz, and Harold Garfinkel.[169] *Verstehen* uses everyday forms of perception, reasoning and action based on subjective meaning. It proposes that meaning is generated by individuals in their interactions with the world. This study was developed for research involving humans, but *Verstehen* can be extended to support thought on nonhuman agency, where other animals can be seen as beings whose actions have meaning. This argument is important to this chapter because it helps describe *biophilic attention*, a key technique I will detail that helps one feel connected with the natural world.

Schutz, who originally conceptualized *verstehen*, describes 'wide-awakeness' as a key component of the method—an active attention in the form of full awareness of life in the present.[170] If we use the previous examples of Darwin and the Peckhams, we can see that they were indeed enacting wide-awakeness in their studies. This is evidenced by the detailed notation of the earthworms' and wasp's actions, and the awareness of their own responses to these actions. The actions of the nonhumans had meaning for themselves, but also for the

[168] Crist 1996, 799.

[169] Ibid.

[170] Schutz quoted in Crist 1989.

researchers. This wide-awakeness to the present moment unfolding is biophilic attention. Contemporary philosopher Brian Massumi describes a similar method as *thinking-feeling*. It is "… a thinking of perception in perception, in the immediacy of its occurrence, as it is felt…"[171] Thinking-feeling, or biophilic attention, acknowledges the interconnected experiences of doing, feeling and knowing. Applied to events with more-than-human beings, it describes how action creates meaning for both the human and the nonhuman being. For example, the wasp's project, and the Peckhams' attention, jointly produced the astonishment. Likewise, the earthworms' remarkableness was co-created by the worm's building project, and Darwin who felt moved by their actions. The naturalists were fully aware in the here-and-now, with the other animals, and this allowed them to recognize how they were affected—how they thought and felt, in relation to the nonhumans' actions. This is a key aspect of biophilic attention which acknowledges life as made up of meaning-making events co-created with all sorts of participants.

Meaning-making between researchers and nonhuman animals is also explored by today's cognitive ethologists. This involves critical methods using everyday language with its capacity for anthropomorphism.[172] For example, as mentioned in the previous chapter, contemporary cognitive ethologist Marc Bekoff conceptualized *biocentric anthropomorphism* as a method to better imagine the life of the animal under investigation.[173] Feeling-like-a-dog, or thinking-like-a-crow, can allow greater empathic engagement with these animals and, therefore, generate better research questions involving respectful means.

Contemporary naturalist Lawrence Kilham used similar methods in his decades of observational studies involving corvids, and he used everyday language to disseminate this information to a broad public readership.[174] In the previous section, my descriptions about crow nesting traditions, family relations and the participation of nonfamily members in the nesting processes were based on Kilham's findings (along with some of my own observations). His methods involved close observation without harm. In his book, he makes an argument for rejecting capturing and banding techniques, and instead argues for identifing individual crows by their markings and behaviour which is a technique he developed. He came to know individuals by a broken or missing wing or tail feather, their bill characteristics, vocalizations and actions.[175] In

[171] Massumi 2011, 44.

[172] Berns 2013; Kilham 1988, 1989; Marzluff 2012; Pepperberg; Slobodchikoff.

[173] Bekoff 2004.

[174] Kilham 1988, 1989.

[175] Kilham 1989, 8-9.

this way, he developed a method to keep track of individual crows and how they socialized within their various groups and communities. He believed that paying attention to the individual's markings was easier than trying to discern coloured leg-bands from a distance. Looking carefully, and being able to recognize individual crows while an event takes place, allowed him to focus on the event as it unfolding.

> "Every bird, as I have found out time and again, can be something special if one will just take the time to really look at it… Watch everything…My system worked from the beginning. I could count on coming home with something learned, something to write in my notes, something to read about, every time I went out."[176]

Kilham would spend hours in the field, looking through binoculars and making notes. His method of "watch everything," and his close observation of individuals in their communities, contributed a wealth of knowledge about crow traditions and cultures. A true naturalist, Kilham was committed to the use of anecdote and everyday language. He argued that "…simple narration, or an anecdotal style, is the soundest way of presenting how animals live."[177] Through his deep attention and compassion for his subjects, he created some of the most compelling narrations about crows, and human and crow sociability. Plus, he had a knack for detailing descriptions of interspecies relational events. For example, in Kilham's encounter with Crowsy, a young crow he adopted,[178] he related the crow's actions and how they create meaning for himself:

> "Crowsy's great interest continued to be playing with pebbles and other objects. One morning he picked up a pebble and, holding it in his bill, did a minuet, taking steps and sideways hops that reminded us of the dances of Crested Cranes we had watched in Africa. He also danced on a stone wall while holding bits of fresh leaves, stems, or flowers. With eyes that were still blue, he suggested, at times, a Satin Bowerbird. Crowsy was very fond of objects. If I returned from a walk and called, he would leave his spruce limb to alight by my feet, pick a small leaf, dance with it, then lay it by my foot or on my shoes."[179]

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[176] Kilham 1988, 13-14.

[177] Kilham 1989, 7.

[178] Kilham relates how his son brought home a fledgling crow he had removed from a nest. Kilham regretted his son's actions but felt compelled to adopt and care for the young bird. Kilham insists that he does not advocate removing young from their parents. Kilham 1989.

[179] Kilham, 137.

The anecdote narrates an understanding of Crowsy's individual character—he likes to play with objects, such as stones, leaves and flowers, and he uses these objects for communication; dancing with the leaf, and laying it at Kilham's feet clearly communicates Crowsy's joy at Kilham's return.

Kilham's representation of Crowsy is profound on a number of levels. It depicts the care and trust of their relationship, and it shows Kilham's willingness to acknowledge his empathic processes. When Kilham returned from a walk he called out to Crowsy demonstrating a desire to interact with the bird. Crowsy responded by meeting up with him and physically interacting with objects in proximity to Kilham's body—a striking example of a wild bird's trust towards a human. The narration includes information about how Crowsy's actions affected Kilham, by evoking recollection of other birds. Kilham's interpretted Crowsy's actions with the objects, and how these created meaning for both the bird and himself.

In my own interactions with the crow neighbours, I've focus on developing a relationship of mutual care and trust. My small gesture of care—a regular source of water—was the first step in developing this trust with the birds. Their response with the pebble gift opened up a whole new world of relating.

Stone communications

The tiny pink pebble on the deck's railing was the first instance of interspecies communication with the birds. The stone was a powerful focal point, drawing attention to how meaning can be shared between the crows and myself through actions with objects. When I first recognized the pebble on the railing as having come from the water dish, I experienced a complicated mixture of feeling and thought. I was simultaneously excited but skeptical. I was excited about the communicative potential with my crow neighbour—how amazing! Doubt was present because of decades of conditioning by normative views on animals that include negative notions about their communicative capabilities. In that complex moment, I couldn't immediately reconcile whether the crow had intentionally left the pebble there or not.

As I examined the pebble, I was keen to come to terms with what was presented to me. Various scenarios played out in my imagination. In one, I pictured the crow had just finished using the water and felt an urge to leave a gesture of appreciation for the water, hopped over to the water plate, chose out a pebble—an object associated with the water—flew onto the railing and left it in an obvious place where I would find it. In this scenario, they anticipated that I would

understand the pebble as a gesture of appreciation. They carefully chose the location to leave the pebble with the knowledge that I would notice it as I sat in the chair. This speculation created all kinds of excitement for me because it meant that the crow had carefully considered my point of view. In another scenario, I imagined the crow picked up the pebble from the water dish, hopped onto the railing and began to fly off with it, but dropped it instead. Its position, in alignment with the view from the chair, was merely coincidence. This scenario had a disappointing effect for me. Both these scenarios seemed likely, but I needed to find out what happened. So, I decided to conditionally accept the first scenario and leave a response for the crow.

I went over to the water dish on the bench and chose a slightly smaller green pebble and placed it on top of the pink one, creating a stack of two. The stack was an elaboration on their move. I hoped they'd understand it as a communicative response. My reasoning was that the green pebble followed the mode of communication, with stones, established by the crow. By placing my pebble on top of theirs, so that the two were directly in relation, it may be understood as both an acknowledgement of their communication method, and a new response.

Fig. 18. The crow's pebble gift with my pebble response on top. Photo courtesy of the author.

The next morning, I woke up early filled with anticipation. I climbed onto the roof deck to check the pebbles. There it was. My little green one was no longer on top of their pink one, but lay to the side. I looked more closely, some doubt sneaking in despite what I was seeing. The pebble

was small, perhaps light enough to be blown off by a strong wind. But it hadn't been windy that night. Doubt still lingering, I decided to create another move, more robust to withstand any potential wind. It consisted of three stacks of two pebbles, larger and heavier than the original ones, all taken from the water plate. I arranged them neatly, in the same location on the railing as the original pebbles.

Fig. 19. The crow's rearrangement of my response. Photo courtesy of the author.

Fig. 20. My new more robust arrangement. Photo courtesy of the author.

Again, the following morning, I checked the stacks. And there they were, beautifully adapted into a fluid arrangement. Immediately, I felt a rush—a strong physical sensation of expansion, as though being swept up. In an instant, my perception sharpened, my vision become clearer, my hearing keener. I looked up at the small birds flying overhead and heard their calls; I looked over at the trees in the park and had a heightened sense of their aliveness. I felt an overwhelming sense of connection to the more-than-human worlds around me.

Fig. 21. The crow's rearrangement of my robust arrangement. Photo courtesy of the author.

In the moments that followed, I reflected on my sensations and I realized I was experiencing a complex swirl of astonishment, joy, and wonder. I felt humbled in the face of trust offered by another animal.[180] I had a flash of insight about creativity as a shared trait amongst all living beings. I was getting a peak into the world of the crows, and a felt new vista opened up. It was an unknown but tantalizing territory.

I was transformed by this pebble play in the sense that it expanded my relationship with the more-than-human community of my neighbourhood. I found myself paying more attention to the

[180] Dorothy Yglesias, a naturalist and bird rescuer, describes her experience with a jackdaw, a member of the corvid family, "[the] first instance of a wild bird's trust was a most wonderful experience. 'Wonder' was the right word. We had never dreamt of finding such a beautiful way into another existence."

crow family, their movements, calls and actions. When I'd leave the house for a walk with Tom and Sugi, I'd hear a *caw–caow—caw.* A sequence of three caws, the second slightly longer and rounder sounding, with a longer pause between it and the last *caw*. They were signaling my presence, not scolding me but announcing me. Hearing this, I'd stop and look around for who was calling. Seeing the one or more of the family members watching us, I'd respond with a cheerful whistle.

The following few weeks, the pebbles were played between the crow and myself. It was like a board game, with the players making moves off-line, and at their own convenience. We never came in direct contact with each other as we manipulated the stones, so I didn't know if the crow was the male or female of the pair. Each morning I'd check the pebbles to see if they had come up with a new arrangement. When they did, I'd examine it for its features, photograph it, and offer a new arrangement in response. As the pebble play progressed, I became curious about the crow's processes. How did they decide what to do? Did they spend time on their arrangements? Did they move a pebble and then change their mind, pick it up and reposition it? Each day, as I'd climb the ladder to the roof deck, I was filled with anticipation hoping to see the crow interacting with the stones. I'd have my camera ready just in case.

One afternoon, I heard a crow making a knocking sound on the roof. I realized I had not yet checked the stones that day. I climbed the ladder, camera in hand. As I poked my head through the roof hatch, I saw them. They were picking at something on the bench beside the water plate. I pushed the video record button on the camera. They noticed me, quickly finished what they were doing, hopped up onto the railing above the bench, and walked over to the pebble arrangement. There, the crow paused and glanced at me. Then, they made a gesture with their beak against the railing. It was a rub on each side of their beak. I remember seeing other birds do this after they'd eaten, as a gesture of satisfaction. But his was different because it was in proximity to the pebbles. The crow looked down at the stones, and over at me. Then, leapt into the air calling *caw-caw-caw-caw-caw* as they flew to the telephone pole across the street. Landing there, they looked back. It all happened so fast that I couldn't tell if the crow was the male or female of the couple. I was more focused on the crows actions which seemed for my benefit.[181] I sensed that the crow created a deliberate, thought-out set of actions, in my presence, to communicate their intentions. I felt moved by the generosity. The actions clarified that the crow had indeed been interacting with the stones, as I had imagined. The little beak rub

[181] See video documentation of this event at: https://vimeo.com/156732166/c1b57cf80b

communicated this. I had just learned something about the crow's playful character and interest in aesthetic experimentation.

Fig. 22. Still from video recording of the crow walking on the deck railing over to the pebble arrangement. Photo courtesy of the author.

According to cognitive ethology, play is defined as activity carried out in benign conditions where the player is free from stresses of finding food, shelter, or other immediate survival needs. It includes typical actions carried out in novel or innovative ways which are self-generative or pleasurable.[182] My crow neighbours had some of their survival needs taken care of with the regular water I provided. Their stresses of day to day living were eased, so they were more likely to have time to engage in play. The crow's actions with the stones were indeed playful. They were using typical actions with objects—stones—manipulated in innovative ways. Plus, they demonstrated their pleasure by continuing to engage with the pebbles. Reflecting on the innovative character of this play, I am struck by its significance. The crow came up with a new form of interspecies expression.

[182] Massumi 2014; Marzluff 2012, 118.

We continued our pebble play for two weeks, and this generated ten moves between us (see Fig. 23). The overall process produced lessons in interspecies aesthetics. Each of us had characteristic gestures we used for each move. I noticed that my arrangements were restrained and repetitive, while the crow's were without repetition or apparent patterning. When I'd create stone stacks, they'd re-arrange these in a beautiful sweep. The spaces between the pebbles of the crow's arrangements were less regular than mine. Their arrangements were more organic looking made up of non-uniform clusters complimented the stones' irregularity, while mine had an awkward look that was contrary to the organic shape of the stones. Their arrangement seemed to move with the gravitational forces, while mine resisted gravity. I realized that the crow was applying a process of indeterminacy, using a gesture with their beak against my pebble stacks, and this allowed the stones to fall-as-they-may. This method generated arrangements that were more relaxed and in-tune with the qualities of the stones. Overall, the crow's arrangements were more beautiful than mine, because they took into account the irregular qualities of the pebbles. This was a teaching moment. I was reflecting on my constrained moves and comparing them to the crow's ability to move with the energetic flows of the Earth. I realized it was a lesson in *wu wei*.

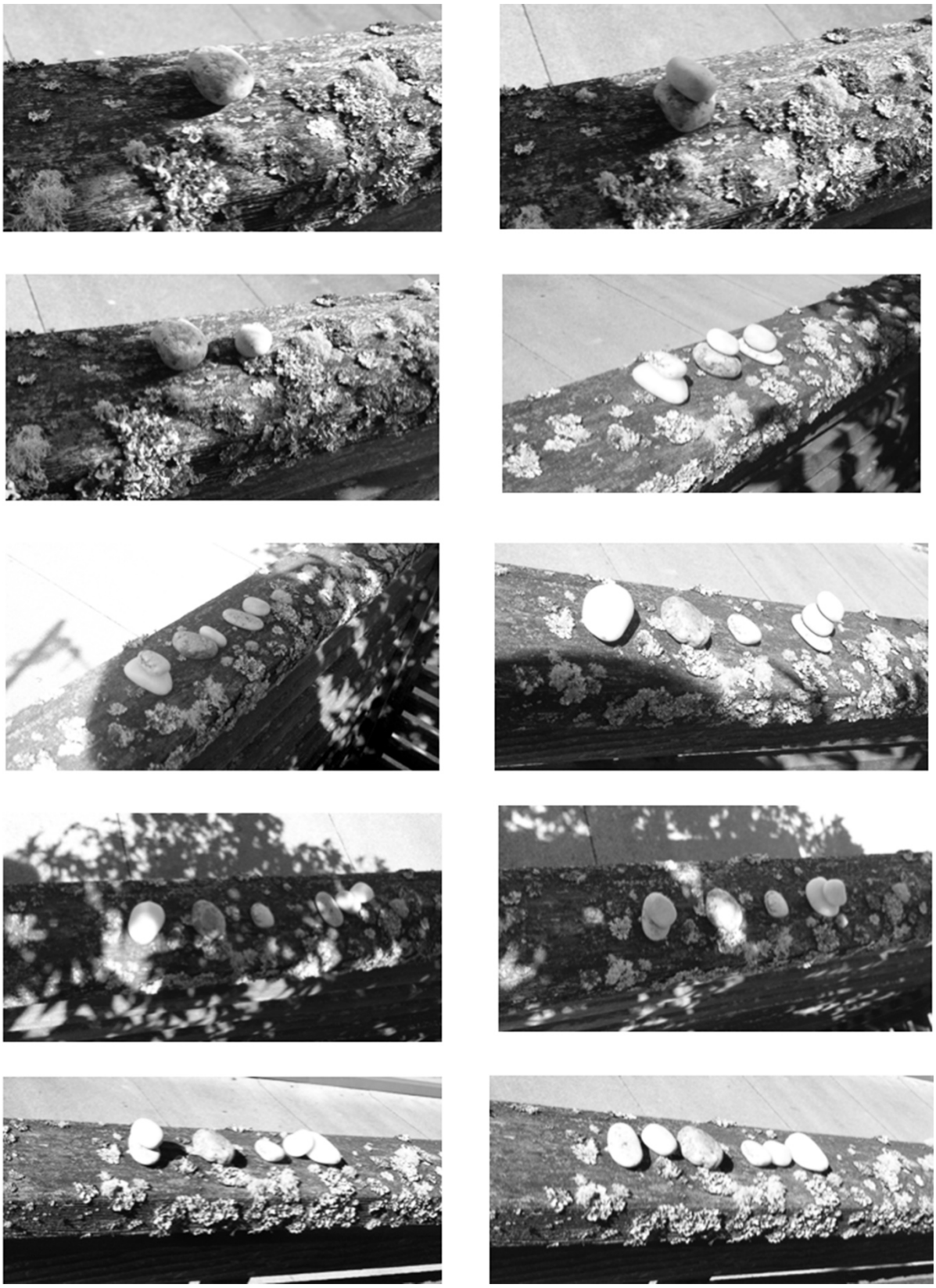

Fig. 23. The sequence of stone arrangements with the crow's on the left, and mine in the right. Photo courtesy of the author.

Stone aesthetics

The worldviews of Tao and Zen share animistic outlooks when regarding what Western cultures consider 'inanimate' matter, such as stones. In Tao and Zen, all matter is considered energetic, and each type contributes to the holistic vitality that is the Earth. Tao and Zen practices, specifically their landscape design aesthetics, helped me think through the pebbles' roll in my interspecies processes with the crow. They led to subsequent projects, *Crow Stone Tone Poem*, and the *Bird Park Survival Station*.

In the ancient Chinese philosophy of Tao, all beings—living and nonliving—are thought of as configurations of *qi* energy. *Qi* manifests along five transformative cyclical phases—wood, fire, soil, metal, water. In Tao, it's thought that the world is not material, but rather, shape-occurrences of *qi* energy configured along this transformative cycle. These shape-occurrences shift according to energetic phases, taking on characteristics of each. It's believed that by attending to the *qi* energy of the moment, and by recognizing its manifestations, one can understand the potential for appropriate action in the world. This is *wu wei*—appropriately responding to the energetic flows of the world in any given moment. The practice includes seeing one's own motivations in relation to the collective energies present in that instance.[183] *Wu wei* proposes no-force, action without striving.[184] This means not clinging to conventions, preconceptions or desires, but cultivating attention to the immediate moment, and acting accordingly. It suggests that one should pay attention to the energetic forces of the world, including the actions of others, and understand how these can tune one's own actions. In other words, it involves being mindful of *becoming in relation,* including with other beings.

The crow's actions with the stones, and my responses, can be described through the lens of *wu wei,* where potentialities emerged at each stage in the game. Each of us responded to the other's arrangement, and used features of the other's stones to influence our own next move. On reflection, I think the crow was much better practicing this mindfulness than I, mainly because I was so constrained by my own preconceptions about pattern-making with the stones. The crow was able to work with the stones' qualities and produce arrangements that reflected their organic complexity. The crow created appropriate responses. When you take animistic worldviews into consideration, it becomes clear that the way Westerners think about stones is

[183] Mathews.

[184] Cleary.

quite limited. This is reflected in my awkward arrangements, shaped by an entrenched worldview about stones as inanimate matter.

Like Tao practice, Zen is also an animistic worldview, and this can be exemplified in how inanimate matter, such as stone, is regarded. In Zen philosophy, dualities at the core of Western worldviews, such as animate/inanimate, human/nature, self/other are incongruent and nonsensical. Rather, Zen proposes that all the world's beings—animals, plants, stones, water, air—are vital manifestations of energetic forces, participating equally in lived reality.[185] It's a democratic view on life. In Zen, the dualities at the core of Western worldviews such as nature/human or self/other represent an illusion, not reality. Even the material presences of stones are thought of as energetic beings contributing to the holistic vitality of the Earth. [186]

Another way to re-think the role of stones is to critically examine Western perceptions where it is thought of as dead matter that doesn't appear to move or change.[187] But if we look at stone through Zen philosophy and take into account limited human perception, we can understand that the stone's geological timescale is imperceptible to the speedy human sense. Dogen Zenji, a Zen master from the 13th century describes mineral being and its durational quality, saying "People outside the mountain do not realize or understand the mountains walking. Those without eyes to see mountains cannot realize, understand, see or hear this as it is...At this moment, you cannot doubt the green mountains walking."[188] In other words, because humans are outside the timescale of the mountains, they can't perceive the mountains' vitality. In a more reduced version: just because we can't perceive something doesn't mean it doesn't exist.[189]

When we consider how stones can participate in meaning-making we can begin to have a greater appreciation for their role in the world. Stones' relation to the larger scheme of things is well-demonstrated in the Tao or Zen garden practice. For instance, in ancient Chinese landscape design, the gardener considers the significant role of stone in the garden's configuration. He pays attention to the characteristics of the rocks at hand, and how these determine their placement. He takes note of their shape, texture, energetic inclination, and sound. Their surface texture, with contrasting openings and solid attributes are considered in

[185] Bai.

[186] Here, I use the animate/inanimate duality to support the point; it is understood that the dualism is used to support the argument, rather than as an adopted method in this philosophy.

[187] Cohen, 80.

[188] Dogen quoted in Bai.

[189] Bennet.

terms of their aesthetic appeal. The rocks may also have sonic characteristics that make meaning. When tapped they may sound like the *bianqing,* an instrument used in Chinese court music (see Fig. 24).[190] By paying attention to their inherent characteristics, the gardener facilitates the rocks' participation in establishing their roles in the garden. The gardener arranges them in such a way as to convey their potentials for meaning. Within the contained space of the garden, the rocks may resemble forces in the world—specific known mountains or other beings, such as grazing animals, or a pair of monks talking. They may also evoke ecosystems.[191] Their arrangement in the total space of the garden, forms a scaled version of the world, such as a mountain range or water system. This practice represents stones as key players within the garden.[192]

Fig. 24. The bianqing chime instrument, from Marquis Yi's tomb, Hubei Provincial Museum. Photo by Zhangmoon618 - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=14519712

[190] Parkes 2000.

[191] Ibid.

[192] ibid.

Fig. 25. Zen garden incorporating *karesansui* at Daisen-in (1509–1513), a sub-temple of Zen Buddhist Temple Daitoku-ji, Kyoto. Photo by Ivanoff, commonswiki assumed (based on copyright claims), CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=958949

Japanese Zen garden practice grew out of Chinese garden design, and further incorporates animist views. The Zen garden merges Chinese Buddhism influenced by Tao, with the indigenous Japanese animistic worldview of *Shinto*. A Zen garden is typified by *karesansui*—dry landscape—where the majority of features are mineral elements, such as large rock arrangements, pebbles, and sand. Karesansui incorporates characteristics of Shinto by considering the vital energy of the universe—*kami*—present in all things.[193] Rocks are considered to be powerful sites of kami, and karesansui acknowledges this through a form of attention cultivated by the gardener in dialogue with the rocks. In the landscape design process, the gardener uses the principle of *kowan ni shitagau*—following the request of the rock. Using this practice, he recognizes the most powerful one of the bunch.[194] This 'master rock' reveals themselves through their surface features, shape and size. These qualities are apprehended by the gardener because of his developed perceptual sense. The gardener responds to the master rock by understanding their correct placement in the garden, and how this allows for an expression of the rock's intrinsic *kokoro*—sense of awareness.[195] The master rock's placement informs the arrangement of the rest of the rocks in a cluster, and in the larger mineral ecology of the garden.[196] In Karesansui, no actual water and very little plant-life participates. Instead, mineral elements create meaning through forms of dialogue and representation. A field of raked sand invites a contemplation on emptiness—a meditation on the illusion of the self;[197] a cascade of rocks recalls a natural waterfall; a multitude of pebbles arranged on the ground in a stream-like formation resembles moving water (see Fig. 25). Using stone to represent water features is an aesthetic practice of meaning-making. For people visiting the garden, meaning is generated at once, in the beholding. For example, the karesansui stone features immediately evoke a sense of water.

A reflection on the practices of karesansui and wu wei is useful as a context for the tiny pebble left by the crow, and our subsequent stone arrangements. The crow understood that stones can create meaning. They chose the pebble gift because of the physical relationship to the water in the plate. The crow anticipated that this relation as presenting a potential shared understanding between us. The crow also understood the larger space of the deck with its furnishings, how

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[193] Ibid.

[194] Parkes 2000.

[195] Carter, 80.

[196] Quote from the *Sakuteiki* (Notes on Garden Design) written by 11th century poet Tachibana no Toshitsuna, translated by Joe Earle. From Earle.

[197] Parkes 2009.

they were used by me, and how they influenced my body and perception. They paid attention to the position of the deck chair—had probably observed Greg or myself using it—so knew how its position, and that of the railing would model my point of view. [198] They anticipated that the features of the deck would mold my perception of the pebble as I sat in the chair. Like a master gardener, the crow knew how to manifest a powerful focal point in the tiny pebble amongst the larger ecology of the roof deck.

In our subsequent pebble play, we shared an understanding about how the characteristics of the stones could be arranged in location. They could lay flat, beside each other, touching, on top of each other, spaced out, arranged in stacks or sweeps. We considered the energetic forces of the earth—the wind and gravity—and how these informed our configurations. The resulting arrangements were material outcomes, brought about by our knowledge of stones, and their ability to participate in creating meaning. The crow also understood that stone could be a medium through which we could connect.

[198] In science, this is called theory of mind; the ability to anticipate what another may be thinking.

Fig. 26. *Karesansui* stream feature as part of my Japanese garden at the back of the house. Photo courtesy of the author.

When I reflect on this interspecies event, I'm struck by how provisional it was. I could have easily overlooked the pebble, being distracted by thoughts or actions on the deck. Eventually and inadvertently, the pebble would have been knocked off the railing, fallen to the roof amongst the other unattended objects, such as leaves and twigs. The crow's gesture towards me would have been missed. Fortunately, I had already been sensitized to the crows and other birds in the neighbourhood so I was tuned-in, eager to forge new relations with the birds. Because I was curious to know more about them, I had developed an eye for noticing. This is a feature *biophilic attention*—a curiosity and openness to the potentials of more-than-human action. Anything can

happen! Biophilic attention is a real-time mindfulness, a wide-awakeness in the moment, with an openness to becoming.

Based on these experiences with the crow, and my research on the observations of Kilham and Marzluff, I believe crows know the communication potential of objects, including stones. Crowsy used stones and other objects to communicate with Kilham; the Seattle crows used gifts to communicate with the little girl who provided food; my crow neighbour used the materials at hand to communicate with me. These events sugges new ways to think about interspecies communications using materials. They also suggest a way to rethink material vitality and the role of objects—specifically stones—and how they can participate in bringing lifeforms together.

Using attentive practices, such as by the crow, the gardener, the naturalist, the sage, human perception can be expanded. And this expansion sets the conditions for moving away from separation and towards connection.[200] Like Kilham's "watch everything," and Massumi's "thinking-feeling," biophilic attention can be a way to grow everyday experience, to feel more embedded in the more-than-human worlds around us. It's a form of self-actualization in relation, offering possibilities to re-sense and re-think conceptions, towards new understandings about the Earth.

Ruins

During the final week of the pebble-play, I found myself getting bogged down in concerns about conventional forms of art-making. Apart from the textual and photographic narrative taking shape with the crow and stones, I began asking myself whether I should be using more traditional art media. The snapshots of the pebble arrangements provided some documentation, but as photographs alone they were not compelling. They needed a narrative to contextualize them. I found myself thinking about how the photographs could be better and this dug a hole of conformity. It provides a lesson on the entrenched nature of instrumental thinking when it comes to art making.

I began to research bird-cams, thinking I could use one to capture photos of the crow interacting with the stones while I wasn't there. I purchased a model housed in a weather proof enclosure that had a motion detection system using an inferred sensor that triggered the camera to take a photo or video. I mounted the camera on a tripod and positioned it close to the area of the

[200] Bai.

pebble play. It was about one metre away from the pebbles, and angled so that the lens pointed down at the pebbles. I left it set up for the day.

Next morning, I checked the *hundreds* of photos it recorded. All of them featured the pebble arrangement that was my last move, but none registered a bird. And, more importantly, the pebbles were untouched. I adjusted the sensor's sensitivity and tried again. Next day, more photos but no birds. After fiddling with the camera for a few more days, it still failed to document the crow. The sensor was somehow being activated, but not in the presence of birds. More importantly, the crow stopped playing.

"The camera looks like a scarecrow." Greg said. He was right. The front of the camera looked like a face, articulated by the sensor, lens and controls. It loomed over the railing, peering down at the pebbles. I realized I had failed to consider the crow's point of view and how they may interpret the camera. I had stopped thinking-like-a-crow. I removed everything, and returned the camera to the store. The delicate nature of our play ended. I had ruined it.

Other gifts

The next few weeks, I focused on repairing the crow's trust. I tried out some new pebble arrangements on the railing. None of these interested them, but I continued to fill the plate and the bath with fresh drinking water. I placed a larger stone next to the plate with a few stacked pebbles on it. They showed no interest in these. I put a couple of colorful beads in the water plate to provide for additional aesthetic potential. They lay there, undisturbed. Each morning as I'd go up on the roof to fill the water, I'd take note to see if the plate was being used.

After a few weeks, I did notice that the pebbles in the plate had been moved around. Sometimes the plate would be dry and there would be a pebble or two on its rim. These ones seemed to be signaling the lack of water in the plate (see Fig. 27) so I'd fill the plate and put the pebble back with the group. Sometimes the stones would be rearranged and I imagined that the crow had been poking around in the water. These stone arrangements were quite lovely.

Fig. 27. Water plate showing pebbles rearranged by the crow. Photo courtesy of the author.

Over the fall and winter, I continued to try and improve my relations with the crow family. In the winter months, finding food can be more of a challenge for birds. So, I knew that providing food for them would be meaningful. In the mornings, I'd put some broken-up pieces of rice cake on the rail above the water plate. They'd be gone when I checked back later. One afternoon, I found a delicate piece of tree bark left in place of the rice cakes. The beautiful fragment had tiny outcrops of lichen and moss, and gave the impression of a miniature landscape.

Later in the autumn, a light dusting of snow fell and one morning I placed rice cake pieces on the rail as usual. An hour later, I went up to check on them. They were gone, and I noticed some foot prints in the snow on the rail and a bunch of seagulls were flying a few metres above my

head. The prints matched the webbed feet of gulls. I realized that the crows probably didn't get a chance to eat the rice cakes. I recalled that Kilham used peanuts to attract crows because nuts are a high-source of protein. I changed to organic peanuts, thinking the crows would try to grab these before the gulls. The crows got used to this routine and would show up as soon as I appeared on the deck in the morning with the peanuts.

A few days after I'd started giving them nuts, a group of crows visited my window while I sat inside the house knitting. I was on the couch in the living room, just inside the window that faces the street. I heard crows calling outside, and looked out the window. A group of six or seven were hanging out on the roof of the building across the street. Then, one flew by my room window, only two or three feet away, and circled around the street and headed back to the group on perched on the building. The crow did this three-times. Each time they were directly in front of the living room window, they'd call, *caw–caow—caw*. The other crows called back in response. I sensed that this crow was signaling my presence, communicating to this group, letting them know who was providing the food.

Since then, I've kept up the practice of providing small amounts of food—popcorn, peanuts, vegetarian dog kibble—to the crows each morning. This morning tradition has re-established trust with the couple and their new offspring. Each morning, I'd wake up to the calls of crows flying into the city from the roost. I'd go up on the roof deck and sometimes, the couple would already be perched on the telephone line beside the house. They'd watch as I put out the food. I'd retreat a few steps to give them space and within seconds, the adult male crow would fly down to the railing, gather all the food into his crop and fly off to eat. I'd put another handful out for the female adult and she'd fly down and, more cautiously, gather up the food.

Each summer since the pebble events, the crow couple has given birth to a new generation. And, as an announcement, and I'd receive a special gift—a regurgitated food pellet, the kind the parents make for their young ones (see Fig. 28). The first time this happened, the couple was on the telephone line waiting for me to notice the gift as I reached the deck and walked towards the railing. When I spotted the pellet, the female excitedly called. She leapt off the telephone line and flew to the tree that housed her nest. She turned around and flew back to the line and called again. She did this a few times, and I understood. She was communicating to me about her newly hatched babies. I felt her joy and excitement, and called out to her "Hey! A new generation!" I celebrated the event by telling Greg and my mother, and friends who were

interested. That day, I increased the amount of nuts, so she could more easily feed her youngsters.

Fig. 28. Regurgitated food pellet gift left for me by the female crow. Photo courtesy of the author.

A few weeks later, I was working in my studio when I heard a crow commotion in the park across the street. I looked out my window. The adult male, and other crows, were on the chain link fence of the baseball diamond scolding human passersby, urging them to keep away. Then, out of the nesting tree, a fledgling swooped down onto the lawn. His first flight! The mother greeted him and regurgitated a food pellet into his mouth. I felt happy about his accomplishment. After a few hours, I heard the crow couple up on the roof, calling. I went up there to give them a handful of peanuts and popcorn. When I approached the edge of the deck, I saw *three* crows. The parents were there with the baby! He had downy brown feathers on his chest and looked a bit stunned by it all. He watched me put the food out, and his parents called a few times. I felt humbled at their trust, that they wanted to introduce the youngster to the deck and to me. I greeted the youngster, “hello world!”

Crow Stone Tone Poem

Almost a year after the stone arrangements, I thought again about how they could inform an art work that could be shared with public audiences. This time, I used a more considered approach. I spent some time thinking about the stone arrangements and their material qualities. They had specific characteristics: the types of mineral, the numbers of stones, the distances between each one, and their relationship to each other—touching, beside or on top of one another. Each arrangement was an individual move, either by the crow or myself, and each of us had our particular style. Around the same time, I attended a workshop called "Branching Out in Somerset: Making Art with Trees" led by British artists Camille Nelson and Alex Metcalf. The workshop included interspecies making with trees, using mostly using text-based processes, such as poetry and performance. I had the opportunity to experiment with the stone arrangements, and to think about them as an algorithm for poetry. [201]

The textual process involved assigning a word to each of the six stones used in the pebble play arrangements. The idea was to use words organized according to the stone arrangements played out over time—line after line—to create a poem. Because I had already started writing this chapter about the crows and stones, I chose words from the draft that could be applied to each of the six stones used in the pebble play. It was an experiment, so it didn't matter so much which words were selected. What did matter was the test to see if the arrangements could be thought of as an algorithm or set of instructions. The first tiny pink pebble was assigned the word *crow*, and the green pebble I put on top was assigned the word *human.* Each stone was assigned a word in this way. Then, each of the rest of the words were arranged in horizontal lines, and from top to bottom in the chronology of pebble arrangements. I took into account the spacing of the words to correspond to the way the stones were spaced. And if the stones were placed on top of each other, or beside, etc, I'd mimic this with the words. This procedure generated a poem (see Fig. 29).

[201] Thanks to Camilla Nelson for suggesting this text experiment.

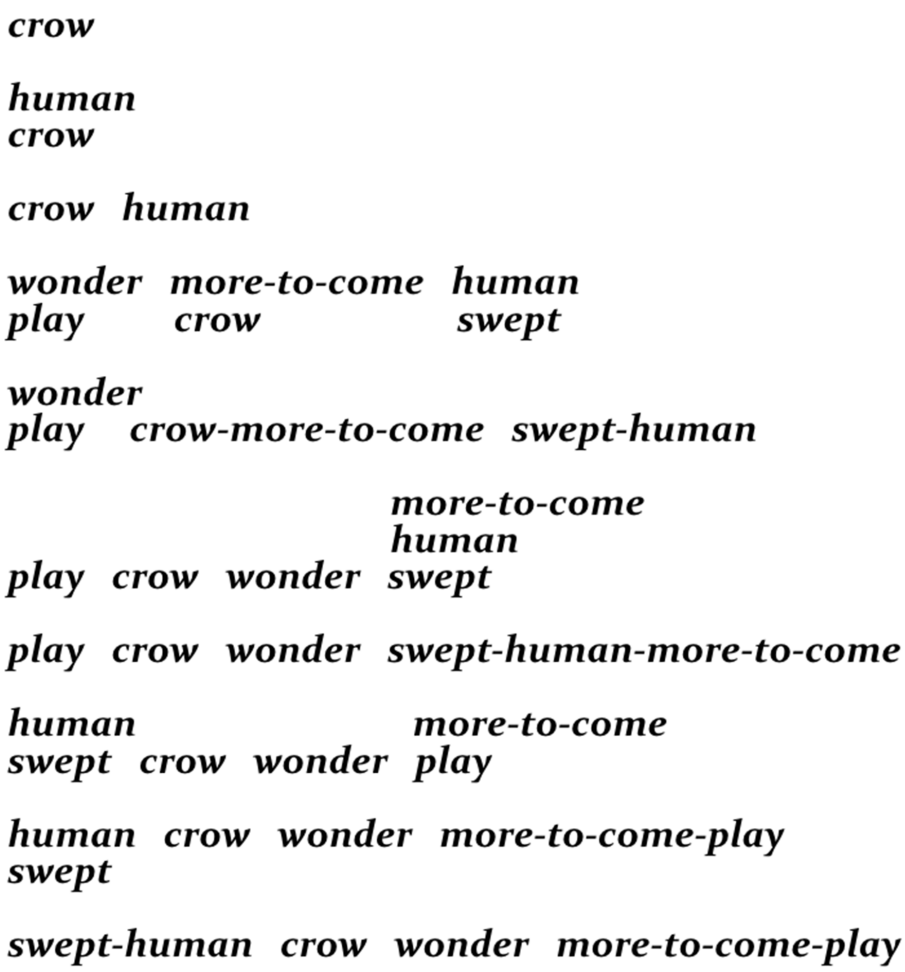

Fig. 29. Poem generated by an instruction based on the stone arrangements by the crow and myself. Photo courtesy of the author.

The resulting poem, while somewhat repetitive and not very good, was proof that this procedure could generate an unexpected outcome. Because I had a growing interest in sound art, it inspired me to think about the stone arrangements as a score. My human collaborator Simon[202] and I discussed how we could do this. We began with the idea of crow and human voices, and how these could represent the individual stone arrangements played out over time. Instead of text, voices could be assigned to the individual stone arrangements; crow voices assigned to the crow arrangements, and human sounds for my arrangements. This required a production process where I recorded crow vocals, and my own soundings.

[202] Simon Lysander Overstall. See www.simonlysander.net

A few mornings in a row, I set up a sound recorder on the roof deck to record the vocalizations of crows as they landed there. Later, I listened to these recordings and identified six different calls to use to represent the six different stones used in the pebble play. I edited the recordings down to the six utterances. Simon and I then played each and listened to its details, such as the number of *caws*, the space between each one, their timbre, pitch, etc. With this analysis I began to think about my own sonic responses representing my stone arrangements. We applied processes similar to the ones described in the previous chapter with the *EPIC_Tom* project, where I responded to Tom's vocal utterances with my own theremin sounds. In the crow project, I tuned my theremin to have similar sonic qualities to the crow calls, so that I could respond with sounds that corresponded to their language. For each theremin response to specific crow call, I used biomimicry techniques. I played the theremin to have the same pitch, number of sonic units (caws), etc. These theremin sounds were recorded.

In the next production stage, we created a process that allowed for the stones to be heard. I remembered the Chinese chime instrument —the *bianqing* mentioned earlier (Fig. 24). When the *bianquig* is struck, it sounds like a chime with specific sonic qualities reflecting the stone material it's made from. Simon built a piece of software that included features associated with the specific type of the materials of the pebble play—granite, marble and sandstone. The mineral parameters built into the software could temper the crow and theremin recordings to have sonic qualities resembling the stone material. Each crow utterance and theremin response now sounded like it was hitting a stone chime. The toned sounds were then arranged into a sound composition. Like the text experiment, each toned sound was arranged in a linear sequence based on the features of the stone arrangements as a score. The spaces between the stones informed the spaces between the sounds in the sequence. If stones were stacked, the two or three sounds assigned to the stones in the stack would play at the same time. Using this process we generated the two-minute soundscape called *Crow Stone Tone Poem*.[203]

When I listen to the *Tone Poem* now, I can hear the crow calls and human responses, but the stone's timbre creates a blending of the two. Because of this, I lose track of who's calling and who's responding. Over time, the crow calls and my responses begin to sound more alike. They seem to come together into a new form as an intertwined acoustic ecology.

New gift, new art

[203] See webpage with recording: http://julieandreyev.com/crow-stone-tone-poem/. Andreyev

Since the pebble play, and my improved relations with the crows, I've received many more gifts. Each one has a particular significance. A beautiful piece of white beach-glass (see Fig. 30) made me think about the crow's process of gift-giving. I imaged they found the glass on the beach, perhaps down at Port on Burrard Inlet where they were foraging for shellfish. They picked it up, and flew with it in their beak the kilometers back to the home territory. They placed it in the middle of the deck, in a location easy for me to find. I love and cherish this gift, and have since made it into a pedant to wear whenever I need crow energy.

On another trip to the beach, the crow found a spectacular pink barnacle formation and left it beside the new plate of popcorn I provided (see Fig. 31). I interpret this gift as an acknowledgement of the popcorn because they're both so strikingly similar in form. I imagined the crow had fun finding this treasure and arranging it, like a master rock, in relation to the field of popped corn.

Fig. 30. Beach-glass gift from the crow. Photo courtesy of the author.

Fig. 31. Barnacle gift from the crow left in proximity to the popcorn I left for them. I was struck by how the shapes of the barnacle are like the shapes of the popcorn. Photo courtesy of the author.

In 2017, I received a gift that inspired the next stage of our creative collaboration. Up until then, I'd leave food for the crows on the deck's railing or in the popcorn dish. As mentioned earlier, this presented problems for the crows because the seagulls often spotted the food as they'd fly by, and would get to it before the crows. I imagined this would irritate the crows. So, they figured out a means to communicate to me an alternative method of leaving food for them.

One morning, after placing some food on the railing, I noticed a tiny granite pebble on one of the horizontal cedar rungs below the top railing (see Fig. 32). It was placed so that, from above, it wouldn't be unnoticed. (I checked with Greg to make sure he didn't put it there.) I immediately understood. The rock's placement communicated how they wanted me to leave their food—out of sight from seagulls. I removed pebble and moved the food down to that location. Later, I noticed they'd taken some of the food and left a few pieces. I realized they no longer felt an

urgency to gather up all the food before the seagulls came. This was a lesson in the crow culture of food caching.

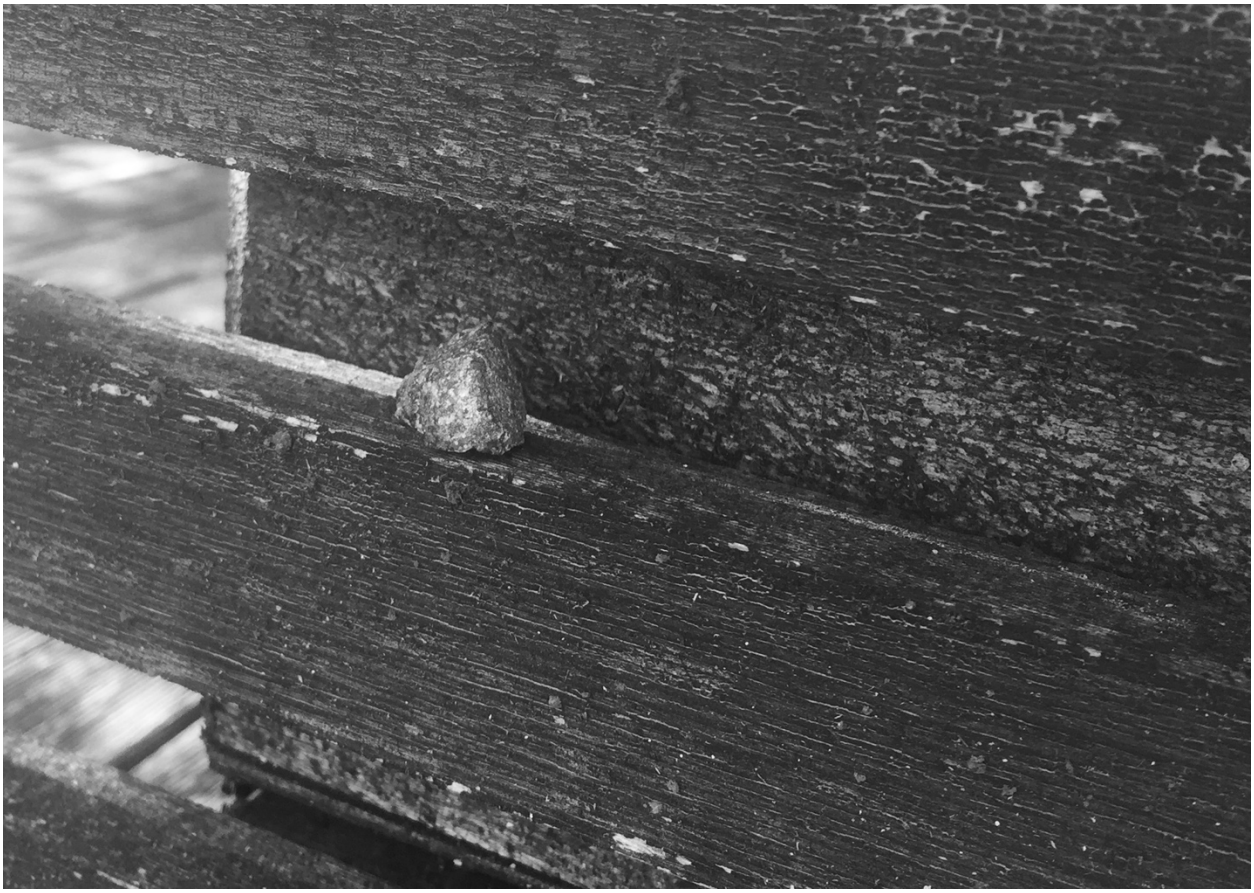

Fig. 32. Stone placed by the crow communicating to me a potential caching, or hiding place for me to leave food out of sight of the seagulls. Photo courtesy of the author.

Crows often hide their food for later use. If there's an abundance of food, they'll put some in locations around their home-territory for later when there's less food to be found. I've seen our crow couple cache food in the planters on the roof deck, or in the grass in the park across the street. (Tom and Sugi found a few of these delicious morsels). I've also observed the crows retrieving these caches, and eating them or feeding them to their offspring. Corvids can remember thousands of cached food locations. Inspired by this tradition, and our developing communications with stones, I began a new research project called *Bird Park Survival Station*.[204]

[204] See the webpage for the project at http://julieandreyev.com/bird-park/.

Fig. 33. The *Bird Park Survival Station*, with a crow neighbour on one of the perching platforms. Photo courtesy of the author.

In its current form, the *Bird Park Survival Station* includes feeding stations for the crows and songbirds. It has two large water dishes for bathing, food soaking and drinking, and planters for the crows to cache their food, and these have shrubs for small birds to perch and hangout (Fig 33). It includes a structure that has two perching platforms, and a long metal bar between them as a prominent perching wire. The features in the *Bird Park* were developed through careful observation and research about what local birds need. It has gained popularity, and each year attracts more birds. It's used daily and throughout the year by the resident and migratory birds, including the crow couple and their offspring, along with sparrows, Northern flickers, house finches, chickadees, hummingbirds, juncos and starlings.

Based on my observations, and analysis of feedback from the birds, I've develop noninvasive methods to integrate recording technologies into the *Bird Park* in order to document the birds' actions. These include microphones to record their sounds and calls, and a Gopro camera activated by a computer vision program, that records video of birds when they're using the features of the *Bird Park* inside (see IMAGES 6 to 13). The equipment is small and unobtrusive, and blends with the things that the birds use (Fig. 34). The camera has recorded some amazing events, and I've been able to analyze the videos for information about the birds' use of the features, and how to improve them to suit their needs.

Fig. 34. Gopro camera installed in a planter for use in the *Bird Park Survival Station*. Photo courtesy of the author.

During the last two summers, I also installed contact mics throughout the *Bird Park* and recorded the vibrations of local birds using the water dishes and perching features. With the help of Cara Jacobsen, my student research assistant, I've developed handmade bamboo perching and feeding troughs that have a contact mic built-in which can record the birds' using these as instruments (Fig. 35). I've also created a drumhead instrument with a contact mic to put on one of the perching platforms (Fig. 36). The starlings and baby crows seem to like landing on this (IMAGE 12 and 13). The sound recordings have revealed instances of local birds enacting their seasonal traditions raising a family: crow parents pounding their finds into small pieces for young mouths, starling families hopping on the metal perching wire, communal bathing and chatting amongst generations of sparrows. When I watch each video recording and listen to each sound recording, I learn something that gives me a sense of connection to my avian community. The birds are creatively using the *Bird Park*, getting on with things and doing what must be done.

Fig. 35. Sparrow using the feeding-perching instrument with contact mic in the *Bird Park Survival Station*. Photo courtesy of the author.

Fig. 36. Drumhead instrument with a contact mic, attached to one of the perching platforms in the *Bird Park Survival Station*. Photo courtesy of the author.

The culture of pebble play continues in the *Bird Park.* Sometimes I arrange stacks of rocks as a caching mound, hiding nuts inside for the crows. I've included a dish of pebbles, like the ones I originally used in the green water plate for the crows to play with. Last year, the camera recorded a new fledgling playing with one of the pebbles. As her parents ate, she chose out a small blue pebble from the dish and took it into the bath. She gently placed in the water, and preened and fluffed her feathers on top of it (see Fig. 37). She then picked up the pebble and flew off with it, like a keep-sake.

Now, from my studio window, I can see this year's youngsters flying from the park across the street and landing on the roof. I can also hear them. They're using their beaks to roll the rocks around, creating a great rumbling for me below. They know the rocks are sound-making objects,

and they use them to catch my attention, communicating that they want more food. These days, I'm not annoyed. I eagerly head up to the roof in anticipation of new forms of relating.

Fig. 37. Still image from a video recording of the *Bird Park Survival Station*, showing a baby crow (foreground) in the bath playing with a small blue pebble (in her beak). Photo courtesy of the author.

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Salmons and River

"Who knows what admirable virtue of fishes may be below low-water-mark, bearing up against a hard destiny. . .?"

— Henry David Thoreau[205]

[205] Henry David Thoreau quoted in catalogue essay by Carol Gigliotti: "Hard Destiny: Julie Andreyev's and Simon Lysander Overstall's Salmon People." *Surrey Art Gallery Presents Julie Andreyev & Simon Lysander Overstall Salmon People*. Surrey: Surrey Art Gallery, 2016.

Salmon lesson

Fig. 38. Still from production video for *Salmon People*. Photo courtesy of Elisa Ferrari and Paulo Pennuti.

It was the summer of 2015, and I was at my computer reviewing video clips of sockeye salmons[206] preparing to spawn in their natal streams at Adams River, a tributary of the Fraser River which is our province's most important fresh water system. I recorded the clips five years earlier, but was only now preparing them for a project. Simon and I had been commissioned by Surrey Art Gallery to produce an artwork for their Urbanscreen venue which uses the exterior wall of the Chuck Bailey Community Centre as an outdoor projection surface for large scale moving imagery.[208] We proposed a site-specific piece and named it *Salmon People*,[209] as a response to the geographic location of Surrey which abuts the south shore of the Fraser River

[206] Johnathan Balcombe uses the term 'fishes' in contrast to the more conventional 'fish' in order to draw attention to these animals as individuals rather than populations. I've adopted his usage, and additionally used 'salmons' instead of the more conventional term 'salmon'. Jonathan Balcombe, *What a Fish Knows: The Inner Lives of Our Underwater Cousins*. (New York: Scientific American / Farrar, Straus and Giroux, 2016).

[208] Surrey Urbanscreen is an off-site venue for the Surrey Art Gallery.

[209] The title of the project, *Salmon People*, is inspired by Tom Jay's essay "Salmon of the Heart," in *Working the Woods Working the Sea: An Anthology of Northwest Writings,* eds. Wilcox, Finn and Jerry Gorsline. "Salmon of the Heart" includes Westcoast indigenous stories of salmon who are described as people living in an underwater world

at its mouth. The plan was to make an artwork that included video and sound from the River, along with the underwater clips of the salmons. The fishes in the videos had a relationship with the geographic location of the gallery because they would have swum passed Surrey in the fall of 2010 on their migration back to the Adams River spawning grounds where I recorded them. Simon and I imagined *Salmon People* as a confluence, displaying the human activities on the surface of the River and the normally hidden world of salmons beneath.

The clips were recorded using an underwater camera, and showed salmons traveling to their spawning streams, or actually spawning. As I followed the imagery in one of the clips, something caught my eye. The fishes were doing things I don't remember seeing when I first looked at the videos five years earlier. I scrolled back to the beginning and looked again. This clip wasn't good enough to include in the project, but it provided an important lesson in interspecies art processes. It was underexposed, and the frame shook as the camera vibrated in the flow of the moving water. Bright red male and female salmons clustered together at the left side of the frame. Their bodies undulated as they used micro-movements to hold their position in the current's counterflow. The way they grouped themselves and waited made me think they were avoiding something. I looked closer to see what they were looking at, and realized their gaze was directed at the camera. This had the effect of them looking at me now, as I watched them. Then, one separated from the group and swiftly crossed right in front of the camera, and exited the frame. The remaining fishes jostled themselves into a new grouping, and watched and waited. Then, another darted across. I realized what had happened. The fishes were holding back, gathering enough courage to break away from the safety of the group, and dart past the camera and the cinematographer. I sat back in my chair and reflected on our filming processes. Even though we'd designed the production stages with good intensions—no direct harm nor obstacles for the fishes—the mere presence of the equipment and the legs of the cinematographer in the stream, were enough to make the fishes temporarily halt their progress. As I thought about this, an image came to mind of salmons jumping a river rapids, with a bear standing in the water grabbing at them as they leapt into the air. Like the bear, we were perceived as a threat, yet another hold-up in their final move to spawn. This insight left me with an understanding that my ethics of engagement with these animals was, at the time, uninformed. I should have had more knowledge about the sockeye salmon before filming them in order to have taken better care in the processes. I should have researched information about the habitat of the Fraser River, the salmons' physical capabilities, their needs during migrations,

and the critical role they play in the health of regional marine life and land-based ecosystems. Upon realizing this, put some time aside to do the necessary research to inform the art.

This chapter looks to marine biology for knowledge on the degradations to the River and the nonhuman communities who depend on it, and it describes our processes for developing the commissioned artwork. Public art can play a part in drawing attention to the importance of the River, by making visible the humans and salmons who share this watery ecosystem. *Salmon People* uncovers how salmons and humans, the River and its ecosystems, are all entangled in the production of meaning.

River

Our province's most important freshwater ecosystem is the Fraser River, and this system includes the Adams River spawning grounds. The Fraser supports human and aquatic life, and the ecologies of forests, grasslands and marshlands that run along its sides. Yet, despite the role the Fraser plays in the ecological health of the Pacific Northwest, it's under continuous pressure from resource extraction and human development. Intrusions on the Fraser continue because of demands for fossil fuels, agriculture, and exports from logging. Over the decades, this has resulted in the Fraser being the province's most endangered and polluted river. It seems like the degradations are generally tolerated by the public because of a lack of direct visibility of their harms to underwater life—out of sight, out of mind. The current status of the River, and its salmon populations, provides an example of the degradations to regional ecosystems through the global pressures of resource extraction and transportation.

The Fraser River's tributaries support coastal rainforests, interior grasslands and the endangered inland rainforest.[210] It supports both land and aquatic animals, including more than 150 salmon populations.[211] The Fraser is the province's largest watershed, draining one quarter of its rain, snow and glacial waters. This action sends 113 cubic kilometres of fresh water yearly into the Pacific Ocean—three times the amount of water used annually by Canadians.[212] As part of this action, the River also sends 17 million tonnes of sediment, containing particles of plant

[210] The British Columbia inland rainforest, more than 500 km from the nearest ocean, abuts the Rocky Mountains. It is home to grizzly bears, and mountain caribou, and ancient trees and plant species of oceanic affinity.

[211] Lapointe, et al.

[212] Canadian Geographic.

matter and minerals that support the ocean's ecosystems.[213] However, because of the industries along the Fraser's banks and on its waters, this sediment also contains fossil fuels, phosphates, nitrates and other contaminants that travel down the River and into the Ocean.[214]

The Fraser's waters are under additional stresses from expanding human developments and transportation projects. During the past decade, there's been an increase in global demand for shipping using the lower Fraser, and this has caused an increase in development projects. The projects not only intrude into the water's ecosystems, but also increase the risk of toxic spills that pose significant threats to salmon, whale and migratory bird habitats. These animal communities are already suffering from the stresses of climate change, existing human development and over-fishing, so additional industrial projects would only increase the threats to their survival. Some of the development proposals have been stopped through the work of scientists and environmental advocates, but others are still in review processes, and a few have been given the go-ahead for construction.

In 2012, a new coal port was proposed at the Fraser Surrey Docks that would have increased yearly traffic with 640 open barges containing US coal—each the length of a football field—towed down the Fraser to the Pacific. The proposal's environmental impact faced significant criticisms and, fortunately, the project was stopped.[215] In 2011, Deltaport Terminal 2 proposed a new container terminal that would intrude into critical salmon and orca habitat, and lands used by migratory birds. Environment Canada issued a negative review of the proposal, but it's currently in the public hearing stage.[216] In 2014, a WesPac terminal on the Fraser near Surrey was proposed that would send 120 tankers and 90 barges of liquid natural gas out onto the River each year. This project is also under public review.[217] A jet fuel terminal at the South Arm of the Fraser River has been approved despite criticism by scientists and the public, and it will send 70-120 tankers per year with volatile toxic jet fuel traveling on the waters to the Fraser River docks.[218] This fuel will then be sent overland, via a 13 km pipeline, to the Vancouver

[213] Ibid.

[214] The Fraser supports 48% of the province's forest industry, 44% of farm land, and is involved in 80% of the provincial annual economic production. Sierra Club of Canada, BC Chapter Education Program, "Lesson Plan: Impacting our Watersheds: Focus on the Fraser River."

[215] Baker.

[216] Pynne.

[217] Province of British Columbia, 2019.

[218] O'Neil.

International Airport.[219] A spill caused by any one of these projects would have devastating effects on the animals and ecosystems depended on the Fraser.

The Fraser River system supports a variety of different salmon species—pink, chum, Chinook, coho, Sockeye—each with unique biological traits specially adapted to their ecological niche. Pink salmons tolerate warmer waters than sockeye; chum salmons are more successful breeders at five to six years old compared to the typical four year old sockeye. Each species consists of populations, determined by their birthplace. A population is defined as a community of salmons native to a specific stream who do not breed with salmons from other natal streams.[220] Different salmon populations have evolved to flourish in different ecosystems, and so, they lend biodiversity to the Fraser River. Where salmon diversity is supported, population abundance remains high from year to year. Sadly, the diversity that was once in streams and lakes throughout the province has been in steady decline. Today, 90% of total salmon populations originate from less than ten nursery lakes.[221] By focusing on one species and population of salmon, the Adams River sockeye, we can see how the challenges facing these fishes has had an effect on their numbers.

The Fraser River is home to the largest number of distinct sockeye salmon populations of any watershed on Earth.[222] Each population is unique because it's tied to a specific natal stream used for birth and reproduction—for example the Adams River spawning grounds. Because of this, each population has specific migrations associated with the geography of that location. The salmon population's migration projects are shaped by their natal stream and nursery lake, and the waterways they use to connect to the Fraser River and finally to the Pacific Ocean. The life cycle of a sockeye includes a number of migrations, of varying scope, each embodying the ecological connections between land and sea, fresh and salt waters, human and more-than-human life.

Sockeye numbers that successfully migrate back to their natal streams to spawn are highly variable year to year but, generally, have been in steep decline over the past decade. The declines are due to human-imposed challenges, such as overfishing, development, and climate

[219] Kearney.

[220] Lapointe, et al.

[221] Ibid.

[222] MacDuffee.

change. The years 2007-2009 had some of the lowest returns on record.[223] In 2009, only 1.5 million sockeye returned to the Fraser, the lowest count since 1947.[224] Because of the low return of that year, the province established the Cohen Commission to examine the current status of 32 genetically distinct populations of Fraser River sockeye. The study found that eight populations are already extinct or nearly extinct.[225] Of the 24 remaining populations, at least seven are at risk of extinction, while only four are clear of risk.[226]

Climate change poses significant challenges for salmons because it has an effect on water temperature, water levels, and the likelihood of pathogens.[227] A heating climate results in warmer river and ocean waters, lower water levels in the river, and increased parasites. These challenges cause energy depletion in the fishes as they migrate, and this means they are at risk of dying before they reach their destinations. Salmon are generally intolerant of warm water. If the Fraser River's water reaches 20 degrees Celsius, the fishes are likely to die of heart failure during their migrations. Over the past fifteen years, the Fraser River sockeye have experienced an increase in prespawning mortality because of warmer water and lower water levels. The Fraser is now two degrees Celsius warmer than it was ten years ago.[228] In 2014, the Fraser was four degrees Celsius above average, and the volume of water was 30% lower than average. That fall, 1.7 million late-run Sockeye were counted as having gone upriver, but never reached their natal streams to spawn.

During the summers of 2015 to 2018, forest fires raged and the province sweltered, and this had an effect on the Fraser. Because of the warmer winters during these years, snow packs were nonexistent in many tributaries. Historically, snow packs melt slowly at higher elevations, replenishing streams and rivers with cold water during the hottest summer months—an event crucial for salmon migrations in the fall. Because of the lack of snow during these years, there was less cool water entering into the Fraser, so the water temperatures were high. In 2015, the summer I was reviewing the video clips, the volume of the Fraser near Hope (a town located

[223] Johannes, et al.

[224] Ibid.

[225] Ibid.

[226] The Province of BC lists species and ecosystems according to a conservation status rank. Red list refers to the risk of being lost (extirpated, endangered or threatened); Blue list refers to species or ecosystems of special concern. Province of British Columbia, 2020.

[227] High water temperatures increase the abundance of the parvicapsula parasite that infects salmons. Salmons are exposed to these parasites when they enter the Fraser. The parasites can affect the salmons' kidneys and gills and lead to premature death. Isabella.

[228] Ibid.

where the Fraser and Coquihalla Rivers join) was 17 per cent below normal. In the main arm of the Fraser, right around Surrey, the water temperature hovered above 19.8 Celsius.[229] That autumn, the total Fraser sockeye run was 2.1 million, far below the forecast of 6.8 million fishes.[230]

Ocean temperatures also play a role in salmon survival. Even a small increase will have an effect on their growth because of reductions in available food. Unusually warm ocean temperatures were observed in the northeast Pacific Ocean throughout 2014 and into 2015.[231] In a warmer ocean, the food supply for salmons is reduced during their years spent there. A warmer ocean affects the abundance of their population, their age-at-return, their health, and their success during migration back to their spawning grounds. In the last few years, even the Adams River sockeye—one of the most successful populations—has been dramatically affected. Tens of thousands of fishes died and washed up on the River's banks before spawning. Imagine swimming hundreds of kilometers up the Fraser to the natal grounds, and not having enough remaining energy to spawn. Unfortunately, future challenges are not easing for these animals. It's predicted that the years 2018 – 2022 will see extreme warming events in the Pacific Ocean surface temperatures, and this may have devastating effects on the sockeye.[232]

The Adams River spawning grounds

The Adams River sockeye remains one of the most successful populations, but it too is being affected by climate change and other anthropogenic challenges. Because of this, the migrations are being closely watched by marine biologists who are monitoring their numbers, and by publics who are drawn to witness the salmon population's migrations. In 2010, the migration was predicted to be the largest in 100 years, with an estimated nine million returning salmons.[233] It was a 'dominant' year, when the number of returning salmons would be substantially greater than other years.[234] During dominant years, Tsútswecw Provincial Park, which includes the Adams River spawning grounds, hosts "Salute to the Sockeye," a celebration that typically

[229] Lindsay.

[230] Nagel.

[231] Fraser River Panel of the Pacific Salmon Commission.

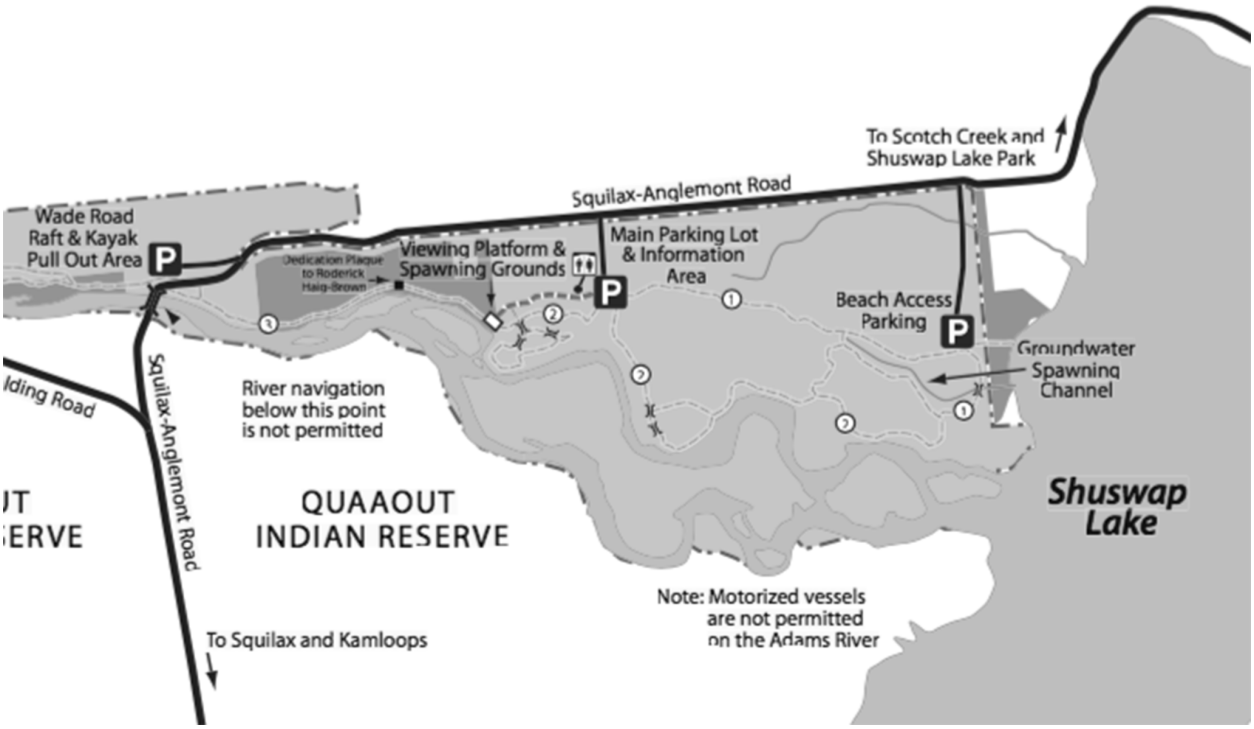
[232] O'Malley.

[233] Adams River Salmon Society.

[234] Fraser River Panel of the Pacific Salmon Commission.

accommodates 150,000 visiting humans.[235] When I heard about the prediction of the dominant year, I knew it was a once in a lifetime opportunity to witness a salmon migration of significant magnitude. I decided to make the trip with Greg, and Tom and Sugi, and I asked my research assistant cinematographers, Elisa Ferrari and Paolo Pennuti, to meet us there and record underwater footage. At the time, I knew that recording this salmon migration was important, but I had no idea how it could become part of an art project. Regardless, we set aside a few days to travel and do the recording.

It was a sunny and warm October afternoon when we arrived at Tsútswecw Provincial Park (Fig. 39). The parking lot was packed, and Park employees were guiding arriving visitors to available spots. After we parked the truck and met up with Elisa and Paolo, we entered the main trail that runs along the Adams River. Within a few hundred metres, we came to the first viewing platform overlooking the water 30 meters below. Just under the river's surface, a large group of bright red salmons—hundreds of them—crowded up against the bank. They were resting against the current before their final move to their spawning streams a few hundred metres away.



[235] Adams River Salmon Society.

Fig. 39. Detail of Province of British Columbia BC Parks' Trail Map for Tsútswecw Park.

Most visitors keep to the main trail and the viewing platforms. But from that distance, it's difficult to get a sense of the scale of the migration, and the salmon actually spawning. To get a better view, you have to walk the smaller trails beside the spawning streams, and go out onto the lake. As we walked single file along the small paths, I was struck by the shallowness of the streams, and how exposed they were. Sunlight sparkled on the surface, and the yellow pebbles on the streambed, just inches below, created a golden backdrop for the red fishes. Some of the salmons were still working their way up the streams, some were paired and already spawning. They were aware of my presence, and gazed up at me on the path as I looked at them. Being in close proximity like this made me feel like an intruder. I moved away, so as not cause them stress. I looked closely at the bottom of one of the streams and could see pink colored eggs mixed in with the yellow sand and pebbles. They resembled huckleberries, and quickly vibrated from side to side in the stream's current.

Returning to the main trail, we headed to a riparian spawning channel shaded by surrounding trees. Other visitors seemed less interested in this area, so we were alone with the fishes. The channel was fed by cool water that gently percolated up from the stream bed. In these tranquil darker waters, the salmons appeared larger. They looked at us as we stood on the bank (Fig. 40). We continued along the trail to where it opened up to Shuswap Lake. There, we got a clearer sense of the immensity of the migration.

Fig. 40. Still from video showing male sockeye salmon in shaded spawning channel. Photo courtesy of Elisa Ferrari and Paulo Pennuti.

A crowd of people stood on the rocks at the edge of the lake, and a scuba diver with an underwater camera rig was neck deep in the water. We looked further along the lake's edge, and could see piles of dead salmons. We wanted to get a closer look, so we walked back to the truck to get the canoe, carried it back to the lake, launched, and paddled out into the waters. From there, we could see down into the depths of Shuswap Lake, and back along its banks. Salmons were everywhere. Some floated just a few metres below the surface, their bodies arced and gills flaring in their final moments of life. Dead salmons, in the tens of thousands, created a red outline on the lakeshore, their bodies deposited by the action of the waves and currents. We canoed for an hour along the shore, witnessing the heaped accumulation of dead fishes marking the water's edge.

We paddled back, passed the launch area to a location where we could watch a team of marine biologists counting dead salmons. Because of the Adams River population's declining numbers, the biologists were studying the challenges facing the migrating fishes. These workers were estimating overall numbers and recording how many had successfully spawned.[236] Each person

[236] Ibid.

held up a body, determined the salmon's sex and whether it had spawned. This took only a few seconds. Then, to make sure the fish wouldn't be counted twice, slashed the body in half with a machete. That gesture left an impression. It was yet another human mark, a final inscription on these aquatic individuals. The whole process had a mechanical quality of calculated efficiency. Suddenly, I felt an overwhelming respect for these small but mighty creatures, and how they carried out their incredible migrations under such extreme conditions.

Salmon migration projects

The Adams River sockeye have a variety of migration projects they undertake over their lifetimes in response to the Earth's daily and seasonal rhythms, and geography. I call these migrations *projects* to emphasize the undertakings as intentional, and with specific objectives. These include micro-migrations, when they first hatch and need to move into deeper water, and the epic river migrations to and from the Pacific Ocean.

Sockeye salmons begins their life in the fall when the adult female lays her eggs in her natal stream, and a male fertilizes the eggs with his milt. In mid-winter, the eggs hatch into their alevin stage. These tiny larvae sense the depth of the water and either migrate deeper into the gravel or move away from the stream margins if water levels have dropped.[237] In deeper water they won't freeze or dry out. The alevin live off the yolk that's still attached to their bodies. In the spring, the alevin hatch into fry and immediately migrate out of the safety of the gravel and up to the water's surface. They take in a gulp of air to fill their swim bladders.[238] This migration takes place at night to avoid predators.[239] Also at night, the fry migrate from the stream to their nursery lake using their rheotaxis sense which allows them to orient their bodies in relation to the water current.[240] Once they reach the nursery lake, they spend the next few weeks in riparian areas, where decomposing trees and logs in the water provide nutrients, shaded cooler water, and hiding places from predators.[241] The juvenile salmons make vertical migrations within the lake's

[237] Cooke, Crossin, and Hinch.

[238] Ibid.

[239] Ibid.

[240] Ibid.

[241] Adams River Salmon Society.

waters, according to day and night rhythms, in order to forage for food and avoid predators which include bigger fishes, kingfishers, otters, and terns.[242]

After one or two years, the young salmons prepare themselves for their Fraser River migration to the Pacific Ocean. To do this, they undergo physical changes, called smoltification, and they develop their senses to assist them on their journey.[243] The smolt use the downstream current to carry them on their way, combined with active swimming to help them travel 10-20 kilometres per day. They don't eat much during this migration, instead relying on stored energy from their previous meals in the nursery lake. Any obstacles along the way will have significant effects on their migration and therefore their survival. For instance, hydroelectric dams and agricultural development can pose lethal challenges. Some are fitted with bypass structures that allow the fishes to migrate, but even these can cause delays of several weeks for the smolts' arrival to the Ocean. Any delays take a toll on the fishes who may die from exhaustion and starvation. Even under favorable conditions, smolt usually arrive at the entrance to the Ocean in a malnourished state.[244]

Smolt that do make it to the Fraser River estuary, need to spend additional time there in order to acclimatize to the Ocean's waters.[245] But the overall stresses of the migration would have resulted in elevated cortisol levels which may cause the smolt to enter the ocean before they're fully acclimatized.[246] Early entry can result in these young fishes being unprepared to survive the salt water.[247] The ones that do survive will feed in the small bays and coastal environments until they're ready to enter the greater oceanic system. They'll need to avoid predators such as seals, flounder, gulls, sea lions, mackerel, shark, dolphin, orcas, and humans. Once they enter the deeper water, they'll spend two or three years moving in a counter-clockwise migration around the northeast Pacific.[248] During this oceanic life, they'll use their specially adapted senses and cognition to assist them in their travels.

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[242] Cooke, Crossin, and Hinch.

[243] Ibid.

[244] Ibid.

[245] Adams River Salmon Society.

[246] Ibid.

[247] Cooke, Crossin, and Hinch.

[248] Adams River Salmon Society.

Salmon have unique abilities they use to create knowledge to help them navigate the Pacific Ocean, and to time their migrations. They create a mental map of the Earth's magnetic fields by sensing the intensity and inclination of the fields, and using them to navigate.[249] They forage for favorable feeding sites that provide them with optimal nourishment. During the last six months of their life in the Pacific, they'll focus on feeding in order to gain weight—about half their adult mass—as energy-stores for their return migration to their spawning grounds. The fishes evaluate whether their weight condition is appropriate for the challenges of their migratory return back up the Fraser River.[250] Some may decide to stay another year in the Ocean in order to gain more mass and fat for the journey. Adults who are ready to migrate pay attention to the seasons, sunlight and water scents in order to time their return, and find their way back the mouth of the Fraser. They make vertical and horizontal movements within the layers of the Ocean's water to find the appropriate scent to guide them. They seek out the scent of their natal stream in the ocean. Salmons have a highly refined olfactory sense, and can detect one drop of water from their natal stream in eight million litres of water.[251] To find their way, they also depend on light and landmarks, and changes in the water's salinity levels. Once they're 700 – 250 kilometres away from the Fraser River's entrance, they'll begin their physical adaptation to fresh water. During this time, they'll sense the flow and temperature of the River, and choose the best moment to enter it. Until this moment, they'll wait and feed at the River's mouth.

The Fraser River spawning migration may be the most challenging one for the Adams River sockeye. Once they enter the river, they'll not feed for the remainder of their lives. All the energy for their migration, including physical changes, travel, and spawning comes from their stored ocean nutrients. Their blue-gray ocean bodies will transform into brilliant crimson river bodies. The males will develop a hooked jaw and prominent teeth to defend their future spawning sites. On the migration, they'll travel 485 km back to their natal grounds, a trip that includes swimming east up the Fraser River, past Surrey, Mission, Chilliwack, and Hope, through Hell's Gate—a narrowing of the River with extreme rapids—through Lytton, where the Thompson River joins the Fraser, and east up the Thompson River, through Ashcroft and Kamloops Lake, and out the other end into the South Thompson River. [252] There, they'll swim through Little Shuswap Lake to Shuswap Lake, where they'll head west to the Adams River spawning grounds. On average,

[249] Giller.

[250] Cooke, Crossin, and Hinch.

[251] Isabella.

[252] Adams River Salmon Society.

they travel 37 kilometres per day over a 14 to 17 day period.[253] In total, the round-trip lifetime travel of all their migrations is an incredible 4,000 km.

Once the sockeye reach the spawning ground, each surviving female will locate her birth stream and begin preparations for spawning. She'll examine the stream's gravelly bottom to find an appropriate spot. Too much silt or sand will smother her eggs. A location with relatively calm water is best. She'll dig a nest by turning on her side and repeatedly striking the stream bed with her tail. This removes silt and sediment and creates a depression. When the nest is ready, the female will be approached by male salmons. She'll choose a suitable mate and the pair will quiver above the nest simultaneously laying eggs and depositing milt. The female will then move upstream to dig the next nest. In the process of digging the new one, she'll cover the previous nest. She'll create three to seven nests to form a *redd,* each one with 500 to 1100 eggs—about 4000 eggs total.[254] Once spawning is finished, the females will stay with their redd until they die, protecting it from other females who may inadvertently dig up her eggs during their own nest building activities. The males may try to find new mates and continue spawning until they too die.

[253] Ibid.

[254] Ibid.

Fig. 41. Still from *Salmon People* production video showing spawning sockeye salmon, male in the foreground, female behind. Photo courtesy of Elisa Ferrari and Paulo Pennuti.

Even though the Adams River sockeye population is one of the largest remaining migrations in the world, it too suffers from the effects of human activity. Of the 4,000 eggs deposited by a single female, only about 800 will hatch. Of the fry, only 200 will survive their migration to the Pacific. Of those, ten may survive to adulthood, and only two may survive the migration back to the spawning grounds where their lives began.[255] These low returns are due to the anthropogenic stresses of warm water from climate change, over-fishing, dams, pollution, and obstacles from industrial and agricultural development. Even industries that are not immediately on the Fraser affect the salmon. For instance, the province's forestry practices, because of unsustainable clear-cutting and over-logging, have reduced the winter snow pack. This has affected the amount of cool fresh water being fed into the river and necessary for the salmons' migrations.[256] Land clearing for agriculture, urban development and industry produces sediment that enters the streams, and this can smother eggs and effect the gills of small fishes. Building developments often remove riparian vegetation, and this diminishes shade needed to cool the water and provide safe areas for the young salmons. Pollutants from road run-off, household products, farming and industrial spills make their way into streams and the Fraser, causing toxic stresses on the fishes. Improperly installed water structures, such as culverts, dams and channels can block salmon migrations. Salmon runs like the Adams used to happen in rivers throughout the world—in Scotland, Norway, and on the Atlantic coast—but those runs are all gone now. With the pressures facing the Fraser River populations, even our salmon species may become extinct. This will be disastrous not only for the species, but also for the region because of the role these fishes play in the ecosystems surrounding the Fraser.

Sockeye are considered a keystone species, meaning that their populations are indicators of the health of the ecosystems of which they are a part. For instance, the salmons have an effect on forest communities that depend on the fishes for ocean nutrients, and this has an effect on the forest biodiversity. Forests connected to the Fraser, contain ocean-originating carbon and nitrogen from the salmons who were consumed by land-based predators, such as wolves, bears, coyote, eagles.[257] These forests have greater biomass and biodiversity than forests away

[255] Ibid.

[256] Ibid.

[257] Isabella.

from salmon inhabited rivers.[258] Salmons also support the next generations; their bodies feed insects and zooplankton, which in turn feed young fishes.[259] By understanding the role of salmons in varied ecosystems, it becomes clear that respect is owed to these fishes who provide lessons in ecological consciousness. Learning about their capabilities can also help overturn outdated views on fishes.

Fish ways of knowing

Human cultures have tended to create valuations of other lifeforms in comparison to human capabilities. Because of this, fishes have historically been thought of as 'lower' life forms. Until recently, it was believed that fishes did not experience emotions nor have feelings such as pain or pleasure. These views were based on presumptions in science with regards to fish anatomy and how it compares to human anatomy. These presumptions produced false and detrimental views about the inner lives of fishes. Fortunately, recent research has made significant progress with regard to understanding how fish-specific features serve similar physiological roles to those in humans and other mammals, and how these produce the feelings and emotions we associate with sentience. This research found that even though fishes have different physical systems from mammals, they experience emotions, memory and other traits. The new studies are overturning outmoded beliefs about fishes, and presenting more realistic views on their rich inner lives.

The neuroendocrine response—the way the brain produces hormonal patterns linked to emotions—is almost identical in fishes as in mammals.[260] Oxytocin, a hormone in mammals produced in association with love and social bonding, has its parallel in fishes in the form of isotocin. The study that looked at isotocin, worked with highly social fishes called daffodil cichlids. The researchers found that cichlids given additional isotocin had increased motivation to defend their territory from others. The hormone also increased their capacity to maintain stable social groups. This indicated that isotocin in fishes, like oxytocin in mammals, plays a role in social coherence.

[258] Adams River Salmon Society.

[259] Ibid.

[260] Balcombe.

In mammals, the amygdala is the part of the brain involved in emotion, memory and decision making. While fishes don't have an amygdala, they do have a medial pallium which performs the same roles. The amygdala, the medial pallium plays a role in stimulating fearful responses. Fishes even experience empathy, like mammals do. When observing the behaviours of others, they learn to be fearful of predators just by watching the fearful responses of their fellow fishes. Other studies showed that fishes experience joy, rage, and frustration, they form social pacts, enjoy the pleasure of touch, use sound to communicate with each other, and are members of communities with ancient cultures.[261] Because of this important research, it's now accepted—at least in marine biology—that fishes are conscious, have emotional states, and do experience pain amongst other feelings. They are sentient.[262]

Recent studies into fish memory are helping to overturn false beliefs about their capabilities. You may have heard the myth about goldfish having memories that last only three seconds? This falsehood has been used to justify keeping them as solitary pets in tiny bowls and fish tanks. I believe solitary confinement, with little environment to interact with nor other fishes to socialize with, would be psychologically harmful for fishes, just like it is for mammals. The research on fish memory included studies with frillfin goby, a small fish who lives in the intertidal zones of the Atlantic. Frillfin like to use tidal pools as feeding areas when the tide goes out. The studies looked into how the little fishes are able to escape a predator in one tidal pool, by jumping to the next pool. It would be virtually impossible for them to know where the next pool is unless they had a mental map. Turns out they do. They memorize the intertidal features before the tide goes out, and create a mental map based on that topography. They use this map to help them plan their life-saving jumps. The research found that the fishes were able to make a successful leap into another pool 97% of the time, much higher odds than just being lucky.[263] This is an outstanding capacity to remember and to use that memory to plan ahead. Other studies, with different species, showed that fishes could remember various physical features, such as colour, escape routes, and other fishes, from 20 days to one year later, depending on the circumstance. The studies reveal the amazing capabilities of fishes, and this mean that humans need to seriously reconsider our relationship with them.

[261] Ethologist Jonathan Balcombe summarizes numerous studies by marine biologists on various fish species behaviors and cultural traditions. Balcombe.

[262] Braithwaite.

[263] Balcombe.

A widespread correction in thought is needed in order to come to terms with the reality that fishes are sentient, and have rich lives and traditions. We need to take into account the intrinsic value of fishes, beyond their utility to humans. This means respecting them as kin because of the states we share, but also respecting their differences in terms of sensing, perceiving and minding. Sockeye salmon exemplify this difference. They understand the materiality, geography, and forces of the Earth, they sense magnetic fields, create mental maps and use these to navigate. They find their way using ocean currents and the scent-specifics of water, navigate using the sun, seasons, landmarks, ocean currents, and they follow the scent of their natal stream. Fishes problem-solve, learn, remember, and initiate short and long term migration projects. They have species-specific, and even population-specific, capabilities that help them carry out the projects necessary for their survival and growth.

Biophilic ethics is especially applicable here in relation to fishes, because it takes into consideration difference. Biophilic ethics includes an openness to more-than-humans ways of knowing that involves unique sensings, perceptions and cognitive capacities.[264] Looked at through a biophilic lens, hierarchies, such as 'higher' or 'lower' with regard to lifeforms, has no validity because each species has evolved the capacities needed to flourish within the ecosystems they inhabit. Biophilic ethics values diverse minds because they are world-forming—simply for themselves.[265] If we consider the complexity of salmon capabilities, their migration projects and their linkages to other lifeforms, a renewed respect for these wild-living beings is brought to bear. They connect with the flourishing of other beings and ecosystems—humans, birds, ocean predators, grasslands, forests. Their migration projects roll out into the global through co-creations within the relational phenomenon that is the living Earth.

Salmon People

In the fall of 2010, while preparing to record the underwater footage of the Adams River Sockeye spawning, I was beginning to experiment with indeterminacy processes. Indeterminacy is a method first developed by Fluxus artists working in the mid-twentieth century. As described in the previous chapter, this method informed the art processes with Tom and Sugi for our

[264] Biophilic ethics is a practice of recognizing that other lifeforms are interested in their lives, their families, communities, and cultures beyond human-centric values. I elaborate on biophilic ethics in my Ph.D. thesis. Andreyev, 2017.

[265] World-forming is used critically here in relation to Heidegger's thought that only humans are world-forming. Oliver.

project *EPIC_Tom*. Thinking about indeterminacy for *Salmon People*, meant that I could develop a method of interspecies collaboration with wild animals.

Indeterminacy emerged as an art method in the twentieth century with Fluxus, a group of artists working from 1960's to the late 1970's who used instructional systems to allow for indeterminate results. Fluxus artists believed that modern art had reached a limit because of constraints of mainstream culture that did not reflect the complexity and vitality of everyday life.[266] Mainstream cultural productions use constraints to control the outcome of the final production for mass consumption. For instance, movie productions employ highly constrained conditions such as script, screenplay, cinematographic direction, artistic direction, editing, and soundscape composition. The constraints provide predictability towards the movie's final form in order to reflect the original vision of the artist or director. Similarly, in classical music, detailed constraints are provided by a score and the conductor's direction of the musicians. The musicians perform within the bounds of these constraints, and are afforded only a small amount of flexibility. In the presentation of these productions, the audience is also constrained. Viewers or listeners experience the film or performance, but do not contribute to its content. The production constraints produce *determinate* results which provide control for the artist-director-composer-conductor who claims authorship. In contrast, Fluxus artists experimented with loosening constraints, using instructional systems and participatory processes, which could allow for *indeterminate* aspects to emerge and contribute to the art. Sometimes this involved creating a simple set of instructions in advance, and enacting these in public.[267] The process may involve the artists themselves carrying out the instructions, and/or audience members being involved. Variability in the performer's interpretation of the instructions would allow for unexpected—indeterminate—events to emerge. This method called into question assumptions about the role of the artist and the audience. Fluxus artists proposed that using indeterminacy methods could provide for occurrences reflecting the relational complexity of everyday life with its variety of agents. Applied to interspecies processes, instruction systems developed by the artist can allow space for emergent content from the participating nonhumans. The resulting outcomes could reflect the ecological reality of the interconnectedness of human and nonhuman creativity.

It is worth noting that Yoko Ono and John Cage, artists of the Fluxus movement, included instructional systems and indeterminacy to explore nonhuman creativity. An appropriate is one

[266] Frieling, et. al.

[267] Ibid.

of John Cage's works, *Bird Cage* (1972). Cage was a sound and performance artist who integrated methods he described as "chance operations", instructional systems which could allow for indeterminate sonics to emerge. These methods were a departure from conventional music processes that favored compositional constraints, such as a notated score, melody, harmony, rhythm, etc. Instead Cage used the *I Ching* hexagram as an instructional system, with the help of birds, to generate the final form of *Bird Cage*.[268]

In preparation, he made recordings from three sources: birds in aviaries, a recording of himself singing a piece based on the writings of Thoreau, and a variety of environmental recordings. All the recordings were set up into eight channels of sound, and the playback sequence of these channels determined by an I Ching hexagram. The eight-channel output was recorded onto sub-master tapes and this was also subject to another I Ching hexagram to process the type, duration and timing of electronic effects on the sounds. [269] The result was a twelve-channel soundscape as a blend of human, bird, environmental and technological sounds. The I Ching system allowed for indeterminate results to emerge, creating a complex listening experience similar to those within everyday sonic environments. It can also be seen as a democratic production process where all contributors to the recordings—human, birds, synthetic, environmental—participated in the creation of the final form.[270]

For *Salmon People*, I adapted the Fluxus instructional method by creating two sets of instructions for my cinematographers to use in the production processes: one for filming the Adams River Sockeye, and later, for recording the human activities on the Fraser River near Surrey. These would allow for indeterminate content to emerge in front of the camera through material contributed by the salmons' actions in the water, and by the humans at the Fraser River location. The Adams River instruction for the cinematographers was:

> "Without disturbing the salmons, set up an underwater video camera in a fixed position on the bed of a natal stream. Record for approximately two minutes. Repeat many times and in many locations over the course of two days."

[268] Listen to samples at AllMusic. http://www.allmusic.com/album/cage-bird-cage-mw0001942198.

[269] The process is described by Gillespie.

[270] In a curious anthropocentric turn, Cage proposed that the final installation of "Bird Cage" take place in a gallery space where live pigeons were to be let loose to interact with the human listeners. He complained that even though he promoted the National Audubon Society in his publicity, he was not able to get any birds for the installation. I haven't been able to find any discourse on the problematic nature of this original proposal. Gillespie.

The open interpretation of the instruction allowed for indeterminate outcomes based on the participation of the fishes, the time of day, the conditions of the water, etc. The results captured the complexity of salmons in action, and their interaction with features of their locale: a female on a nest circled by a male; hundreds of yellow salmon fins piercing the water's surface; red eggs floating in dark water; shimmering red bodies running powerfully against the current; undulating fishes looking at the camera. All these events were not predetermined. When I first looked at the recorded footage, I immediately recalled my first snorkeling experience. Dipping my head into the ocean took my breath away as I caught a glimpse the underwater world of fishes.

Fig. 42. Still from production video for *Salmon People* showing spawning sockeye salmon with their fins piercing the waterline. Photo courtesy of Elisa Ferrari and Paulo Pennuti.

Fig. 43. Still from production video for *Salmon People* showing spawning sockeye salmon running against the current. Photo courtesy of Elisa Ferrari and Paulo Pennuti.

Not only did the instructions allow for indeterminate results, but the cinematographers did not know exactly what they were filming in each location because they could not see what was happening underwater while they recorded. They didn't have a view underwater because they weren't submerged themselves, nor did they have a separate screen to monitor the action below the surface. They were, in a sense, blind to the events in front of the camera. This worked in favor of indeterminant results but, in hindsight, created the problematic situation for the fishes narrated at the beginning of this chapter. The cinematographers were unable to read if the fishes were communicating that they were uncomfortable with the presence of the camera and humans. On reflection, if I were to undertake a project like this again, I would create a more detailed instructional system, and prepare the cinematographers with knowledge about salmons so that they could evaluate if the camera and their presence would be a perceived as a threat and therefore a barrier to the fishes' progress. This better process would include training the cinematographers in methods to be un-intrusive, as well as building in more time to observe the fishes on location in order to understand how the salmons used it. This would provide knowledge on how to situate the camera so as not to interfere with their activities. It would probably involve keeping the camera further back from the fishes, and choosing streams that have enough room for the salmons to easily pass by the camera and cinematographer. A

separate above-water screen would be useful for the cinematographers to monitor the situation in front of the camera. They'd need to be prepped with knowledge about how to read the fishes' body language and if their gaze was focused on the camera in fearful response to the apparatus. This would allow the cinematographers to interpret if the fishes were showing any signs of stress or discomfort with the human presence and therefore be able to remedy the situation.

As mentioned earlier, at the time of recording the footage in 2010, we had no preconceived idea about what final form the project would take. Would it be an installation, a documentary video, an interactive interface, a performance? The final artwork did not fully emerge until five years later, informed by research about salmons and their migration projects, the ecologies of the Fraser River, and the human industry on and beside the river.

In 2015, when Simon and I were invited to create a project for Surrey Urbanscreen, we were interested in producing something in relation to the exhibition location. The exhibition site, within the City of Surrey has a relationship with the Fraser River which has the south bank defining Surrey's northern boundary. The salmons in the 2010 recordings would have swum by Surrey in their migration back up the Fraser to the Adams River spawning grounds. The commission presented opportunities to explore the interconnections of salmons and humans within the ecology of the Fraser. We already had the video clips of the salmon, but we needed material representing the human activities.

In order to depict the ecosystem of the Fraser around Surrey, we decided it was important to record video showing the human activities on the River and somehow combine this with the footage of fishes. We didn't know how this combination would occur yet. But for this production stage, I created simple set of instructions for my research assistant and cinematographer, Jonathan Nunes, to use:

> "In the morning or afternoon hours, over the span of a week, record two-minute video clips from a variety of locations on the north bank of the Fraser. Use a fixed camera point of view looking across the river at Surrey. The south bank of Fraser should be in the same position in each clip, forming a consistent horizon line within the frame."

This instruction had a loose set of constraints that could provide indeterminate recorded outcomes depicting the happenings on the Fraser. The resulting videos included a variety of

human actions: workers sorting log booms bundled at the river's edge; a massive paddle-wheel tour boat motoring under the Alex Fraser Bridge; trains shuttling industrial freight cars along the river's south bank; rush-hour traffic clogging the Pattullo Bridge linking New Westminster to Surrey; and a vast barge carrying industrial material crossing the River to dock at the Seaspan terminal. The recordings revealed the intensive use of the Fraser's waters by industry and leisure, and provided visual confirmation about human pressures on the Fraser that I had read about in my research. After reviewing both the footage of the salmons and of the human activities, I edited them into clips, each one showing a specific event such as the ones listed above. We sorted these into two separate folders, one for the fishes and one for the human activity. We needed to figure out the next step and see how the final project would emerge, so we continued using instructional systems, this time involving a computer.

Fig. 44. Production photo for *Salmon People* showing logging industry at the mouth of the Fraser River, Surrey in the background. Photo courtesy of Jonathan Nunes.

Fig. 45. Still from production video for *Salmon People* showing industry at the mouth of the Fraser River on the Surrey bank in the background. Photo courtesy of Jonathan Nunes.

Fig. 46. Still from production video for *Salmon People* showing transport industry at the mouth of the Fraser River, Surrey in the background. Photo courtesy of Jonathan Nunes.

The instructional systems by Fluxus can be considered early examples of generative art. They influenced the contemporary computational art genre, called generative art which uses computer programming to create the circumstances for the generation of art works.[271] For *Salmon People,* Simon created a computational system to generate a display of the videos. He instructed the software to join the video recordings of the underwater salmons with the recordings of the above water human activity, into a grid which arranged the videos realistically to depict above and below water activity. The software included a set of constraints determined by the exhibition site—the size and shape of the projection wall at Surrey Urbanscreen—and the horizon line in the above-water clips. The projection wall dimensions of Surrey Urbanscreen afforded a space that could easily play nine videos within a grid created by the software. We realized that we needed to create a third type of footage—waterline clips—in order to visually join the above-waterline and below-waterline realms. I created these by editing remnants of the Adams River footage. Then, we had three types of video clips representing realistic space: humans' activities on the water, the waterline, and salmons' activities in the water. The software combined these three types of clips into a fixed grid—three columns and three rows—determined by the projection surface dimensions. The software, used a recombinant method that included randomness to play different clips from each type, and display them in their respective row. The final outcome portrayed an ever-changing land-water-scape reflecting the complexity of the River's ecosystem shared by humans and fishes (Fig. 47 and IMAGE 14, 15).

Fig. 47. Still from *Salmon People* generative video installation showing recombinant panorama. Photo courtesy of the author.

[271] Galanter.

We used a similar set of recording processes and generative recombinant methods to produce the project's soundscape. This involved making sound recordings of the activities on the Fraser, and creating synthesized sounds to evoke a speculation on the underwater communications of the salmons. Recent marine biology research finds that fishes do produce sounds for communication.[272] We speculated that the participating sockeye would have been communicating with each other in their pre-spawning moments. The software played these synthesized sounds along with clips from the recorded sounds, in a recombinant way in order to compliment the visual panoramic display. On site at Urbanscreen, the soundscape could be accessed via FM frequency using a car radio.

The interspecies indeterminacy methods used for the production of *Salmon People* provided for emergent nonhuman creativity, and for a rumination on interspecies ethics. What the fishes did in front of the camera nudged me to consider their creative responses, and their intentions. The fishes watched, waited and decided. They went about their projects, and they *looked back.* This understanding inspired me to do a salmon's lifetime of learning—five years—to study up on how to appropriately represent them. It also provided a lesson on how to do better job of involving nonhumans in future projects. Marine biology provided some of this knowledge, specifically on fishes' emotional capabilities and their perceptual differences; climate science provided information on how our salmons are affected by human action. However, for citizens the science can seem distant, the magnitude of ecological impact too vast, and the forecast too bleak. The salmons' struggles can remain unknown. An experiential understanding is needed which can depict, in an instant, the interconnections of salmons and humans. This realization is what drove us to produce the *Salmon People* as a public art project.

[272] Balcombe summarizes numerous studies on different fishes that use sound to communicate. While I have not found research on salmons' sonic communications, there is no reason to rule out the potential that they too use sound to communicate.

Fig. 48. Installation of *Salmon People* at Surrey Urbanscreen, 2015. Photo courtesy of Blaine Campbell.

Salmon People was exhibited at Surrey Urbanscreen from October 23, 2015 to January 31, 2016 (Fig. 48, IMAGE 16, 17). The Surrey Art Gallery hosted the exhibition to coincide with World Rivers Day, and collaborated with the City of Surrey fish protection program which invited the public to participate as volunteers taking stream samples from Bear Creek, a creek that runs by the gallery and is part of the Fraser River water system. The activities, and the exhibition, drew thousands of visitors to the project.[273] It was also inadvertently seen by individuals who passed by the site on their commutes. The projection was visible from the Skytrain, the above ground transit system that services the Greater Vancouver Regional District. Travelling along the Surrey section of the Skytrain, passengers can catch a glimpse of *Salmon People*.

We received comments about the exhibition, including from a marine biologist who said he appreciated seeing sockeye represented in a realistic way that drew attention to their struggles. The exhibition gained interest from graduate students and faculty at the School for Interactive Art and Technology (SIAT) at Simon Fraser University, Surrey Campus. The SIAT researchers

[273] From correspondence with the Surrey Art Gallery curatorial staff, they conservatively estimate 10,000 visitors per year to the Surrey Urbanscreen exhibitions.

featured the work in a scholarly essay presented at the International Society of Electronic Arts (ISEA 2017), in Columbia.[274] The exhibition further gained international recognition from our neighbouring Washington state arts community. Curator Barbara Matilsky invited us to exhibit the work in an international exhibition called *Endangered Species: Artists on the Front Line of Biodiversity* at the Whatcom Museum, Bellingham, in 2018.[275] Overall, the public display of *Salmon People* at Urbanscreen entered the imaginations of local, regional and international art communities and publics, creating an expanded understanding about the local salmon populations and their challenges in the Fraser River system.

Crucially*, Salmon People* is a realist representation that makes more tangible the otherwise imperceptible struggles of the sockeye. The watery membrane normally separating humans from fishes is plunged through by the camera and microphone. The project joins critical locations and species together—the Adams River sockeye and the Fraser River humans. Here, things are presented as they are: salmons swimming amongst the burden of human activity. Seeing and hearing fishes and humans in this realist rendition in the form of public art, foregrounds the need for public responses to the salmons' hard destiny. By presenting this ecology in an accessible public art forum, a possibility is opened for a new level of reciprocal looking. *Salmon People* and its processes present a biophilic ethics of aesthetics by calling for public responses to the anthropogenic forces affecting this remarkable keystone species.

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[274] Sun, et al.

[275] "Endangered Species: Artists on the Front Line of Biodiversity," curated by Barbara Matilsky, Whatcom Museum, Bellingham, WA,

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Forest

… a forest is more than just the trees—it is a cooperative…[276]

—Sven Jorgensen

[276] Luther, 3

Dawn

Fig. 49. Production photo for *Biophilia* of the forest canopy in Fillongley Park. Photo courtesy of the author.

The dawn's morning light and sounds tugs at me. I slowly emerge from sleep into the blue morning light, and hear the waves of Lambert Channel washing the beach. I realize the birds are calling the dawn chorus. I pick up the Zoom recorder, hit the *record* button, and hold the recorder out the trailer's window. I glance at the time—05:43—and listen. After a few seconds, *fraaahhhhk–fraahhhk–frahhk*, the great blue heron calls out as she flies from her sleeping site in the forest to the sands of the tidal zone. A few seconds later, *braaawhk-braaawhk*—the low resonant voice of the raven as he flies over the campground. I can't see him, but I imagine he's doing a partial barrel-roll; quickly pulling in his wings and then flaring them out to create a playful spin. (He did this yesterday as he flew over me, like a stunt-pilot gesturing a greeting to a waving fan.) Next, a flurried *honk-honk-honk* as the local gaggle of Canada geese arrange themselves on the water just beyond the shore. They'll hang out there for hours, chatting and

up-ending as they feed in the shallow water. The smaller birds—robin, sparrow, chickadee—call to their kin and organize for the day. The *chirp* and *buzz* of insects also participate in the chorus. During the past few mornings, I've awoken up to notice this dawn sequence, but wasn't fast enough to record it. Today I'm lucky. I hit *stop* on the Zoom, get out of bed, dress, put Tom's and Sugi's collars on them and head for the forest.

The forest is a good place to get a sense of the interconnectedness of life—a particularly crucial practice now with current knowledge about the climate crisis and the ecological degradations from centuries of anthropocentric actions on Earth. When healthy, a forest is a diverse community where its inhabitants creatively participate in its flourishing. In this forest at Fillongley Park, I can sense myriad residents working in close ties. I hear the birds' layered communications, each species calling and listening within their own acoustical bandwidth. Other forest collaborations are not obvious, such as those in the soil beneath my feet where life is invisible and inaudible to humans. But these hidden vitalities can be pictured, using knowledge from forest ecology combined with art-making techniques, such as sensory attention and creative imagination.

This tiny forest has a few remaining old-growth trees in the region, and as such, it represents the problem of large-scale deforestation and human development. A walk in the woods can teach us about our local ecologies, about the creativity of its inhabitants, and how these can inspire creative making. Walking the trail, the forest affects us. Its creatures and their expressions—calls, movements, phytochemicals, energies—co-create our experiences. The forest is a space of regeneration where new found love and respect for all life can emerge. This particular forest has wisdom that can guide us, and help create a renewed respect for wild ancient spaces.

The forest

Fillongley Provincial Park is located on the east coast of Denman Island (Taystay'ich).[277] Denman is a Northern Gulf Island situated between Vancouver Island[278] and the mainland of the province of British Columbia, Canada. The Park has a small forest on the east shore which includes old growth Douglas fir and western red cedar trees. Denman Island is part of the

[277] Denman Island (Taystay'ich) is part of the traditional unceded territory of the Pentlach people including the K'omoks, Sliammon and Qualicum First Nations.

[278] Vancovuer Island is part of the traditional unceded territories of the Coast Salish, Nuu chah nulth, and Kwakiutl–the first peoples.

Coastal Douglas fir biogeoclimatic zone, an ecosystem that includes the southeastern portion of Vancouver Island, the southern Gulf Islands, a small strip on the southern coast of the BC mainland, and parts of Washington State in the US. Most of the Coastal Douglas fir ecosystem, an area that is 256,800 hectares, has been logged and developed by humans over the last 100 years. Only 160,000 hectares remain as forest, with less than 1 percent as old growth.[279] These old growth pockets are now small, such as in parks like Fillongley.

The Coastal Douglas fir ecosystem is characterized by the conditions of its particular geographical inclination, being in the rain-shadow of Vancouver Island's mountains and the Olympic mountains. This location creates warm, dry summers and wet winters, resulting in one of the mildest climates in Canada. Frost rarely occurs because of the forest floor's protective humus layer and vegetation. However, the plant communities of the Coastal Douglas fir ecosystem are defined as globally imperiled, despite knowledge about the ecosystem's features which support rich biodiversity and provide habitat for animal species at risk, such as spotted owl, marbled murrelet.[280] This ecosystem is also habitat for some of the largest and oldest beings on Earth. An old-growth tree has unique abilities to breathe in large amounts of carbon and even harvest fog for water contributions to the ecosystem.

Because of the long dry summers in the Coastal Douglas fir forests, coniferous trees predominate. Douglas fir is the most common tree, accompanied by a variety of other trees such as western red cedar, grand fir, Garry oak, red alder, shore pine, Sitka spruce, western hemlock, bitter cherry, western flowering dogwood, bigleaf maple, trembling aspen, black cottonwood and arbutus. This ecosystem also has hundreds of plant, fungi, moss, and lichen species. The plants are defined within community groups, some of which are not found in any other ecosystem. The four most typical plant communities are Douglas-fir–Salal; Douglas-fir–Shore Pine–Arbutus; Redcedar–Grand fir–Foamflower; Redcedar–Skunk cabbage.[281] The locations of these communities are characterized by topographic relationships from highest elevation to lowest, respectively. The communities in Fillongley Provincial Park forest are primarily Douglas-fir–Salal. Parts of the forest that include old growth trees also support Oregon grape, and trillium, twinflower, anemone, western starflower, and dogwood plant-life.

[279] Nuszdorfer, Klinka and Demarchi

[280] Environmental Law Centre Clinic

[281] Nuszdorfer, Klinka and Demarchi

Fig. 50. Production photo of an old Western red cedar in Fillongley Park for *Biophilia.* Photo courtesy of the author.

The method of defining these systems, originated within ecology, a field first developed in the late nineteenth century.[282] Ecology grew out of biology as a study that looked at how organisms interact within geological locations. Ecological research is still asking questions pioneered by Alexander von Humboldt and Charles Darwin, such as *what are the connections between organisms within a location?*[283] *What are the roles that each organism contributes to the whole?* Ecology, as the study of ecosystems, is a holistic examination of the interacting biotic and abiotic aspects of a site. An ecosystem has specific elevation, soil type, temperature and humidity that contributes to attracting particular groups of plants, fungi, bacteria and animals. Ecological study involves methods of working in the field, paying attention to organisms in their habitats and how they generate cultures of community living.

[282] Luther

[283] Wulf

The coastal Douglas fir old-growth forest is a special ecosystem where cooperative alliances form between beings of different scales, species, and even kingdoms. Giant trees rely on the microscopic hyphae-work of fungi; tiny insects depend on the trees' airborne canopies; inter-species tree communities converse across distances using phytochemical particles that relay the conditions of their existence. Here, abiotic and biotic beings create vital systems of reciprocity: water, light and soil minerals to trees and plants; tree carbohydrates to fungi and bacteria; fungal and bacterial mineral generation to trees; tree berries and seeds to birds and mammals; fauna excrement to humus; micro-fauna generating soil; conifer fog-harvesting and water dispersal to the forest-floor; tree cast-offs to fauna habitat; tree-top lichen fertilizing the soil below. Knowledge about these vital goings-on, that are primarily hidden to us, can inform our imagination and help us expand our senses towards the wonderous qualities of the forest.

The trail is dry and soft as we walk, and the ground gives slightly under paws and sneakers. The surface is thatched inches-deep with confer needles. The needles are part of the organic material layer that's the forest floor which includes living plants, trees, fungi, lichen, moss, cast-offs from trees, and fallen trees. Below this, the mineral layers are documents of geological histories—morainal deposits, colluvial and marine minerals from the debris of glaciers and ice sheets, and from the Pacific Ocean. In the Coastal Douglas fir ecosystem, the soil is called *Dystric* or *Eutric Brunisols*, described as brown acidic soil with organic material sitting on top of poorly drained mineral soils.[284]

I stop and look at the plant life off the trail. There, the forest floor is strewn with logs, conifer needles and twigs laying amongst living plants, fungi, lichens, mosses, and trees. Tree and plant off-casts are part of the cycle of regeneration that occurs here. This dead material contributes rich nutrients for living beings, and provides a buffer against temperature drops for the organisms living in the soil beneath. The predominance of evergreens in the forest creates a litter that is high in carbon and low in nitrogen. Consequently, it does not decompose as quickly as the litter in a forest with more deciduous trees where soil fauna would to do most of the decomposition work. In the Coastal Douglas fir forest, decomposition happens through fungal

[284] Nuszdorfer, Klinka and Demarchi

mycelium that has woven itself into the top layer of humus.[285] The mycelium form a matted layer together with the roots of plants, giving the ground that particular springiness underfoot.

Fig. 51. Still from production video for *Biophilia* showing fern species as typical undergrowth on the forest floor of Fillongley Park. Photo courtesy of the author.

The cast-offs produced by big old trees can remain on the forest floor for decades, even centuries, providing long term habitat for young trees, fungi and animals. After large trees die and fall over from fire or other causes, they may transform into nurse-logs. Hemlock trees are particularly good at becoming nurse-logs who germinate young trees that sprout on top. Fungi, , such as angel wing and honey mushrooms, also inhabit the fallen trees. The tree's sapwood is eaten by centipedes, millipedes, and beetle larvae, and the excrement of these animals feed the bacteria and fungi that further decay the wood.[286] Mosses grow very slowly around the fallen trees, at a rate of one tiny fan branch per year. When looked at closely, the mossy areas are themselves tiny forests that habitat for insects and hold moisture in the soil for larger plants.

[285] Virtual Soil Science Learning Resources

[286] Steen

I notice some mosses on the logs. They look dried out and brown. They seem dead but are, in fact, only dormant waiting for the right conditions to awaken them. The air must be 15 degrees Celsius or lower, the soil must have moisture, and the light provide a third of direct sunlight.[287] Under these conditions, mosses become green again and help support an abundance of other life. Mosses are excellent collaborative partners. They are actually colonies, made up of tiny individual plants, each with roots, leaves and a sporophyte—a reproductive shaft topped with a capsule containing hundreds of thousands of microscopic spores. Mosses support insects, such as aphids, mites, flies, moths, grasshoppers, and midges, who spend crucial parts of their lives in these micro-forests. Slugs also prefer the dampness provided by the moss, and microscopic fauna, such as amoebae and nematodes live alongside slugs. So far, biologists have named an astonishing 10,000 species of moss. Pacific northwest hosts 10 percent of the Earth's total mosses, with British Columbia supporting the majority—800 species.[288] Beneath the mosses, a subterranean world with billions of organisms busily community-build the vitality that is the forest.

The world beneath my feet is beyond my senses, but Tom and Sugi, who have an amazing sense of smell, can detect the bacteria, fungi and micro-fauna in this hidden world. While they can know the soil's vitality through their highly refined and sense of smell, I will have to rely on my imagination. As we walk, the dogs stop and gently scratch the surface of the soil. They take a small mouthful and chew it. Dogs will eat soil that is rich in probiotics and minerals that support their digestion. As mentioned a previous chapter, crows also mix a tiny bit of soil in with food which they then feed to their youngsters.

As the dogs taste the soil, I imagine the colonies of life underground. In one cubic meter of healthy soil there may be 1 trillion bacteria; 500 billion flagellates (organisms with whip-like tails); 100 billion rhizopods (amoeba and protozoa); 10 billion actinomycetes (a type of bacteria that helps decompose organic matter and lives symbiotically with plants); 1 billion fungi (many living symbiotically with plant beings); 1 million nematodes (round worms that feed on organic material and some living organisms); 25,000 rotifers (microscopic invertebrate animals); 10,000 polychaetes (bristle worms); 150 insects; 100 dipteran larvae (the larvae of insects); 100 beetles

[287] Luther

[288] Ibid.

and their larvae; 80 earthworms; and 50 spiders, snails, and wood lice.[289] Many of these organisms eat the plant litter and, through their actions, generate nitrogen for the plantlife. The earthworms and other fauna mix the soil, and their borrowing blends the minerals from the lower soil into the higher humus layer, an activity that is crucial to the growth of the forest. Of the vast populations of living beings in soil, only about 5-10 percent are known to biologists, and some of these are kin to the oldest forms of life on Earth.

Life's beginnings

The Earth is thought to be about 4.5 billion years old in a universe of over 13 billion years. One theory on the beginnings of life proposes that a form of bacteria originated through chemical reactions occurring in the location of the hydrothermal vents of the Earth's ancient oceans. The vents provided high pressure and temperatures as energy sources which initiated complex chemical systems into mutually dependent components.[290] These systems generated peptide formations and these in turn developed into vesicles with membranes surrounding the chemical reactions, like simple cells. The vesicle formations adapted to generate their own energy using polypeptides—chains of amino acids. It's thought that these formations evolved into bacteria around 3.8 billion years ago. This would have been an early green sulphur bacteria which had the ability to photosynthesize by taking light energy and converting it into food.[291] The bacteria may have used the light emitted by the hydrothermal vents which were fed by glowing molten rock from the Earth's core. Later, around 3 million years ago, these evolved into blue-green algae inhabiting areas closer to the surface of the oceans. These beings were able to photosynthesize the sun's light, and this critical evolutionary event changed atmosphere of the Earth as photosynthesis processes released oxygen into the air. The oxygen-enriched atmosphere assisted with the evolution of eukaryotic cells, which evolved 1.5 million years ago. These cells contain the proteins and processes that are in today's plant, fungal and animal cells.

Today's bacteria that evolved from the ancient ones described above, inhabit most of the Earth's surface. They live in the soil, water, and even in the Earth's crust. Bacteria diversity is so vast that biologists working with genome related research have determined that they make up

[289] Scheaub et al.

[290] Trewavas.

[291] ibid.

two-thirds of the biodiversity on Earth.[292] Bacteria also inhabits the inside and outside of plant and animal bodies. Tom's and Sugi's canine bodies, and my homo sapiens body, are habitats for vast amounts of micro-organisms. Our micro-biomes are species-specific, and even individual specific, based on what we eat, our histories, and where and how we live.

The human body has 37 trillion homo sapiens cells, and about three times that amount—100 trillion cells—belonging to bacteria and other microorganisms.[293] This community of about 1000 species is called the human microbiome and weighs about 1.3 kilograms. The microbiome is critical to our health because it protects our skin, lungs, glands and reproductive organs. It helps us with digestion, rids infectious organisms, and assists with brain function. An unbalanced microbiome can contribute to common diseases, such as tooth decay, inflammatory bowel disease, autoimmune disorders, allergies, diabetes, obesity, and sleep and emotional disorders. Animal bodies and their microbiomes have co-evolved over millions of years into their respective symbiotic relationships. Looked at from an ecological viewpoint, the human body itself is an ecosystem that includes microorganisms that assist with the flourishing of that habitat. This leads to a question: *what is human?* Looked at from a microbiology viewpoint, historical views that hold humans as separate and distinct from other lifeforms are no longer tenable.

Detrimental historical representations of life, including the outmoded thought about humans as separate and distinct, have also been responsible for problematic representations of life as a hierarchy of beings, each with its respective degree of value. This goes back to the ancient Greeks with Aristotle who theorized the *scala naturae*—the great chain of being. Later, the idea was elaborated by Christianity as the 'tree-of-life' which usually shows humans near the top just below God and angels. The recentt genomic research into bacterial lifeforms has generated a new phylogenetic tree-of-life (see Fig. 52, left). Incidentally, the image looks similar to a sketch by Darwin, created in 1837, that illustrates bacterial relationships (see Fig. 52 right). The new phylogenetic tree-of-life shows the vast biodiversity of bacteria, compared to the eukaryotes, the multicellular beings such as animals and plants, shown on the bottom right. Both Darwin's and the new phylogenetic image show a lack of hierarchy, instead representing life as a radial pattern where the three domains of phyla—bacteria, archaea, and eukaryota—branch out as

[292] Hug et al.

[293] American Academy of Microbiology

classes, from a common centre. The classes depict the genetic lineages within each domain, and show all beings as co-evolving through bacteria. In an interesting recent theory, evolutionary biologist Lynne Margulis argues that the evolutionary associations between bacteria and animals or plants—rather than solely random mutation, as in the Darwinian theory—are responsible for generating new species.[294] This research and the phylogenetic tree-of-life presents a new and humbling way to think about humans as participating within the larger ecology of the Earth. It draws attention to human and bacterial interdependence where humans can no longer think of themselves as being the 'highest' representatives of Earth's species. Our evolution simply could not have occurred without the participation of bacteria. (In another humbling note: the new tree-of-life presents a mere 20 percent of the Earth's total biodiversity.)[295]

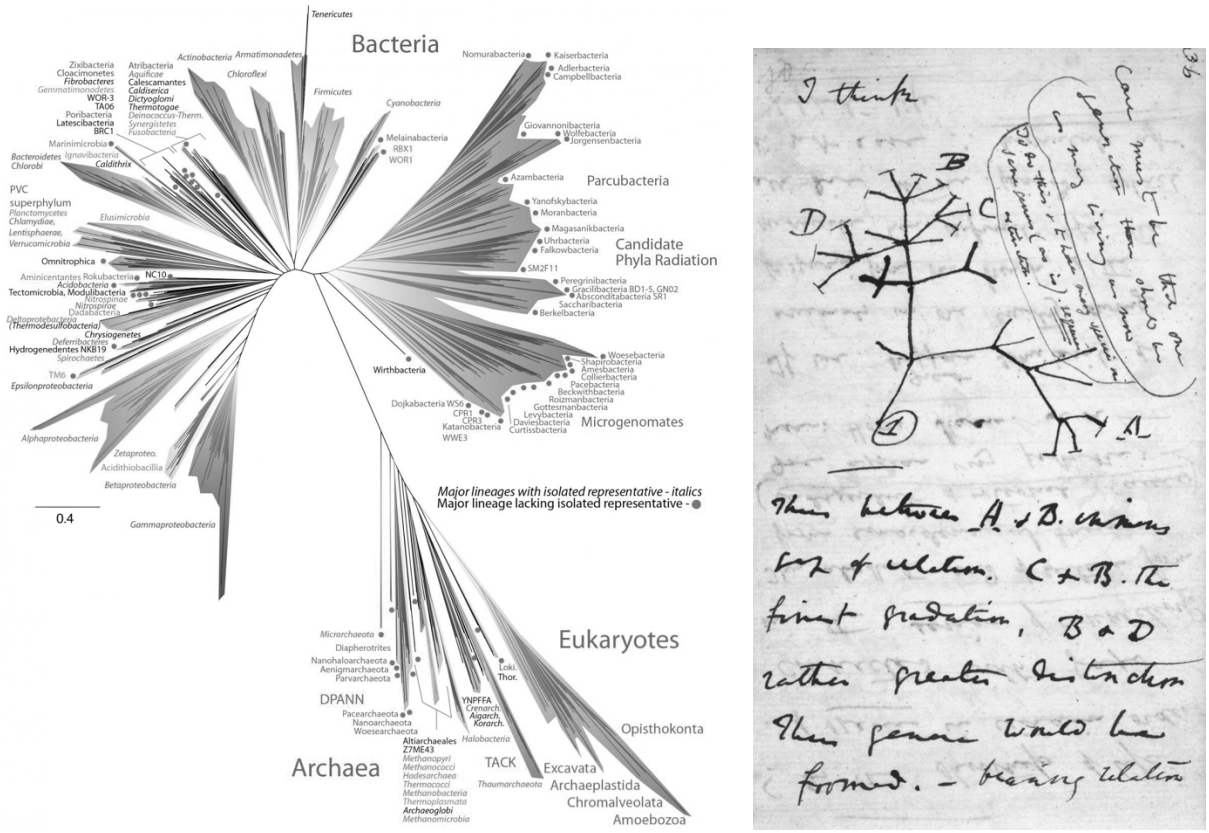

Figure 52. (Left) A current view of the tree of life, encompassing the total diversity represented by sequenced genomes (Laura A. Hug, Brett J. Baker, Karthik Anantharaman, Christopher T. Brown, Alexander J. Probst et al). Reproduced here under a Creative Commons CC-BY 4 license. (Right) Darwin's tree-of-life (McLendon).

[294] Margulis and Sagan

[295] McLendon

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Phyto-fungal-communications

Tom and Sugi and I stop on the trail. For a moment I want to think about the mycorrhiza networks beneath our feet, the multiple plant, fungi and bacteria interactions within the soil. I stand still and imagine the chemical and electrical signals, the myriad instances of nutrient sharing happening below us. Chemical signals are sent and nutrients are exchanged between fungi and trees to shape their behaviours and growth in the ecosystem.[296] The root tips of trees and woody plants make ultrasonic sounds as they forage for nutrients. They sense the soil's material to identify helpful fungi and bacteria that will assist with their foraging. The root tips communicate with the fungi nearby by secreting hormones to attract them.[297] During these conversations, the root tips determine if the fungi will make a suitable partner. If they agree to form a bond, the fungi send out hyphae—microscopic fungal tubes—that penetrate the root tips and bind with them on a cellular level.[298] They form symbiotic bonds, called mycorrhiza networks, specific to the type of species in the forest. These networks benefit the plant life, because the fungi hyphae can move through greater areas of soil than the plants' roots, thereby extending the soil's mineral availability.[299] The network allows the fungi and plant life to cooperate and exchange nutrients. The fungi shuttle mineral nutrients, such as phosphorus, to the trees and plants; the plants and trees create carbon from photosynthesis, and share these with the fungi. The plants and trees decide whether to do this by assessing the efforts of the fungi. The ones that supply them with more phosphorus will receive more carbon in return.[300] The fungi even assist seedlings by joining with their roots, and these seedlings are more likely to survive.[301]

We walk past the boggy area of the forest where a few unique plants grow and form particular relationships with fungi. I spot a small delicate, translucent white plant that looks like a cross between a flower and a mushroom. The plant is a *monotropideae* and, being white, does not photosynthesize at all. Each of its stems bears one white flower that relies on wild bees to

[296] Gorzelak et al.

[297] Trewavas

[298] Macfarlane

[299] Field

[300] Trewavas

[301] Bingham and Simard

pollinate. Unable to photosynthesize, the plant is dependent on Russula fungi to provide their nutrients.[302] I recall an autumn day, hiking with the dogs in a forest on Mount Seymour and coming across Russula fruiting bodies poking above ground as mushrooms. They had colorful red and purple caps with white stems. Some of them were delicious!

Not only do plants and trees cooperate with fungi, but bacteria also participates in the mycorrhiza network. Plants and trees recognize helpful bacteria and, like with the fungi, allow them to connect to their roots. These bacteria are able to fix nitrogen from the atmosphere and share these nutrients to their plant or tree companions. Like with humans and other animals, a plant's microbiomes helps the plant resist disease. The nutrients from the bacteria's work are assessed by the plant or tree, and if adequate, their work will be reciprocated with carbon supplies to the bacteria.[303] This reciprocity extends the network capabilities of the forest, and further assists the communities' collaborations.

Mycorrhiza networks are cooperatives built by proximity, by kin association, and by connectedness within the network. For instance, a network may have a hub tree—a tree highly connected to other trees, plants and fungi in the forest—who provides rich sources of nutrients to the network. Hub trees are usually large old trees who use the mycorrhizal network to shuttle nutrients to nearby plants and trees that may be deficient in nutrients. For instance, an old-growth Douglas fir has access to more sunlight and water because of their height, so they are able send carbon and water to nearby smaller trees standing in a shaded or dryer location. The Douglas fir will favour kin over nearby trees who are not their offspring.[304] But the hub tree may also cooperate with non-kin trees, and even to trees of other species.

Hub trees sense the stresses experienced by other trees through using phytochemical communications. A hub tree may receive a distress signal from another tree who is communicating that they are not getting enough nutrients.[305] The hub tree will send nutrients,

[302] Yang and Pfister

[303] Trewavas

[304] Gorzelak et al.

[305] Simard et al.

over the course of a few days, to the deficient tree. The nutrients provided by the donor tree will be remembered by the receiving tree, and they may return the favour in the future.[306]

Trees also experience stresses by leaf-eating insects, and they communicate this to other trees using the mycorrhiza network. The phytochemical communications are received by trees in the vicinity, and the receivers will initiate the production of insecticides in their own leaves to defend against potential infestation. The communications are even understood across species; the Douglas fir experiencing their needles being eaten by the western spruce budworm will release chemicals via the mycorrhiza network that are understood by nearby pines.[307] These pines will produce a defense enzyme in anticipation of the potential migration of the budworm to their own branches. All of these plant behaviours, include sensing, foraging, and memory, are only now being considered as intelligent and sentient.

Even before plant behaviour was recognized as a field of study, Darwin experimented with the movements of plant-shoots over the course of the day as they foraged for light. Plant behavior is now described using language that supports a view on plant consciousness.[308] By understanding plants as having senses, making decisions based on their environment, and responding to environmental inputs, they can no longer be though of as inert and unconscious. Plants sense light, they smell airborne phytochemicals, taste chemical signals received via their mycorrhiza networks, and experience touch from nearby plants and trees. Like animals, plants use foraging methods with their root tips and leaves, to search for, encounter and decide on appropriate nutrients. They also decide who they will form bonds with in their network. Plants and trees will evaluate the amount and quality of potential nutrient sources, and this will affect their movement and growth. For instance, the leaves of some plants forage by following the direction of the light during the course of the day, and, over time, this will affect their shape.[309]

Plants also have memory in relation to knowledge they've gained from their senses.[310] This happens without neural networks like in animal bodies. Some plants, such as vines, have tendrils that make their winding movement around a support in response to sensing and

[306] Gorzelak et al.

[307] Song et al.

[308] Marder.

[309] Trewavas

[310] ibid

remembering touch. They will remember the touch of the structure for up to 2 hours. Some grasses need to feel a spell of cold weather for them to decide to produce flowers. The memory of this cold period will last for up to a year. Some plants remember a cold spell and adapt to better withstand future temperature drops. Plants and trees that anticipate bug infestation, like in the forest communities, will remember the potential threat for years.

Plants and trees also understand self and other. Root tips sense other plants and work cooperatively to avoid the vicinity in which the other's roots are already established.[311] Darwin described plant root tips as acting similarly to brains of animals where decisions are made to create adaptive behaviours.[312] As trees grow, they sense—via touch—the neighbouring trees, and they avoid producing branches that interfere with the other trees' branches. Trees also avoid overlapping the branches of others. By considering their sense of touch, we can see that trees respond to input and adapt their shapes in order to flourish within the community.

Making another stop on the trail, Tom and Sugi and I breath in the delicious scent of cedar and fir trees. The airborne particles are phytoncides that smell good, and also make us feel good. The chemicals stimulate our immune system to generate cancer fighting cells. In Japan, the practice of breathing in the forest air is called *shinrin-yoku*—forest bathing. Shinrin-yok*u* was recognized in 1982 in Japan for its health benefits, and has since become a practice regularly enacted by adults and children. The biological and physiological benefits of being in the forest have been researched since 2001 by the Japanese Society of Forest Medicine. The Society describes the optimum shinrin-yoku practice as simply walking and paying attention to our breathing and senses.[313] Practicing shinrin-yoku in this Pacific northwest forest is a way to discover the wonderous complexity of the wild habitat. We listen to the animals, gently touch the nearby plants and trees, look at the details of the forest, smelling the scents, and maybe even taste a few edible berries. A shinrin-yoku session of only a few hours has a lasting effect on the immune system.[314] For about one month my cortisol level will be lower, I'll have decreased stress effects from the intensive city-life. Tom and Sugi and I take in a few more breaths…

[311] ibid

[312] ibid, 150

[313] Nippon Medical School

[314] Li

We continue walking the trail, breathing the air, and opening our senses. We feel a growing sense of vitality, calmness and well-being. The experience of paying attention and imagining the forest's complexity, has prepared me for the interspecies production processes ahead.

Interspecies indeterminacy and biophilic attention

The following morning at 5am, I leave the dogs sleeping and head for the forest. I bring the sound recorder and video camera, and a journal. It's still dark, so I can't see much detail, but I can hear the sounds of the woods. I stand still and listen to the layered sonics of the dawn chorus. It's much louder, richer, and layered in this forest than I had anticipated. A Swainson's thrush dominates with his fluid call—a sound that characterizes the Pacific northwest forest. Nearby, a Pacific wren calls, one of the most complex vocalizations in the forest. A hummingbird whirls past my ear. I hear *mewing* from the tree tops and wonder if young ravens are just waking up in their nesting tree. The dim morning light catches the edge of nearby trees, and creates a pale halo around them. I set up the video camera to record a dim shaft of light on the forest floor. I turn on the sound recorder.

Moments later, I hear a loud crash in the bushes ahead, and a few snarles—raccoons. I look in the sound's direction, in the bushes off the trail. I can just make out the silhouette of a small family of raccoons climbing down a tree. A young one must have lost their footing and slipped into the salal and let out a complaint. After a few minutes, I stop the recorders, pick up my gear, and move another 20 metres down the trail. Again, I set up, just in time to record a loon flying overhead, calling on his way to the water. In the distance, two young eagles call from their nest.

Moving along the trail, stopping and recording in this way, I record 2 minutes of video and audio in each location. As I do this, I notice that each spot has its own bird and insect soundscape, its own plant communities, and morning light qualities. I hear a series of loud hollow taps to my right—probably a greater pileated woodpecker—and more tentative taps to my left from a smaller woodpecker species. Lichen hanging from the cedar branches seems to glow with the gentle morning light. As the sun comes up, a breeze moves the maple tree's branches creating a light green rustling. I notice that each time I move to a new location, the birds pause their calls. They're watching me as I set up. Once I stop moving, they resume their communications. I note the number recording number and make notes in my journal detailing the sonic and visual characteristics at each location. This is a field recording journaling method for the post

production work later when I'll be sorting through the recordings. The journal will help me keep track of the sonic events and how the sounds relate to the location captured in the videos. This could inform the artwork to come. The dawn timing, the two-minute recordings, the distance between locations, the journal notations are the only predeterminations for this production process. The forest inhabitants contribute the rest.

Figure 53. The author making field recordings on location in Fillonley Park forest. Photo courtesy of Greg Snider.

This method of using simple instructions to gather creative content by other beings, is an art-making process I have already used for over a decade in the *Animal Lover* projects, and I've discussed in previous chapters. I call it an *indeterminacy* method, and it's an important part of loosening preconceptions and expectations when it comes to interspecies processes. It's informed by artists from the Fluxus movement, working from 1960s to the late 1970s, who experimented with processes that allowed for indeterminate aspects to emerge in their art events. The Fluxus artist held art events called *happenings* and these were unlike anything else in modern art. Happenings were initiated by a set of short instructions conceived in advance by the artists. The instructions were enactment by willing participants, sometimes audience members, who attended the events. The variability of the participants' interpretation of the instructions would allow for unexpected—indeterminate—aspects to emerge. This generative method made space for active contributions from publics. Audience members were no longer passive, as in conventional art events, but became participants in the creation of the art. The method called into question assumptions about the role of art and the artist. The performance of the instructions, not instructions themselves, were consider to be the artwork. Fluxus artists proposed that making room for indeterminacy through generative systems, such as the simple instructions, could provide for occurrences to emerge reflecting the complexity of everyday life.

Applied to my own processes, interspecies indeterminacy is a method of being open to unexpected emergent content generated from the actions of other lifeforms. Using film language, you could say that the production stage, such as the one happening on the trail, was carried out in collaboration with other animals and plants. In this way, *interspecies indeterminacy* is an ecological approach to art making, because it recognizes the creative contributions of other lifeforms. Rather than only being subjects of art, the other beings are participants in the art making processes themselves. In this forest, the creatures create the events that I record—the moss and lichen colonies on the trunk of a Douglas fir, the lightly moving maple leaves, the calls of young eagles, a loon's passage, the liquid call of the Swainson's thrush—all participate in the process. This realization makes me feel gratitude for the forest's creativity, and for the willingness of each participant to create alongside me.

Back to Fluxus for a moment. Yoko Ono and John Cage were Fluxus artists who used instructional systems. And, interestingly, some of their processes can be seen as early examples of interspecies art. I talked about John Cage's work *Bird Cage* in a previous chapter.

Here, I want to elaborate on one of Yoko Ono's works called *Secret Piece*. In 1964, Ono printed 150 instructional pieces and published these in an artist book called *Grapefruit*. *Secret Piece* (1953) is one of the works, and involves human participants performing a set of instructions in relation to a wild location at dawn. The instructions for *Secret Piece* are: "Decide on one note that you want to play. Play it with the following accompaniment: The woods from 5 a.m. to 8 a.m. in summer."[315] This work is an adaptation of Fluxus' participatory methods, but it involves wild nonhuman beings. In this work, the context of the woods sets the conditions for involving wildlife inhabiting a situated ecology. I can imagine playing a note to accompany bird and plant sonics. The specified time and season present probabilities in terms of nonhuman contributions. It's likely that birds would be enacting a dawn chorus and leafed trees would be sounding in the early morning breeze. The resulting performance would emerge as a co-creation between the artist, myself and the nonhuman contributors.

In *Secret Piece*, Ono's instructions support indeterminate outcomes where the woods' accompaniment is not controlled by the artist or human performer. Each time *Secret Piece* is performed, a richly different result is generated by the complexity of its site-specific location and timing. Assumptions about [human] participants and audiences are also called into question by providing opportunities for other beings to listen and participate. *Secret Piece* is an early example of an artwork that uses interspecies indeterminacy methods where all beings and forces in a location may contribute to the art event. Here, the human offers a sustained note as an experiment to communicate and improvise with nonhuman others.

[315] Ono

Fig. 54. Still from production video for *Biophilia* showing maple leaves. Photo courtesy of the author.

On the trail, as I stop, watch and listen, and record, I pay attention to how I feel. I make notes about this in the journal. This attention, both to the forest's inhabitants around me, and to my own emotions, is a practical example of *biophilic attention*. It's a way to detail affective events in the moment, and it provides an understanding about how the various forest creatures and events generate my experience. The thrush's uplifting call makes me feel joyful, the raccoon's snarls momentarily frightened me, the *mewing* of ravens peek my curiosity, the light breeze on the maple's fresh green leaves fills me with wonder. Here, biophilic attention is a form of mindfulness in relation to the life of the forest. It's both outwardly moving, and inwardly reflecting. As such, it attends to the co-creative nature of reality. The raccoon, the hummingbird, the thrush, the wren, the mycorrhiza, all participate in creating my experience. Being fully aware in the moment, I sense the world unfolding. I feel that Earth is with me, I am part of the Earth. In that moment, on the forest trail, I feel fully connected.

The techniques I've described—interspecies indeterminacy and biophilic attention—are inspired by naturalists and acoustic ecologists. The renowned ornithologist and sound recordist Theodore Parker used a naturalist method which he simply describes as "…walking slowly

down a path, frequently pausing to watch and listen…"[316] Using this approach, he created more than 15,000 recordings of 1600 species of birds. His body of work significantly contributed to research on bird biodiversity. Likewise, acoustic ecologist Rodolphe Alexis developed a method of listening and recording, but with the objective to record the wholistic character of a location. He spent months in the forests of Costa Rica. He noticed that the sonic richness of a location was best experienced at dawn when one after another, each bird, insect, and amphibian awakened and called. He heard the communications gradually reach a layered intensity, then tapering off as the sun emerged and the animals moved on with their other daily activities.[317] In my own field recording, I noticed a similar narrative arc lasting a few hours. When there's just a tiny bit of morning light the birds begin to call, and this builds to a layered intensity as the sun raises, and then decreases as the birds start foraging for food.

Recently, acoustic ecologist Bernie Krause described these natural soundscapes as *biophony*, where all animal calls occupy a frequency range as an adaptation in order to be heard.[318] He noticed this in his research in Africa when, at dawn, in a semi-awake state, it became clear that he was hearing a well-developed collection of sounds from the calling animals, each fitting within their own acoustical bandwidth. The animals were listening to their kin, and could disambiguate their calls from the overall layered soundscape. They were tuning in to their community's bandwidth—the insects to the highest frequencies, birds to the mid-range, elephant to the lowest. Krause later developed biophony as a scientific method to collect sonic data reflecting a location's biodiversity (more on this below).

It's important to keep in mind that the methods I'm using—interspecies indeterminacy and biophlilic attention—informed by the researchers above, not be considered as means to paint a full picture of what's happening. We humans have limits in terms of our senses and perception which only provide a small window onto the larger scene of nature. This is limitation is exemplified by our hearing. Recent advancements in sound recording have made evident our human short-comings, by uncovering the richness of bird calls previously unheard by human ears. In the field, we hear the Pacific wren's eight second call as a complex sequence of notes. What we can hear is only a 'low resolution' version of it. When a high-speed recording is made,

[316] Fischer and Cory, 70

[317] Fischer and Cory

[318] Ibid.

and then slowed down so that we can hear the detail, the technology reveals complexity. Our temporal resolution is far slower than the wren's and, therefore, we can't distinguish the details of the call in real-time. But in the slowed down version, we can hear the bird's eight second call consisting of an astonishing 64 individual notes![319] Technological approaches offered by sound recording and playback can help us get a glimpse into the natural richness beyond our senses and perceptions. Biologists have used these techniques, along with spectrogram analysis—a visual graph showing amplitude and frequency over time—to gain a bigger picture on the complexity of bird communications. Some of this research has forced humans to rethink their exclusivity with regard to linguistic prowess.

Until the late twentieth century, it was believed that human language set us apart from other animals. However, recent careful analysis of the calls of some birds has revealed that they have properties, such as syntax and combinatorial characteristics, previously thought to only exist in human languages. Syntax refers to the rules that a language adheres to in order to be understood. Combinatorial is a quality where parts of a language and can be combined in various ways to generate new meanings. For example, human languages have sounds that can be combined create words, phrases and sentences. The same is true for some bird languages. For example, a tiny native of the Pacific northwest—the black-capped chickadee (*Parus atricapillus*)—has a formidable linguistic system. The chickadee's call follows a set of grammatical rules, and uses *note-types* (like human language syllables) in combinatorial ways. Just focusing on two calls of the black-capped chickadee, the *chick-a-dee* call and the *gargle* call, can demonstrate this system. The *chick-a-dee* call is used by both the male and female, and is bound by the rule of four note-types called in sequence—ABCD.[320] The *chick-a-dee* call also has combinatorial characteristics giving the birds the ability to generate thousands of different calls, and therefore meanings.[321] For example, the call may be as short ABCD, or longer ABCDDDDD. Because A, B, C, or D notes can be inserted into the sequence (in the proper order), it has a combinatorial character. The *gargle* call—a sonic burst of about half a second, consisting of up to fifteen high-pitched note-types.[322] The organizational rules for these

[319] Ibid.

[320] Hailman et. al.

[321] Ibid.

[322] Ficken and Popp

are looser than the *chick-a-dee* call, allowing for greater variation.[323] In *gargle* calls, the note-types are rarely repeated in the same call, and individuals will have at least 30 different gargle calls that they use.[324]

I remember one summer evening listening to the chickadees who live in the pine across the street from my home. One of them was rattling off a *chick-a-dee* diatribe "AAABBBCDDD, DDDDDDD, ABCCCDDDDD…" and so on, for about 10 minutes straight! I could hear the beginning and end of each *chick-a-dee* sequence, but they were strung together closely, giving the impression of a continuous narration. The bird was telling a complicated and elaborate story for those listening.

If the chickadee calls' syntax and combinatorial characteristics aren't mind-boggling enough, consider this: the *chick-a-dee* and the *gargle* calls share other speech characteristics with humans. Both the *chick-a-dee* and the *gargle* average 6 notes per call, like short words in human spoken language, and both feature descending pitches through the duration of the call, similar to human speech.[325] Both chickadees and humans begin a sentence, usually at a higher pitch, and complete the sentence at a lower pitch. (I've heard other birds do this too). Both humans and birds add variations in amplitude and frequency when talking to teach other. Amplitude variation is used for close or distant communication—like whispering to someone close up or shouting to those far away. Frequency matching is used by birds,[326] and humans, to align their calls to those with whom they are communicating. The birds elaborate on their vocal language by combining body gestures, such as with tail flicks, wing vibrations and feather ruffles,[327] just like humans use body language.

While ornithologists know that birds communicate via calls and gestures, details on the meaning of their communications still remains elusive. This area is largely uncharted territory waiting for some patient Ph.D. students to explore. However, we do have a general understanding about how birds use their calls. For example, *chick-a-dee* calls are used as alarm calls, to maintain

[323] Ibid.

[324] Ficken et. al.

[325] Ficken and Popp

[326] Otter et. al.

[327] Slobodchikoff

contact with between birds, and to coordinate group movements.[328] *Gargle* calls are used by males in agonistic settings, in sexual and territorial contexts.[329] Specific *gargle* call-types are shared by chickadees in the same area. As I listen to the chickadees in the pine across the street, I don't know the details of the calls' meaning, but I can hear the long string of calling and the low amplitude. I can imagine that they are communicating with their kin perched close-by. They're enjoying the cool shade offered by the dense branches of the tree, listening to each other tell-story about the day's events.

Ornithologists understand the general meaning of a call by paying attention to context in which the call is made. In my experience with the crow neighbors around my home, I get a sense of the meaning of their calls by paying attention to the calls in relation to the context in which they are used. This has helped me come to some general understandings about their communications. When I first started this observational process, all crows sounded the same; their calls were a sequence of undifferentiated *caws*. However, as I started to pay attention to the context, and really listened to the calls, I began to distinguish differences. So far, I have noted a handful of call-types: quiet *clucks* from the mother to her fledglings while she grooms them, insistent *maamaa* from youngsters demanding food from their parents, patient *braack* by parents calling their young to follow, *cawcaw* sequences from individuals calling their mates, annoyed *grakks* from adults chasing seagulls, persistent and monotone *crawcrawcraw* used by groups of crows pointing out a nearby raccoon, quick *cawcawcawcawcaw* sequences used to alert youngsters about predatory ravens flying overhead. By paying attention and listening, I feel I have learned a bit of crow language. It's been gratifying to be able to understand a bit of what is happening, because it makes me feel more connected to bird communities around me. In the morning when I'm on a walk with the dogs and I hear a persistent and monotone *crawcrawcraw* from a group of crows in a tree, I know I just have to look closely inside the tree to see the raccoon. Taking the time to listen and observe the creativity of birds has made me appreciate that there's always something interesting happening in the nonhuman communities around my home. Once again, understanding aspects of more-than-human communications around me allows me to consider the creative diversity of my neighbourhood, and makes me feel connected.

[328] Ficken and Popp

[329] Ibid.

French composer Olivier Messiaen was one of the first composers to listen to bird calls, and develop annotation techniques that would assist in his compositions.[330] He was around before portable recording equipment was invented, so he developed a system of notation which led to thousands of pages. On his walks in the French countryside, he spent time listening, and writing down everything he experienced. His notes were the basis of his compositions *Réveil des oiseaux* (1953) for piano and woodwinds, and *Oiseaux exotiques* for piano and orchestra (1955-56). Between 1956 and 1958, he composed the *Catalogue d'oiseaux*, a three-hour solo piano performance consisting of thirteen pieces, as seven 'books', each focusing on specific birds in their contexts. Informed by naturalist methods, Messiaen understood the relationship of birds to their ecologies. This is demonstrated in his notes for a composition: "Each soloist is presented in its habitat, surrounded by its landscape and by the songs of other birds (77 in all) from the region …All here is truth, even the countryside with all its accompanying sights, sounds, smells and thermal currents."[331]

I finish up the last recording on the trail and realize I've spent 2 hours recording and annotating. I need a break from the intensity of listening and watching. I pack up the gear and think about my journal notes. They'll be important for later, when I review the sound and video recordings, and discuss compositional approaches with my human collaborator Simon Overstall. Our listening and watching in the studio will allow us to pay attention, in detail, to the specifics of the recorded expressions. Like Messiaen, I'll use my notes to recall the feel of the locations. These may inform the artwork. As I walk back to the campground, I wonder about how the upcoming studio processes will generate the final form of the project. I don't have the answer yet, but I am certain it will be revealed through listening again.

Anthrophony

Later in the afternoon, after I've had a rest, I return to the forest. I walk the trail on the other side of the stream. I want to make recordings during this time of day when the forest's sounds are different. The human soundscape, called anthrophony, is much more prominent in the afternoon, and this is a reminder of the anthropogenic forces affecting the Earth. Human sounds can harm other beings by interfering with their sonic bandwidth. Known as acoustical masking,

[330] Fischer and Cory

[331] Althaparro-Minck

they can interfere with nonhuman animal communications and, therefore, their breeding, predator avoidance and survival. Birds have to adapt their communications when they're subject to traffic noise. They use higher frequency notes because these pitches are more audible.[332] Some birds use greater amplitude—call louder.[333] They even rely on the calls of other species. The northern cardinal understands the alarm calls of tufted titmice and will flee a location if they hear the titmice call about a predator.[334] Animals are under pressure from the increased human noise. If they can't hear their kin's communications over the din of human noise, they may miss-out on critical information about dangers, such as approaching predators. Here in the forest, and in the ocean surrounding Denman Island, all sorts of animals are experiencing stresses caused by the anthrophony.

[332] Parris and Schneider

[333] Brumm

[334] Grade and Sieving

Fig. 55. Production photo for *Biophilia* showing frog on the forest floor in Fillongley Park. Photo courtesy of Greg Snider.

Spiders in the leaf litter depend on seismic vibrations to communicate with potential mates. When they're subject to noise that interferes with their ability to sense the seismic vibration, it affects their ability to communicate.[335] In Lambert Channel off of Denman Island, and further into the Pacific Ocean, dolphins, orca and other whales use sound to find their way around, and to detect predators, search for food, find mates, and communicate with their young. The sound frequency range that whales and orca use to communicate and echolocate corresponds to the frequency range of ship engines. Whales and dolphins have to call louder in order to be heard

[335] Gordon and Uetz

above the noise of ships.[336] Plus, in the ocean, sound waves travel much farther. Even ships hundreds of miles away can be heard by these animals and this can interfere with their survival.

Earlier, I mentioned the concept of the biophony developed by acoustic ecologist Bernie Krause. In his research, he has been able to use sound to demonstrate climate change and habitat destruction.[337] In 1988-89, Krause conducted field listening and recording sessions within a forest called Lincoln Meadow in the Sierra Nevada mountains in the US. He made the first set of recordings before selective logging in the area. He listened and analyzed the spectrogram created from this recording. It was dense throughout frequency ranges, reflecting the biodiversity of calling animals in the area. Exactly one year after the logging, Krause returned to the forest to make a second recording in exactly the same location as the first, and during the same time of day. He said that the forest *looked* very similar to how it looked the year before, but it sounded significantly different. He could only hear the sounds of the stream and a solitary woodpecker. Plus, the new sound recording was completely absent of the sonic biodiversity of the previous year.

In another location—the Sugarloaf Ridge State Park, California[338]—Krause conducted field listening and recording sessions over the span of a decade, from 2004 to 2015. Each year he visited the area, he heard fewer and fewer birds. He was alarmed to find that the latest visit resulted in recordings completely silent of bird calls. He attributed the bird declines to climate change factors that produced the California drought. Recently, I had a similar experience at Okanagan Lake[339] in the interior of our province. I have been visiting a specific spot for over a decade during the summer. Each time I'd go, I'd enjoy watching and listening for birds. Over the past four years, the bird populations have declined, and the diversity of birds in the location has dropped. This is because the general area of Okanagan has been devastated by wild fires over the year, events that climate scientists are attributing to the drier summers of global heating.

On the trail this afternoon, I glance down at the stream running through the middle of the forest. I descend on to its tiny pebble beach. A sunray beams down through the trees, touching the water and highlighting a small fish. I hear a distant speed boat, probably pulling water skiers

[336] B.C. Cetacean Sightings Network.

[337] Mosbergen

[338] Traditional Wappo native American Indian territory.
[339] Syilx/Okanagan traditional territories.

along Lambert Channel. The drone of its engine echoes in the forest, creating a tapered sound as the boat recedes. It probably sounds much louder under the water, with its sound traveling miles. I hear cars on the road that bounds the park. As they approach, and then pass by, their sound shifts in pitch. I realize the pervasiveness of human sounds even on this small island, in this tiny forest, indicates how the forests of this province are under pressure from all sides.

Fig. 56. Still from production video for *Biophilia* showing stream in the middle of Fillongley Park. Photo courtesy of the author.

Old trees

Logging combined with global heating has had a dramatic effect on the forests in our province. Historically, the forests functioned as carbon sinks, contributing to slow climate change. They captured significant amounts of carbon from the atmosphere through the action of the trees' photosynthesis, and through the forest soils where large quantities of carbon are stored in the organic materials. Old growth forests are particularly good at removing carbon from the air and storing it as biomass. This is because old trees, unlike younger ones, take in vast amounts of carbon from the atmosphere because of their growth rate that accelerates with age.[340] Each

[340] Stephenson et al.

year, big trees add biomass to their size equivalent to a small tree. This is another reason why ancient trees are so important to the health of the planet. One old growth tree can absorb the carbon equivalent of numerous smaller trees. Over the last decade, because of over-harvesting and climate change induced wildfires, our province's forests no longer function as carbon sinks. They're now *carbon sources.* More carbon is released into the atmosphere than the remaining forests can absorb.[341]

Vancouver Island, the large island that sits to the west of Denman Island, has historically been a site of old growth forests. However, over the last decade, old growth logging has increased by 12 percent annually, resulting in 100,000 hectares of old-growth forest being harvested.[342] The original three million hectares of old-growth forests has been logged, leaving only 10 percent of large old trees. This logging has released 370 million tonnes of carbon into the atmosphere. With this data, the Sierra Club of BC has stated that unless there's a significant change in the practice of old growth deforestation, there will be an ecological and economic collapse in the province.[343] This warning can be extrapolated globally. A recent study lists over-harvesting as one of the top three biggest threats—along with agriculture and hunting—to Earth's biodiversity.[344]

[341] David Suzuki Foundation

[342] Sierra Club of BC

[343] Sierra Club of BC

[344] Maxwell et al.

Fig. 57. Still from production video for *Biophilia* showing ancient cedar in Fillonley Park. Photo courtesy of the author.

I walk a few hundred meters into the Fillongley forest to see the old growth trees. I can spot them from a distance because of their enormous trunks. But seeing them from afar it's difficult to get a sense of their scale. This phenomenon is due to the more common experience of walking in forests of much smaller, younger trees. Now, humans rarely come in contact with large trees, so when we do, we can be astonished by their size. Even when I get up-close, the size of the old growth Douglas fir and old western red cedar is hard to grasp. The fir's massive trunk is fortified with a thick layer of bark forming a wall between the elements and their vulnerable insides that took centuries to grow. Their trunk's layers are made up of xylem and phloem tissues that transport water and nutrients. The outer growth layers, just underneath the bark, are the most active, where water flows up from the roots and into to the branches and crown. This water movement is assisted by two forces: the negative pressure in the roots that pulls the water up through the xylem, and the water evaporation action from transpiration in the needles which generates a pulling action. The tree's needles are doing the photosynthesis work and generating sugars. These nutrients are then sent throughout the tree body, down to their roots, and out through the mycorrhiza network to the forest community.

I hear a breeze. In the forest, the wind is not usually felt at human height, and even less at Tom and Sugi's height. I look up. The branches of the old growth Douglas fir start at about 20 metres from the ground, where they unfold into a complex canopy structure. The breez is felt there, by the creatures living in the branches of the canopy. Until recently, not much was known about canopy ecologies because they were difficult to access. However, current technologies, such as cranes, climbing gear and laser scanning are now used by forest ecologists to investigate the canopy systems. This research is generating a better understanding of the unique biodiversity of these systems.

Diverse canopy ecosystems are features of old growth forests where micro-ecosystems that have developed over centuries, are largely untouched by forest fires. The bark of an old Douglas fir is so dense that shields them from the effects of fire, and these structural characteristics give the fir the ability to survive for centuries. They continue to create new branches in their canopies, even after centuries of fires at ground level.[345] In the canopy branches, there are soils which are distinct from the soil on the forest floor. These microhabitats support canopy arthropods who flourish there without ever touching the forest floor.[346] The canopy soils have specific humidity that supports plants, lichen, fungi, and animals.[347] Plants that grow on other plants, called epiphytes, also populate the canopy layer because there's more light. Tree voles live in these habitats, and bats sleep there. Spotted owls use the canopy to hunt for the voles and squirrels. Over one hundred species of lichens and mosses inhabit old growth canopies.

The lichen in the canopy can be considered a micro-community in itself. Lichen is a collaboration between three organisms—two types of fungi and a cyanobacteria. These colonies respond to environmental factors and adapt to form the structure that we associate as lichen. It's not sufficient to consider lichen for its individual parts, but more as a story told between the parts.[348] The cyanobacteria uses sunlight to create nutrients for the colony, and the fungi creates the visible structure we associate with lichen. Lichen plays a crucial role in the forest. It has the ability to fix nitrogen from the air and distribute it to the ecosystem below. This happens

[345] Pacific Northwest Research Station

[346] Winchester and Lindo

[347] Pacific Northwest Research Station

[348] Luther

when rain falls on the lichen that releases nitrogen into the water which drops to the forest floor. Some of the nitrogen-fixing lichen are considered keystone organisms who provide nutrients to conifer forests for which nitrogen is otherwise scarce.[349] The nature of lichen draws attention to the importance of thinking about living beings as relational. Through the lichen's symbiotic processes, the bacteria and fungi literally become another organism that can no longer be separated into the original parts.[350]

Old growth forests also have unique air temperature and water activity. An old growth coniferous forest will have reduced air temperatures—2.5 degrees Celsius cooler—than younger forests. This is also because of the canopy features. When conifers release terpenes—phytoncides to ward against insect infestations—these terpenes collect water condensation.[351] This action adds to cloud creation and produces greater chance of precipitation. That's why we say that the forests in the Pacific northwest are rain forests.

Large conifers can even provide hydrological activity to the forest when it's not raining. The needles in the canopy branches are up high enough to be able to harvest moisture from fog that passes over the forest. The needles release this moisture as *fog-drip* to the smaller trees and plants below them.[352] This is important for the forest during the dry months of summer when there may be little rain, but some fog. It's estimated that fog provides 10-30 percent of a forest's water.[353] That's why the volume of water coming from a forest watershed is greater than the precipitation in the area. In this way, the trees themselves influence the cool, moist conditions for their own flourishing, and provide an environment for species who rely on cooler ecosystems.[354]

Even after they die, old trees support the forest. Standing dead trees, called *snags* can provide centuries-worth of habitat for animals, insects and other plants. Insects inhabiting the snags are food for woodpeckers foraging there. Pileated woodpeckers rely on large snags for their homes, and osprey and kingfishers use them as perches while hunting or eating their prey. Even

[349] Goward and Arsenault

[350] Luther

[351] Wohlleben

[352] Ewing et al

[353] Thompson

[354] Houtman

chickadees create nests in snags. The rich structures of old-growth forests with their canopy and snag ecosystems are literally standing supports for the forest's biodiversity.

Later, as the night settles in, I make one last visit into the forest. The wind has calmed, the canopy branches are still. It's quite dark, but I can just make out small bats flitting over my head. They're awake for the night and calling using ultrasonics to map the surroundings and to communicate with each other. No birds are heard because they're resting in the trees. Crickets chirp. I can barely see the large trees because of the darkness, but I imagine them preparing for sleep. Like humans, trees have circadian rhythms.[355] During the night, they don't photosynthesize, so transpiration through their needles is reduced. Their bodies are under less tension, so their branches slightly droop.[356] They rest.

Biophilia

When I return home, I'm eager to hear and see what the recordings reveal. Simon and I begin this long process in my studio where we listen to the recordings, and look at the videos. We notice that in the sound recordings, some of individual bird's calls are more pronounced, such as from the Swainson's thrush, raven, eagle, loon, wren, woodpeckers. Probably my recordedr was closer to these birds when they called, or they were calling louder than the other birds I heard. We decide that the calls from these prominent individuals would be the starting point from which to build the structure of the project. Some of the birds are calling singularly, such as the raven, and others are calling at the same time such as the Swainson's thrush and the Pacific wren. Using Messiaen's approach, we think about these birds as soloists or duet performers whose contributions can provide the basis of the composition. The recordings also reveal the prominent human sounds from the speed boat and the cars. We think of these as anthrophonic soloists. Through listening and analysis, the project begins to emerge. We decide that our soloists and duets—Raven, Woodpecker, Eagle and Loon, Anthrophony, Thrush and Wren—will provide the basis of five sonic movements.

Referring to the notes in my journal, we agree to incorporate the context of each call, and when and where it was recorded. We listen to the less prominent communications from the other birds and animals to see how they could provide supporting roles for the soloists and duets in order to

[355] Puttonen et al

[356] Coglan

create this sonic context. We determine that some of these calls should overlap with the soloists, in order to replicate the layered richness of the real time experience of the forest.

In the next stage, we discuss how to represent the act of listening in the field, and how my experience was a co-creative with the beings around me. We experiment with a call and response approach traditionally used in vocal or choral music. To do this, Simon plays each of the soloists and duet recordings, and I listen to them and respond sonically on my theremin. This electronic instrument can be tuned, via guitar pedals, to generate sounds that approximate human or other animal vocalizations. I like to use biomimicry techniques to produce sounds that have characteristics of the birds' calls. For instance, in response to the wren's complex call, I played short bursts of high frequency note-types that sound a bit wren-like. These theremin phrases are recorded by Simon. The call and response process allows the form of the project to further take shape.

For the next stage, we work on the euphonic aspects, sonic representations that can generate feelings, like the ones I experienced in the forest. We apply a similar method to Messiaen's naturalist approach, where he concerned himself with portraying the feel of walking the countryside—the temperature, richness of the auditory field, and other sensings. In the Fillongley forest, I had an overall sense of wonder for the vitality and complexity. In order to represent this, we considered introducing a set of drawn-out sonic tones, as background for each movement in the composition. These *pad* elements are informed by musical drone techniques where a note or harmonic chord is played continuously in the background, underneath more prominent sounds or notes—in our case the bird calls and theremin responses. We created a pad for each movement that has an emotional quality and functions as a context on which to build the compositional layering of the animal calls for that movement. The sonic pads are generated using granular synthesis techniques that extend the duration of a recording, similar to playing it in slow motion. For example, one of the bird call recordings of a northern flicker is fed through Simon's granular synthesis software to create a minutes' long drone. The software allows us to shift the pitch of the sound to evoke emotional qualities, such as anticipation, contemplation or joy. The particular pitches in each movement's sonic pad provides evocative qualities that can generate emotional experiences for listeners.

Having created a general sense of each movement's soundscape, we then review the video recordings, editing them down to a variety of short clips, each 90 seconds long. These are

arranged into five groups, reflecting the five movements conceived for the composition. The clips for each group are selected to complement each other, reflecting the time and location represented in the five sonic movements.

We began to consider the project's final form. Would it be an installation, a performance, a soundscape? In the studio, methodically going through the recordings and videos, we were able to get a sense of the appropriate form to present to the public. A critical consideration was that the work represent the vitality and wonderous qualities of the forest. We agree on a generative installation approach to help recreate these qualities.

For the installation stage, we developed a generative computational system to play the sonic movements and the projected video clips. This involved developing software to play the sound recordings of the soloists, the background players, the sonic pad, and the theremin responses. Simon built the software to include a set of constraints—like instructions—to play the recordings in each group, in relation to their specific movement. An indeterminate aspect of this computational process was programmed into the software so that those recordings may play back in a variety of arrangements. This generative method allows for unexpected combinations and outcomes to emerge, like the spontaneous events that occur in a real forest. For the audience, each movement would have non-repeating aspects; new combinations of animal calls and visuals could be heard and seen each time a movement is played.

It was important to me that the visual aspect of the installation reflect the experience of the day unfolding. So, while the software plays the video clips that are part of each movement, a transition treatment is included between each clip. This is a long cross-dissolve between each clip that has a duration of 30 seconds, or one third of the clip. Therefore, most of the time, the visuals consist of a video clip fading out and a new one fading in. The overall effect is one of constant change like in the real-world forest. The technique creates a slow unfolding sense of wonder and expectation as viewers see the new location slowing emerging. In the gallery, the generative video is projected on a large translucent screen suspended in the middle of the space so that the visuals can be seen from all locations. The generative soundscape is played via surrounding speakers. The overall installation composition recreates the sense of being in the original location, with its sights, sounds, and affective experiences.

Many visitors to an exhibition of *Biophilia* at the Western Front told me that they experienced similar feelings to being in a real Pacific northwest forest. They felt themselves slowing down, feeling a sense of calmness. They felt a need to quietly stand, watch and listen.

Fig. 58. Installation of *Biophilia* at The Western Front. *Biophilia* was commissioned by The Western Front as part of the International Society of Contemporary Music, World New Music Days, Vancouver, 2017. Photo courtesy of the author.

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Afterword

February, 2020—

Fig. 59. Tom on one of his last walks around the neighbourhood. Photo courtesy of the author.

As I walk with the dogs in the grassy playing field by our home, I can feel the sun's warmth on my face. It's been a long and rainy winter, and these past few days of sun are a welcome sign of the emerging spring. I'm suddenly reminded of the significance of the coming season, and I turn around to look for Tom. He's about twenty yards behind me, standing still in the middle of the field. Facing me, the gray fur around his mouth forms a highlight on his otherwise black body. I gesture with my arm a swoop—my signal to 'come.' I use gestures now to communicate with Tom and Sugi since they've lost most of their hearing with old age. I signal again. He just stands there, looking in my direction, his rear-end slightly drooping with his weakened hind legs. *Is he sniffing the air, or spaced-out?* I can't tell. I look ahead for Sugi. He's turned around to ascertain our progress, and I make sure he sees me head back to retrieve Tom. As I approach, Tom gives a few licks with his tongue at the tip of his mouth, acknowledging my intention to leash him up. Once we're connected, I turn around and start walking to let him know I want him to follow.

He obliges with a little hop to gain his stride. The gesture faintly recalls the bouncy trot of Tom as a younger dog, and I feel a fleeting sense of optimism. I look over at Sugi who's still ahead, waiting. *Good boy*. When we catch up, I connect Sugi to the other side of the two-ended leash, and we finish crossing the field. On the sidewalk, as we head up the hill of William Street, I feel Tom's slowness creating resistance.

These days, the dogs no longer tolerate walking cooperatively joined by a lead between them. Tom gets annoyed at Sugi sniffing every little thing and, in protest, pulls back. Sugi's not strong enough to coax Tom along, even with Tom's diminished state. So, they end up fixed in position, Tom in his stubbornness and Sugi with his resignation. Our new leash arrangement seems to suit them. I use the longer end for Tom who walks behind, and the shorter one for Sugi who walks beside me. I feel Tom stop, and I turn around to see what he wants. With his nose, he's pointing at the large mossy maple to the right of the sidewalk. I respond by easing up on the leash, and he moves towards the tree to explore the interesting scents. Sugi, by my side, politely waits. Once Tom finishes checking out the scent marks left by other dogs, we continue our walk. As we reach the top of the hill at Cotton Street, the sidewalk flattens out and I let the dogs off-leash. They take a few moments to examine the bushes and grass within reach, and I slowly walk to the end of the block, looking behind now and then and gesturing with my arm to follow. After rounding the corner onto Charles Street, I turn around to watch Tom gaining momentum. He enjoys the downhill part of the walk because it's easier on his back legs. His stride takes on the smooth loping motion dogs use to conserve energy while covering distances. Tom's lope still has its characteristic long-legged elegance and, for a moment, he seems younger than his sixteen years.

Tom is still game for two walks a day, but these take twice as long as they did only six months ago so we've had to shorten the distances. I know he has discomfort in his back legs, and he's bothered by the tumor in his small intestine. His medication relieves some pain and nausea, and the CBD[357] acts as an anti-inflammatory while—like a miracle substance—increases his appetite. The herbal anti-oxidant, and turkey tail mushroom supplement known to slow the growth of cancer, may give him more time. I use homeopathic remedies ease any residual pain. I don't know how long he has left so each day now, I take Tom out for a walk on his own. It's a

[357] Cannabidiol.

way for us to have quality time and enjoy each other's company without distraction. I practice slowing down to his speed and, as I walk beside him, I get a sense of the fragility of life and the uncertainty of reality.

At home, after the walk, I run my hand along his back to let him know I'm going to pick him up and rinse his feet in the sink. Through his fur, I feel the protruding bones of his back and hips. He's lighter than Sugi now, and sometimes when I hold him, I have a mental image of him fading away. The biggest challenge has halting stopping the weight loss. It's a balancing act with the CBD. Too much, and he gets spaced-out on the walks, too little and his hunger wanes. Even with an appetite, the mechanics of chewing are an issue. He no longer bites into hard food because the pieces fall out the side of his mouth where he's missing teeth, removed years ago after a painful infection that left the right side of his face temporarily paralyzed and where, now, he has a loss of sensation. The food that falls out, he'll refuse to eat, and even if I put the pieces back in his bowl, he'll just sniff them and turn his head away. Maybe they have a new scent—traces of the cancer that we know dogs are able to detect. In these moments, I feel panic welling up and a tightening desperation.

Despite all he's going through, Tom is still capable of communicating his needs, and I've learned some of his new requests. His changing relationship to food has challenged my ethics. One by one over the months, he's turned down the variety of veggies he previously loved. He no longer stands in the kitchen waiting for hand-outs when I'm preparing lunch, and he's not interested in what we're making for dinner. He's even rejected the store-bought dog treats that used to excite him. As his appetite diminished and he shed pounds, I was faced a decision. After a brief struggle with my vegan conscience, I decided to try him on a meat diet. I started with a little cooked chicken, heated with warm water. He chewed the pieces in his effortful way, but keenly lapped up the broth. I realized he'd probably like puréed food. I began feeding him local free-run organic non-medicated chicken breast or thighs puréed with squash and yam—the only two remaining veggies he'll eat—mixed with pureed dehydrated store-bought nonmedicated free-run chicken-based food. Each time I feed him, I think about the birds who were raised in barns and slaughtered, and who are now keeping Tom alive. I don't have a ready philosophical argument for returning him to a meat diet, only a practical one—it's stopped the weight loss, and I love him. With the new diet he gained appetite, energy, and some of his

previous eagerness with regard to mealtimes. At the appropriate time of day, he'd get up and walk to the kitchen, reminding me that he wants to be fed.

In December, when the vet told us about test results and the tumor, she gave us a print-out with information about end-of-life considerations. She penciled a few calculations in her file estimating the speed of the tumor's growth, "He probably has until spring." On a good day, when I returned home from teaching, Tom made an effort to walk over and greet me. The small gesture communicates that he's still happy for our companionship. I felt gratitude for his company, and kissed his nose and face. It wasn't yet time. I hoped he'd let me know when it is.

May 2019—

I'm on the roof deck preparing to refill the water dish in the *Bird Park Survival Station* and notice our crow couple perched on the corner of the house. The female has her head bowed down and the male is gently preening her neck feathers. I've seen them do this in the past when they're preparing to nest, but this time their interaction seems different. From her, I sense grief and disappointment, and from him, tenderness and encouragement. They've had a challenging season, with at least one nest failure. The week before, Greg and I were looking through our new spotting scope when we noticed the female franticly poking around in the nest. Soon after, both adults stopped visiting the nest. Likely, their eggs didn't hatch, the babies died, or predators got to them. Crow couples will abandon nests that have failed, but if it's early enough in the season, they'll try again. Our couple did, in a different tree, and were able to successfully fledge two babies. One of them had a tough time in her first few months. I noticed she would perch in a peculiar way on the telephone wire by the house. She'd crouch with her underbody feathers draped over her legs and feet. When she'd come down to get some popcorn from the feeder, I could see her bad case of avian pox which left her feet covered in large bumps. The disease probably caused her discomfort or pain, making it difficult for her to stand or perch.

The nest failures, and the suffering of the new baby, seemed to have a transformative effect on the parents. In previous years, they'd chase away the youngsters once they were able to find food for themselves. But this year, the adults seemed kinder and more tolerant of the fledglings, allowing them to stick around. As the summer and fall progressed, and with her limited mobility,

the little female would stay close to the *Bird Park*. When I'd emerge onto the roof to refill the bird feeders, she'd call to her parents—*caw–caow—caw*, and they'd fly over. The new family seemed content enough. I witnessed the parents letting her eat first from the feeder, and then helping themselves. Over the months, her pox cleared up, but I'd still see her perched on the telephone line with her feet tucked up inside her underbody feathers.

In 2019, when the Cornell Laboratory of Ornithology released their study on bird declines, I felt an urgency to provide more real-world relief to our local birds, easing some of the stresses they may be experiencing with climate change. Around here, a shifting climate has brought warmer and drier summers, and heavier rains over longer periods during fall, winter and spring. Increased help for the birds includes more access to fresh water during summer, more variety of foods during the winter months, and more perching opportunities. Up until the study, the *Bird Park Survival Station* focused on the crow couple and their new generations, but has since expanded it to include a variety of feeders for different local birds. The upgrades have been successful and attracted more species. The regulars—house sparrows, Northern flickers, house finches, black-capped chickadees, Anna's hummingbirds, juncos and European starlings—are now joined by red-breasted nuthatches, white-crowned sparrows, song sparrows, bush tits, pine siskins and boreal chickadees. With the increased visitors, I've noticed some interesting interspecies sociability. The crows don't mind the starlings and chickadees at their popcorn feeder, the Northern flickers hang out with the finches and sparrows on the seed feeder, and a mix of finches, starlings, and sparrows drink at the water dish. From my office, I can hear the calls of the new birds and this has added a richness to the biophony surrounding the house. With the expanded project, I'm keen to witness new instances of interspecies creativity.

Fig. 60. Still from video of *Bird Park Survival Station* showing a female house sparrow drinking and a European starling having a bath. Photo courtesy of the author.

The increased activity in the *Bird Park Survival Station* has helped me reflect on my responsibilities toward our local hummingbirds. The Anna's hummingbirds used to live more south, in California and Mexico. But since the 1930s, with an increase in garden flowers and the popularity of hummingbird feeders, these birds have expanded their territory northwards along the Westcoast, all the way to Vancouver.[358] It's a recent phenomenon where resident birds will stay year-long in the city if they've found a dependable food source, such as winter-blooming flowers, insects or hummingbird feeders. The adaptation has implications for humans because the hummingbirds may become dependent on the feeders and, without them, would not be able to last through the cold months. During recent winters, these birds have been observed perching for hours on a twig, close to their feeders, in order to feed regularly and conserve energy that they'd normally use for flight. The birds have also developed physical adaptations to help them survive. During the day, they'll gain 16 percent of their body weight and use this fat as fuel while they sleep at night.[359] During the cold winter nights, they'll go into a state of torpor,

[358] Audubon.

[359] Green.

significantly lowering their body temperature, and reducing their respiration from 245 breaths per minute to just 6! In the *Bird Park Survival Station*, I've become vigilant, replacing the sugar syrup in the feeder each week in order to keep it fresh from mildew and, during freezing nights, rigging a light bulb nearby to warm the mixture for the morning. Our hummingbird neighbours will awake just as the sun begins to light the sky, head to the feeder for a meal, take a few sips, and survive another day.

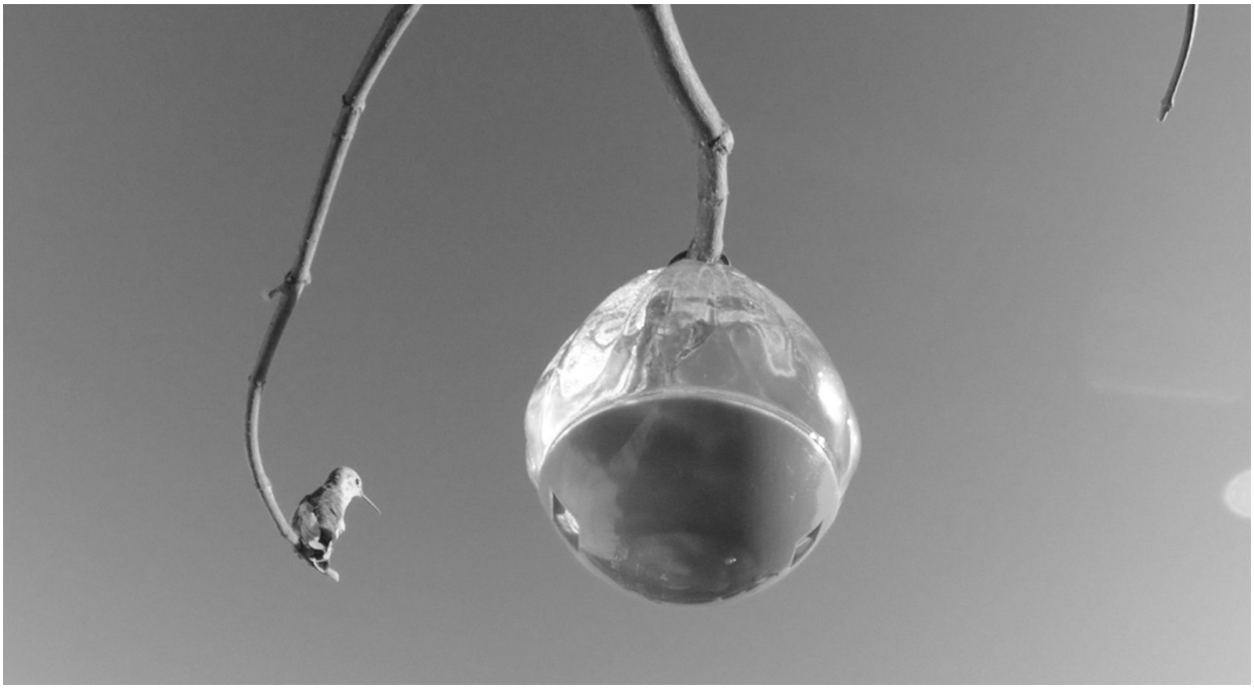

Fig. 61. Still from video of *Bird Park Survival Station* showing a female Anna's hummingbird perched next to the feeder. Photo courtesy of the author.

June, 2019—

The Canadian Department of Fisheries and Oceans reported a major landslide in the Fraser River canyon around Big Bar, 64 kilometres north of Lillooet, BC. Satellite imagery revealed that it had occurred months earlier, in October of 2018, but because of the remote location, hadn't been discovered until June, 2019. The avalanche dumped huge boulders into the River creating an impassable waterfall. It meant that Fraser River salmon populations, who have natal streams north or east of Lillooet, would not be able to migrate back to their spawning grounds. The populations affected included chinook salmon, the species that our threatened killer whale population, living in the Salish Sea off the Westcoast, depend on. Federal and provincial

officers, scientists and First Nations people joined together to help the salmons and clear the blockage. For weeks, thousands of fishes waited on the other side of the slide, while teams of people hand-carried individual fishes to oxygenated transfer tanks. The fishes were then airlifted by helicopter over the blockage where they were released back into the river to continue on their migration. The team was able to move 60,000 fishes before they began clearing a passage for the remaining fishes. Hundreds of thousands of fishes died because of the delay in their migrations adding to the thousands of fishes who did not survive the wait before a passage was cleared. The tragedy is not over. Restoring a proper channel will take at least through spring 2020, and this timeframe will have effects on upcoming migrations.

The government has estimated that the sockeye salmon populations who run along this route has been reduced to 600,000 fishes, a substantial decrease from the estimated five million predicted before the news of the slide. Scientists say the blockage is a catastrophe for salmon populations of the Fraser, and will likely mean extinction for some. Environmental organizations are calling for the federal government to declare a state of emergency for the fishes, including a moratorium on fishing.[360] But, while the government has put 15 million dollars towards studying the effected salmon populations, it has not changed regulations on fishing.[361]

The Big Bar tragedy is a reminder that with the existing anthropogenic stresses of climate change—warmer waters, increased pathogens, and shallower waterways—and on-going insults from development, industry and agriculture, any natural events can have unforeseen and disastrous impacts on threatened species. The event is an opportunity for the region's human citizens to pause and reflect on the significance of our role in the lives of salmons. The precarity of their survival calls for increased care and action, and we need to ask ourselves how we can improve conditions for the remaining salmon communities in order for them to recover their numbers. Care should include monitoring the status of the riverways and natal streams, and enforcing strong regulations to mitigate the stresses from global heating, fishing, development and agriculture.

July 2019—

[360] Lindsay.

[361] Fisheries and Oceans Canada.

Fig. 62. Production photo with *Wild Empathy* research team member scientist Dr. Deirdre Brink on location with an old-growth Douglas fir on Vancouver Island, BC. Photo courtesy of Maria Lantin.

The provincial government announced protections for 54 old growth trees within the Big Tree Registry. The ones included are only the exceptionally large trees, and a fraction of the total 347 trees in the Registry. The protection includes a meager one hectare of the area surrounding each tree.[362] Environmental organizations and scientists have called this action largely symbolic, because it doesn't significantly curb the effects of logging. Environmental groups are demanding a moratorium on old growth logging altogether, and the public is in agreement. Nine out of ten people asked are concerned about our forests want to preserve them.[363] Yet the government is stalling in its responsibility to take action. Since the announcement, the province has created a two-person team to go around to communities and get input on the importance of old trees. But this process is too little too late. Logging companies, with approvals from the provincial government, continue to clear vast areas of forest, even old growth. While the climate emergency wears on, the logging industry fuels the crisis by cutting ancient forests in the province at a rate of *500 soccer fields per day*.[364] This a striking injustice when information about carbon reduction by forests is widely known, and knowledge about the ability of old growth forests to absorb carbon at a rate much greater than younger trees and newer forests is readily available.

Not only is the inaction by the government and the resultant logging having an impact on the forests, but climate change is also putting pressure on these wild ecosystems. A study released by Environment and Climate Change Canada concluded that the previous two years' abundant wild fires were the result of human-induced climate change.[365] In 2017 alone, 1.2 million hectares burned, an area seven to eleven times larger than would have occurred without the anthropogenic stressors of global heating. The year 2017 was a record for the amount of wild lands burned by fires, only to be surpassed in 2018. Scientists say that the years to come will see intensification in wild fires which will further reduce grasslands and forests. The drier summers are also affecting our indigenous flora, specifically the cedar trees and salal bushes which typify the region's forests. These species, with their shallow root systems and inability to withstand drought, have begun to die off in parts of the province.

[362] Government of British Columbia.

[363] Sierra Club of BC.

[364] Ibid.

[365] Environment and Climate Change Canada.

With a growing sense of the need to advocate for our regional forests, I've started a new project called *Wild Empathy*. It's a long-term project involving a team of researchers and artists including scientists and students.[366] We're working to raise awareness of the value and irreplaceability of our ancient trees and forests through the creation of immersive art and media experiences for public display. The project involves research with old growth trees in regional forests, and we're using media created through the research to create virtual forest experiences for city dwelling citizens. Urban residents may not have access to forests, and may never be able to stand in the presence of ancient trees. So, we're combining our recordings of real-world forests with rich media techniques and methods—VR, stereoscopic video, animation, immersive sound—to create experiences that people can interact with and explore to better understand the liveliness of old trees and to appreciate their significance. Recently, we teamed up with Science World BC, our local science centre, to exhibit some of the first artwork outcomes, and this partnership has given us access to broad public audiences, including children, youths, adults, families, school groups, and tourists.

[366] www.wildempathy.org

Fig. 63. Production photo with members of the *Wild Empathy* research team: (left to right) student research assistant Edward Madojemu; scientist Dr. Dave Barr; co-investigator Dr. Maria Lantin; and student research assistant Mana Saei, on location in an old-growth forest on Vancouver Island, BC. Photo courtesy of the author.

In discussion with the staff at Science World BC we've found common ground and determined a set of shared values to help the collaboration move forward. This has been especially important for funding applications and the processes of installing the artworks. The values have informed the exhibitions of the artwork at Science World, where they are on display in their natural history gallery called The Search Gallery. These are the shared values we've come up with:

- We're moved by the initiatives of young people, such as the Extinction Rebellion, the Sunrise movement, and Fridays for Future, who aim to conserve natural environments for future generations. We believe a better world will be created through young people becoming creative nature ambassadors and activists.
- We believe optimism and new outlooks must accompany an awareness of the urgency of climate change action, and the protection of wild spaces.

- We agree to use care ethics for natural systems and beings who inhabit them, and believe that these should be represented in ways that respect their natural communities and cultures.
- We aim to provide aesthetic approaches that offer quiet ambience and slower experiences for publics, in order to reinforce the calming benefits of real forest experiences.
- We aim is to inspire discovery, awe and wonder for our regional forests leading to better care in future encounters.

The values have helped us build the art experiences to engage publics in meaningful ways. Each artwork experience focuses on a particular forest feature and invites visitors to consider their own relationship to forests. The works include a VR project called *Tree Earth Sky* that presents a story of the underground mycorrhizal network, and how it connects to the above-ground grove of ancient trees in an old-growth forest (see Fig. 64 and IMAGE 24). It includes a soundscape composed by Simon Overstall based on our recordings of a dawn chorus on location in an old growth forest on Vancouver Island, BC.

Fig. 64. Still from *Wild Empathy* 360-degree, 3D VR experience called *Tree Earth Sky*. Photo courtesy of Sean Arden.

Inspired by an existing hollow western red cedar at Science World, we created an immersive mixed-media experience called *They Speak in Whispers* (Fig 65 and IMAGE 22, 23). It plays a generative soundscape of a dawn chorus inside the tree, and has a video projection installed in the open top of the tree. The work invites visitors to step inside and listen to the biophony of an old-growth forest, and experience being underneath a virtual forest canopy. Using special speakers, some of the sounds vibrate the tree body and present a speculation on what an old-growth forest sounds like for a western red cedar.

Fig. 65. The *Wild Empathy* project called *They Speak in Whispers*, a mixed-media experience at Science World BC. Photo courtesy of Arian Jacobs.

The most recent work at Science World makes use of an existing feature they had in storage. Their tree cookie[367] was a remnant of an ancient tree that came down in a wind storm in Stanley Park, Vancouver (see Fig 66). It was donated to Science World by the Vancouver Parks Board and we've enhanced it with a generative soundscape. Simon built custom software to analyze the tree rings of the cookie and play a soundscape representing the shifting environment over the tree's five hundred years of growth (see IMAGE 25, 26).

[367] A horizontal slice of an old-growth tree.

Fig. 66. Production photo from *Wild Empathy* project *The Sound of Tree Rings*, showing the tree cookie in storage at Science World BC. Photo courtesy of the author.

The *Wild Empathy* exhibition at Science World has already reached tens of thousands of people, particularly young people, and the team has been interviewed by national radio and by newspapers.[368] Working on this project feels like an opportunity to gain some traction with large publics. I believe we've been able to put our aesthetic expertise and ecological knowledge to work by creating rich experiences for publics, while advocating for the conservation of our regional forests.

[368] Dec 29, 2019: interview about *Wild Empathy* exhibition at Science World, with Matthew Parsons, North by Northwest, CBC radio (Canadian Broadcasting Company).

Fig. 67. Production photo with *Wild Empathy* team member Simon Overstall, doing sound recording on location in an old-growth forest on Vancouver Island, BC. Photo courtesy of the author.

Fig. 68. Production photo for *Wild Empathy* project, showing the author doing sound recording on location in an old-growth forest on Vancouver Island, BC. Photo courtesy of Simon Overstall.

There's a growing global awareness about the precarious situation we're in with regard to climate change and species extinction, and the roles we can play to help curb the devastation. There's a lot of data being generated and new scientific knowledge, and this is being rapidly shared. Alongside the dissemination of this information, there's a worldwide shift in consciousness happening. I'd like to participate in the best way that I can. In order to do this, I'm

staying optimistic even in these times when there's so much at stake for humans and nonhumans alike. To maintain hope, I'm focusing on creativity. I believe artists can play a role by making evocative experiences. Art can reflect the wonder and beauty of our natural world, demonstrate critical and ethical engagement, and model positive change. I also believe art can help revitalize our relationship to the Earth. This involves expanding our senses outward, to local ecologies and nonhuman creativity while, at the same time, paying attention to how we feel and think in response to the Earth.

I'm inviting you to enact radical biophilic attention, by focusing on nonhuman life immediately surrounding you—the household, the neighbourhood, the region. Try looking closely and listening deeply, and feeling your emotional responses to these systems. Do you feel the wonder, joy and love co-created with the diversity of life around you? These are vital instances of interspecies connection.

Care for local people of all kinds will help us move forward with an eye on multispecies flourishing. It will provide an everyday means for living-well within the wonderous creative system that is the Earth.

Ode to Tom

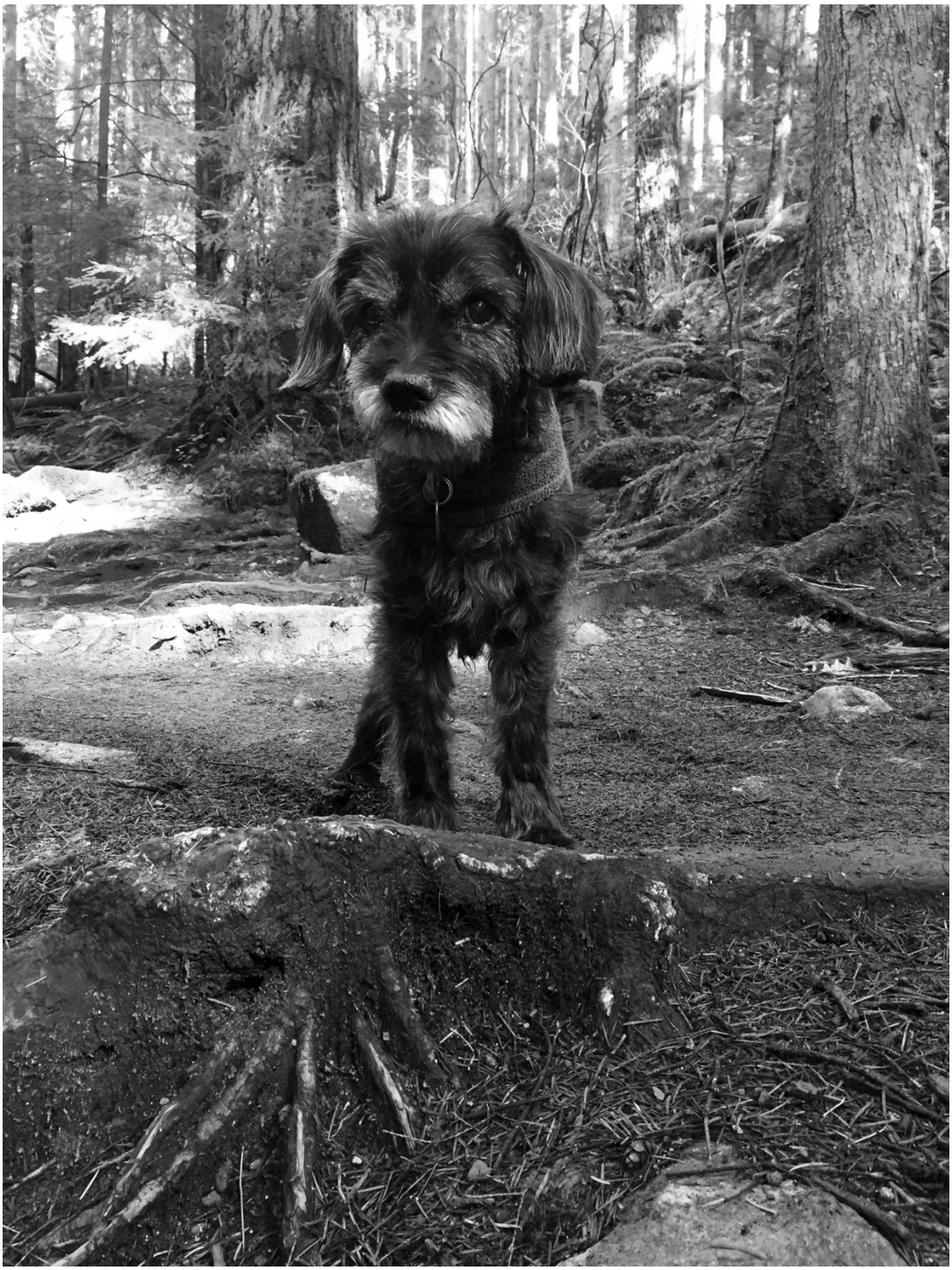

Fig. 69. Tom on one of his last hikes in our local forest. Photo courtesy of the author.

you had a little white star on your chest and looked into the camera
you were the one
you wanted to be alongside and follow our tracks
you chased the bottom of my pants, and were annoying
you had a hard bite until I yelped
you were always in motion even in sleep
when you dreamed I followed you
as you walked, you spread joy, and I became present
you were a miracle dog

you taught Sugi, guided him on a lead, just the two of you
you helped him be social, and stood passively when he yelled at you
you showed him how to be polite, and chased him, and played
I learned of your creativity

you leapt and caught and moved with precision
you spoke, and sang like a Rockstar
you complained and protested
sometimes your opinions were annoying
you rubbed cheeks and feet on snow and ice
scratched carpets, scratch theremin
you ran beaches and trails downhill shoulder-bumping Sugi for the lead
you ate salal berries, thimble berries, salmon berries and black berries
your fur smelled of fresh air
you were EPIC

in the mornings, you'd ask me for a back rub
your spine surrounded by soreness
gray hairs sprinkling your muzzle and eyebrows
teeth were removed

the right side of your face paralyzed from an infection
for weeks I flicked your right ear and tapping the corner of your eye until they twitched again
an ear infection gave you vertigo
I walked with you in a harness until you could walk again on your own
I learned of your tenacity

you became a peacemaker
you stopped complaining and became a steady presence
your heart was failing but you loved children
your nose was dry so I put on lotion
you lost weight and we found a tumor
your back legs weakened and I made a sling
you persevered and I learned of your courage

you were my beloved
I carried you upstairs
I fed you puréed food and arranged you in your favourite chair
I carried you downstairs and tucked you in bed
I took you out at night

In the morning, we walked side by side across the street to the park
you lost strength and I caught you in my arms
I carried you home with your head on my shoulder
Greg, Sugi and I surrounded you
you surfacing now and then to say hello
you were swift
even that day you moved with grace

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