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Cultivating Arts of Attentiveness

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Abstract Scholars in the humanities and social sciences are experimenting with novel ways of engaging with worlds around us. Passionate immersion in the lives of fungi, microorganisms, animals, and plants is opening up new understandings, relationships, and accountabilities. This introduction to the special issue offers an overview of the emerging field of multispecies studies. Unsettling given notions of species, it explores a broad terrain of possible modes of classifying, categorizing, and paying attention to the diverse ways of life that constitute worlds. From detailed attention to particular entities, a multiplicity of possible connection and understanding opens up: species are always multiple, multiplying their forms and associations. It is this coming together of questions of kinds and their multiplicities that characterizes multispecies studies. A range of approaches to knowing and understanding others—modes of immersion—ground and guide this research: engagements and collaborations with scientists, farmers, hunters, indigenous peoples, activists, and artists are catalyzing new forms of ethnographic and ethological inquiry. This article also explores the broader theoretical context of multispecies studies, asking what is at stake—epistemologically, politically, ethically—in learning to be attentive to diverse ways of life. Are all lively entities biological, or might a tornado, a stone, or a volcano be amenable to similar forms of immersion? What does it mean to live with others in entangled worlds of contingency and uncertainty? More fundamentally, how can we do the work of inhabiting and coconstituting worlds *well*? In taking up these questions, this article explores the cultivation of "arts of attentiveness": modes of both paying attention to others and crafting meaningful response.

Keywords multispecies, immersive methods, attentiveness, more-than-human ethics, worldmaking, cobecoming, responsibility, liveliness

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All living beings emerge from and make their lives within multispecies communities. As Gregory Bateson put it, the fundamental unit of survival is the "organism-in-its-environment."[1] Life cannot arise and be sustained in isolation. But relationships also have histories. Beyond a static ecological exchange, like the energy circuits mapped by early ecologists,[2] organisms are situated within deep, entangled histories. And so, beyond mere survival, particular lifeways in all their resplendent diversity emerge from interwoven patterns of living and dying, of being and becoming, in a larger world. The intimate relationship between a flower and its pollinating bee is one in which both forms of life are shaped and made possible through a shared heritage, an entanglement that Isabelle Stengers characterizes as "reciprocal capture."[3] As such, they do not just happen to meet each other, this bee and this flower; rather, their relationship emerges from coevolutionary histories, from rich processes of cobecoming. This cobecoming involves the exchange and emergence of meanings, immersion in webs of signification that might be linguistic, gestural, biochemical, and more.[4] From the directed visual and scent markers with which a flower calls out to its pollinators, to canid play invitations with their complex modes of responsive etiquette, the world is a lively communicative matrix woven through with "signs and wonders."[5] Multispecies relationality tuned to the temporal and semiotic registers makes evident a lively world in which being is always becoming, becoming is always becoming-with.[6]

Multispecies studies takes up this understanding of our world, drawing inspiration from the natural sciences and beyond, bringing diverse bodies of knowledge into conversation and pushing them in new directions. Multispecies scholars are asking how human lives, lifeways, and accountabilities are folded into these entanglements. In taking up these questions scholars are also engaging with long histories of relational, agentic thinking from indigenous peoples.[7] As with all living organisms, human lives and ways of life cannot take place and be described in isolation. As Anna Tsing notes, "Human nature [in all its myriad forms] is an interspecies relation."[8] Only-human

1. Bateson, *Steps to an Ecology of Mind*, 457.

2. Odum, *Fundamentals of Ecology*. See also the discussion of energy circuits in Murphy, *Sick Building Syndrome*.

3. Stengers, *Cosmopolitics I*, 35–36.

4. Buchanan, *Onto-ethologies*; von Uexküll, "Stroll through the Worlds of Animals and Men"; Hoffmeyer and Haveland, *Signs of Meaning in the Universe*.

5. Haraway, *Modest_Witness*, 8.

6. In recent years these insights have refigured and broken down a long-assumed divide between the sciences of evolution and ontogeny, requiring scientists and allies to rethink inheritances (genetic, epigenetic, behavioral, and cultural) as part of larger developmental processes. See, for example, Oyama, Griffiths, and Gray, *Cycles of Contingency*; Jablonka and Lamb, *Evolution in Four Dimensions*; and Gilbert, *Developmental Biology*. This new thinking about inheritance is integral to our understandings of what life is and can be, how we take up the past and are shaped by it.

7. Descola and Scott, *In the Society of Nature*; Ingold, *Perception of the Environment*; Rose, *Dingo Makes Us Human*; Graham, "Some Thoughts."

8. Tsing, "Unruly Edges," 141. Thinking the human in this way requires the kind of "indefinitely expandable trans-knowledging approach" that Donna Haraway has called "EcoEvoDevoHistoEthnoTechnoPsycho

stories will not serve anyone in a period shaped by escalating and mutually reinforcing processes of biosocial destruction—from mass extinction to climate change, from globalization to terrorism. There are many names for our current condition—Anthropocene, Capitalocene, Plantationocene, Chthulucene, White-supremacy-cene, and the list goes on[9]—but whatever it is called, what it seems to demand are detailed practices of attentiveness to the complex ways that we, all of us, become in consequential relationship with others. Taking this provocation seriously, multispecies scholars are exploring and reframing political questions: How do colonialism, capitalism, and their associated unequal power relations play out within a broader web of life?[10] What will count as conservation in our postnatural world?[11] How must we rethink "the human" after the anthropocentric bubble has burst? What forms of responsibility are required, and how might we learn to respond in other, perhaps better ways to the communities taking form in "blasted landscapes"?[12]

These complex and vital questions are explored by multispecies scholars in a particular way: through immersing themselves in the lives of fungi, microorganisms, animals, and plants. In this way, the field of multispecies studies aims to open up new spaces for interdisciplinary and collaborative research. While both "the animal" and "the environment" have in recent decades been the subject of new forms of scholarly inquiry in the humanities and social sciences, multispecies studies promises something a little bit different. In contrast to animal studies, multispecies scholarship takes up a broader taxonomic scope of inquiry. But it does not simply replace a focal animal with a plant or bacterium. Much, but by no means all, of the work in animal studies has focused on people's relationships with a given animal (a dialogic focus that is readily apparent in the term *human-animal studies*). Instead, a multispecies approach focuses on the multitudes of lively agents that bring one another into being through entangled relations that include, but always also exceed, dynamics of predator and prey, parasite and host, researcher and researched,[13] symbiotic partner, or indifferent neighbor. But these larger contexts are not mere environments in the sense of a homogeneous, static

(Ecological Evolutionary Developmental Historical Ethnographic Technological Psychological studies)" (*Staying with the Trouble*).

9. Moore, "Capitalocene"; Malm and Hornborg, "Geology of Mankind?"; Haraway, "Anthropocene, Capitalocene, Plantationocene, Chthulucene"; Mirzoeff, "It's Not the Anthropocene."

10. Capra, *Web of Life*; Moore, *Capitalism in the Web of Life*; Tsing, *Mushroom at the End of the World*.

11. Lorimer, *Wildlife in the Anthropocene*; Kirksey, *Emergent Ecologies*; van Dooren, *Flight Ways*; Reinert, "Care of Migrants"; Chrulew, "Managing Love and Death at the Zoo"; Collard, "Putting Animals Back Together"; Collard, Dempsey, and Sundberg, "Manifesto for Abundant Futures"; Dempsey, "Tracking Grizzly Bears"; Candea, "Habituating Meerkats"; Münster, "Working for the Forest."

12. Tsing, "Blasted Landscapes"; Kirksey, Shapiro, and Brodine, "Hope in Blasted Landscapes."

13. Incidentally, the "researcher" need not always be human. For a short discussion of ants conducting research on sleeping people, see the views of Steve Meredith (an Aboriginal Australian Ngiyampaa elder) in Rose, "Val Plumwood's Philosophical Animism," 99.

background for a focal subject. Rather, they are complex "ecologies of selves,"[14] dynamic milieus that are continually shaped and reshaped, actively—even if not always knowingly—crafted through the sharing of "meanings, interests and affects,"[15] as well as flesh, minerals, fluids, genetic materials, and much more. As is discussed further below, this multiplicity, this multiplying of perspectives and influences, is key to what multispecies studies is all about.

In addition, as this special issue illustrates, this immersive approach is now also increasingly being applied to forms of liveliness that many, but by no means all, of us would consider to be nonliving: from stones and weather systems to artificial intelligences and chemical species.[16] For example, in their contribution to this collection, Vinciane Despret and Michel Meuret articulate a cosmo-ecological approach that brings gods, ancestors, and spirits into our accounts of the forms of life, and thus the modes of rapport and connection, that constitute worlds.[17] In this way, a growing group of scholars is challenging the biotic prejudices of multispecies work.[18] From this perspective, biocentrism is often no longer viewed as an important corrective to previously anthropocentric approaches but, rather, as itself an unjustifiable bias. Grounded in important insights from a range of fields—including new materialisms,[19] political geology,[20] and indigenous metaphysics[21]—the liveliness of the abiotic is being brought to the fore. Many entities, from geologic formations and rivers to glaciers, might themselves be thought to have distinctive ways of life, histories, and patterns of becoming and entanglement, that is, ways of affecting and being affected, and so they too might become subjects of ethologies in the Deleuzian sense of the term.[22] Whether and in what ways these multispecies approaches might be useful for thinking abiotic

14. Kohn, *How Forests Think*, 134.

15. Lestel, Brunois, and Gaunet, "Etho-ethnology and Ethno-ethology," 155.

16. The Multispecies Salon has lately begun to consider "chemical species" as a frame for exploring the unexpected possibilities and uncanny haunting specters that emerge with encounters between organic matter and inorganic matter—between rock and water, among biological organisms, metabolites, and toxins. Imperceptible forces work around, against, or despite our attempts to control and catalogue them. Chemical species, as measured by technical and scientific apparatuses, are ephemeral: they change quickly. See www.multispecies-salon.org/events.

17. In particular, in this issue also see contributions by Reinert, by van Dooren and Rose, and by Wolfe and Whiteman.

18. TallBear, "Beyond the Life/Not Life Binary." Also see contributions by Reinert and by van Dooren and Rose in this issue.

19. Bennet, *Vibrant Matter*; Barad, *Meeting the Universe Halfway*; Dolphijn and van der Tuin, *New Materialism*; Ingold, "Toward an Ecology of Materials."

20. Clark, *Inhuman Nature*; Clark and Yusoff, "Combustion and Society"; Yusoff, "Geologic Life."

21. TallBear, "Beyond the Life/Not Life Binary." Scholars are increasingly pointing out the tremendous debt that posthumanist and related work owes to indigenous thought, a debt that is all too often unacknowledged. See Todd, "Indigenous Feminist's Take on the Ontological Turn"; and Sundberg, "Decolonizing Posthumanist Geographies."

22. See the contribution by Despret and Meuret in this issue.

liveliness and how they might shed light on the consequential work done by various forms of boundary making between the alive and the not remain open questions at this stage.

The term *species* in multispecies studies gestures to particular ways of life and to any relevant gathering together of kin and/or kind (as Donna Haraway has argued, pointing to the historically much broader meanings of the term *species*).[23] *Species* here is in no way intended to imply that kinds are fixed or homogeneous, nor should the term be taken to assume a specifically Western, scientific mode of taxonomy (discussed further below).[24] While some cultural critics have suggested that the notion of species is an anthropocentric imposition on the world,[25] close attention to other kinds of life reveals that humans are not exceptional in our ability to classify and categorize. To our ears, the notion of species holds open key questions: How do entangled agents torque one another with their own practices of classification, recognition, and differentiation? How are different kinds of being enacted and sensed in the ongoing ebb and flow of agency in multispecies worlds?

As an umbrella term, *multispecies studies* draws together diverse disciplinary and interdisciplinary approaches that have emerged in recent years. These include multispecies ethnography,[26] etho-ethnology,[27] anthropology of life,[28] anthropology beyond humanity,[29] extinction studies,[30] and more-than-human geographies.[31] Despite their differences, we see all of these approaches as united by a common interest in better understanding what is at stake—ethically, politically, epistemologically—for different forms of life caught up in diverse relationships of knowing and living together. In other words, each of them is an example of the new science studies that Tsing has pointed to, one that is grounded in "passionate immersion in the lives of the nonhumans being studied."[32]

There are two main sections to this article. The first offers an overview, a miscellany of sorts, of what we take to be some of the dominant modes of immersion that ground and guide research in the broad area of multispecies studies. Each of these approaches might be understood as one method of cultivating what Tsing has called the "arts of noticing":[33] from engagements and collaborations with scientists, farmers, hunters, indigenous peoples, activists, and artists to the development of new forms of

23. Haraway, *Companion Species Manifesto*.
24. Kirksey, "Species"; Rose and van Dooren, "Encountering a More-than-Human World."
25. Ingold, "Anthropology beyond Humanity," 19.
26. Kirksey and Helmreich, "Emergence of Multispecies Ethnography."
27. Lestel, Brunois, and Gaunet, "Etho-ethnology and Ethno-ethology."
28. Kohn, *How Forests Think*.
29. Ingold, "Anthropology beyond Humanity."
30. Rose and van Dooren, "Unloved Others"; Rose, van Dooren, and Chrulew, *Extinction Studies*.
31. Lorimer and Driessen, "Wild Experiments at the Oostvaardersplassen"; Whatmore, "Introduction."
32. Tsing, "Arts of Inclusion," 19.
33. Ibid.

ethnographic and ethological inquiry. The second section explores the broader theoretical context of multispecies inquiries, the kinds of questions and topics that these approaches aim to open up and redo. Transforming noticing into attentiveness—into the cultivation of skills for both paying attention to others and meaningfully responding—this section is concerned with the politics and ethics of how we might come to know others and so (re)craft modes of living and dying on a richly varied yet fundamentally shared world.

Passionate Immersion

Passionate immersion can take many forms. At its core it involves attentive interactions with diverse lifeways. Beyond viewing other creatures as mere symbols, resources, or background for the lives of humans, scholars in multispecies studies have aimed to provide "thick" accounts of the distinctive experiential worlds, modes of being, and biocultural attachments of other species.[34] Immersive ways of knowing and being with others involve careful attention to what matters to them—attention to how they craft shared lives and worlds. *Passion* does not here mean to practice an unqualified enthusiasm or support for another's flourishing. Immersion in the lives of the awkward, the unloved, or even the loathed is very possible.[35] As such, some of this scholarship runs against the grain of dominant norms and sentiments, cultivating attentiveness to such creatures as ticks,[36] pathogenic viruses,[37] and vultures.[38] Other work, such as Haraway's canine companions[39] and Heather Paxson's post-Pasteurian microbial cultures,[40] has orbited around critters that are good for humans to live with. Still others are studying multispecies assemblages in zones of wildness that proliferate beyond realms of human influence and control.[41] A diversity of foci is possible; not all of them are comfortable and life affirming (although the question of whose life is affirmed is itself one of central, critical interest). In short, passionate immersion means becoming curious and so entangled, "learning to be affected"[42] and so perhaps to understand and care a little differently.

In their efforts to better understand multispecies worlds, some scholars are reaching deep into the archives of the humanities and social sciences to engage sometimes

34. On thick accounts (of a somewhat different variety), see Geertz, "Thick Description." For a gentle reworking of Geertz on this topic, see van Dooren and Rose, this issue.

35. Beisel, Ginn, and Barua, "Living with Awkward Creatures"; Rose and van Dooren, "Unloved Others"; Raffles, *Insectopedia*.

36. Hatley, "Blood Intimacies and Biodicy."

37. Lowe, "Viral Clouds"; Berrigan, "Life Cycle of a Common Weed."

38. van Dooren, "Pain of Extinction."

39. Haraway, *When Species Meet*.

40. Paxson, "Post-Pasteurian Cultures."

41. Kirksey, *Emergent Ecologies*; Collard, "Putting Animals Back Together"; Lorimer, *Wildlife in the Anthropocene*.

42. Despret, "Body We Care For," 131.

unexpected intellectual allies, many of them writing in a period before the solidification of the "two cultures."[43] For example, Lewis Henry Morgan's 1868 *The American Beaver and His Works* was a study conducted before biology and anthropology were established as distinct disciplines.[44] Similarly, in the discipline that we now call philosophy, a range of early and foundational thinkers practiced forms of careful attention to the ways of life of other species, even if they didn't always get it right: we might think of Aristotle's *The History of Animals*. Goethe's 1790 *The Metamorphosis of Plants* stands out as an early example of observational rigor coming together with theoretical imagination. Goethe was a passionate gardener whose interest in plants blossomed in the spring of 1776 when he began planting and tending a garden given to him by Duke Charles Augustus at Weimar.[45] Michael Marder has worked through the archives of European philosophy, pulling out thinkers like Goethe that remain relevant to contemporary conversations on "plant thinking" and multispecies studies more generally.[46] Gary Steiner has done something similar for animal minds.[47]

Creative and critical readings of contemporary natural scientific literature have also enabled scholars to deconstruct and reconstruct truth claims toward a better understanding of the worlds of others. Haraway's work on primates stands out as an early example of this approach in the Anglophone literature.[48] Others, such as Belgian philosopher Despret, have developed extensive bodies of related work: from Arabian babblers to baboons and sheep, Despret has offered critical rereadings of ethological and biological literatures.[49] These rereadings are attentive to historical contexts and the complex ways in which scientific practices and knowledges are shaped by politics, gender, and the positionality of the observer.[50] In a similar vein, Carla Hustak and Natasha Myers have explored the intelligence and agency of plants, rethinking the centrality of competitive individualism in dominant biological accounts, from Darwin to the neo-Darwinians.[51] Beyond an engagement with the published scientific literatures, these scholars have also spent time in the field interviewing and observing scientists and the plants, animals, fungi, and microbes that interest them.[52] Despret calls her practice an "ethology of the ethologists," interrogating tools for observing animal behavior developed by

43. Snow, *Two Cultures*.

44. Feeley-Harnik, "Ethnography of Creation"; Kirksey and Helmreich, "Emergence of Multispecies Ethnography."

45. Miller, "Introduction," xvi.

46. Marder, *Plant-Thinking*.

47. Steiner, *Anthropocentrism and Its Discontents*.

48. Haraway, *Primate Visions*.

49. Buchanan, Chrulew, and Bussolini, "Vinciane Despret"; Despret, "Body We Care For"; Despret, "Sheep Do Have Opinions"; Despret, "Domesticating Practices."

50. Also see Barad, "Invertebrate Visions."

51. Hustak and Myers, "Involutionary Momentum."

52. Despret et al., "On Asking the Right Questions"; Despret, *What Would Animals Say?*

the likes of Konrad Lorenz (a complex and problematic figure)[53] and then turning mutated forms of them back on the scientists themselves. This space of critical intervention is also alive and well within a fundamentally heterodox scientific community. Behavioral biologists such as Jane Goodall, Barbara Smuts, Thelma Rowell, Marc Bekoff, and Frans de Waal, among many others, have for many years been actively engaged in challenging and reinventing the practices of knowing and experimenting within their fields, acknowledging the subjectivity and individuality of their research partners as well as the researcher's own context, embodied situatedness, and implication in what is able to be known.[54]

These more creative and generous biologists, as well as trespassers from other disciplines who venture into the domain of the life sciences, have frequently been charged with anthropomorphism and the illegitimate use of anecdote (among other things). While taking seriously the danger of projecting human(?) norms and sensibilities onto others—every anthropocentrism is also an ethnocentrism, as Dominique Lestel reminds us—multispecies studies scholars have also highlighted the promise of writing narratives that are rich with anecdote, metaphor, and figuration. The charge of anthropomorphism shuts down discussion, according to Val Plumwood, rather than opening up critical inquiry about how elements of a given trait may or may not be shared by nonhumans.[55] At the same time, as Eileen Crist has argued, efforts to adopt neutral language have themselves often been mechanomorphic, projecting characteristics of machines onto forms of life, or exhibited entrenched forms of what de Waal has called "anthropodenial."[56] Similarly, while field observations, especially of single individuals or instances, lack the (supposed) repeatability of laboratory experiments, they also create new opportunities to appreciate personality, innovation, and improvisation. As some ethologists have noted, anecdote can be a remarkable resource,[57] allowing us to move outside a narrow space of species-typical behaviors to recognize individual or social diversity and creative capacity within other modes of life.

However, the natural sciences are far from being the only way to know and understand the lives of other species. While the knowledges and practices of the sciences have played a key role in multispecies studies, the field has also sought out a range of other approaches, aiming to decolonize[58] and more broadly challenge dominant assumptions about knowledge, expertise, and who is authorized to speak for Nature. All of us craft shared lives in multispecies communities, but we do so in diverse ways

53. Deichmann, *Biologists under Hitler*. As we were writing this introduction, the University of Salzburg announced its decision to strip Lorenz, a Nobel Prize winner, of his honorary doctorate for his ties to the National Socialist Party and its ideologies.

54. Rowell, "Concept of Social Dominance"; Bekoff, *Emotional Lives of Animals*; de Waal, "Anthropomorphism and Anthropodenial"; Goodall, *In the Shadow of Man*; Smuts, *Sex and Friendship in Baboons*.

55. Plumwood, "Nature in the Active Voice," 127.

56. Crist, *Images of Animals*; de Waal, "Anthropomorphism and Anthropodenial."

57. Bekoff, "Animal Passions and Beastly Virtues"; Fuentes, "Ethnoprimatology."

58. Apffel-Marglin and Marglin, *Decolonizing Knowledge*.

and more or less attentively. This biocultural diversity has itself become a central thread of multispecies studies. Drawing on both written materials and ethnographic research, scholars have explored the ways that indigenous communities, hunters, farmers, and many others understand and inhabit worlds. This work has, for example, focused on indigenous Australian dreamings that sing up relationships of pollination and mutual flourishing,[59] intimate ecological and animal knowledges of Amazonian and circumpolar hunters,[60] and chemical-laden cultures of lawn maintenance in the contemporary United States.[61] Multiplying perspectives, these approaches unsettle the hegemony of scientific accounts of Nature, highlighting the complex and often contradictory ways of knowing, valuing, and living that are always unavoidably at play and at stake in the shaping of worlds.

Artists have also become core participants in scholarly projects that question conventional approaches to speaking for Nature, exploring opportunities for immersion in the lives of others.[62] Rather than limiting themselves to producing the monograph or the essay, artists have long generated multimedia installations and performative interventions to bring attention to animals, plants, fungi, and others at the periphery of anthropocentric worlds.[63] In their contribution to this collection, Cary Wolfe and Maria Whiteman play with the conventions of academic scholarship, drawing us into the life-worlds and landscapes of mountain pine beetles through poetry, image, and sound.

Performative experiments are also being used by artists and ethnographers to probe speculative dimensions of multispecies worlds, as Eben Kirksey and colleagues illustrate in their contribution to this collection. Rather than simply describe what life is like at particular times and places, or what it once was like, scholars in the field of multispecies studies are engaging with people in their speculations about what life might or could be.[64] Performance art with other kinds of creatures often cites the work of Joseph Beuys, who lived with a coyote in a Manhattan art gallery for three days in 1974. Drawing on more than forty years of ecological art that has come since Beuys, contemporary artists are facilitating alternative ways of speaking and thinking about how our own survival is contingent on entanglements within multispecies assemblages.[65] Illustrating the uncomfortable material and semiotic connections linking her own flesh and blood with the domain of viruses and plants, Caitlin Berrigan performed what she called a "nurturing gesture" at the Multispecies Salon. Drawing her own blood, which is infected with the hepatitis C virus, Berrigan offered it as nitrogen-rich fertilizer to a dandelion plant. Enacting a relation of shared suffering, of mutual care and

59. Rose, "Flying Fox."
60. Kohn, *How Forests Think*; Ingold, *Perception of the Environment*; Descola, *Beyond Nature and Culture*.
61. Robbins, *Lawn People*.
62. da Costa and Philip, *Tactical Biopolitics*; Haraway, *When Species Meet*; Kirksey, *Multispecies Salon*.
63. See Kirksey et al. and Wolfe and Whiteman, this issue.
64. Ingold, *Making*.
65. Spaid, *Ecovention*; Broglio, *Surface Encounters*; Baker, *Artist/Animal*.

violence, Berrigan told audience members that she takes dandelion root as medicine to help her liver cope with the viral infection.[66] Other artists, such as Miriam Simun, Kathy High, and Natalie Jeremijenko, have augmented the human sensorium to reconfigure our engagements with multispecies worlds. Rather than pretend to stand apart and aloof from subjects of study, many scholars in multispecies studies are taking a cue from artists to more fully embrace the work of observation as part of an ongoing performance in the world.

Personal encounters with companion critters—some of which are commonly called pets and house plants—have also given rise to a rich corpus of empirical knowledge: Haraway's dogs, Sebastian Abrahamsson and Filippo Bertoni's arts of vermicomposting, Franklin Ginn's sticky engagement with garden slugs, Jennifer Hamilton's "bad flowers," and Tarsh Bates's slime molds, to name but a few.[67] In this work, practices of living with and observing have allowed scholars to rethink the lab and the field to create sites of para-ethnographic encounter, forming the basis of new knowledges about other species and our possibilities for crafting shared lives.[68] At the Centre for Feline Studies, Jeffrey Bussolini and Ananya Mukherjea have established a new kind of laboratory with six cats in their Manhattan apartment.[69] Playing with a traditional experimental ethos embodied by Lorenz and others (who lived with some of the animals they studied), Bussolini and Mukherjea's lab provides opportunities to make detailed etho-ethnographic observations of cats engaging in daily interactions that a formal laboratory could never provide.[70] At the same time, this informal experimental space means that not just one party (the scientists) decides what the interesting questions are and imposes them on the research subjects. Instead, more tactful and polite interactions emerge as the cats explore myriad opportunities to be inventive, to propose, to demonstrate their capabilities and interests.[71] Beyond the immediacy of our own encounters, viral videos on YouTube and social media outlets now deliver a nonstop stream of footage and commentary on interspecies relations. If television nature documentaries of the twentieth century helped shape how scientists think, emergent work in the field of multispecies studies is responding to these twenty-first-century media with projects that deploy critter cams or orbit around Facebook fan pages and Meetup groups.[72]

66. Berrigan, "Life Cycle of a Common Weed."

67. Haraway, *Companion Species Manifesto*; Abrahamsson and Bertoni, "Compost Politics"; Ginn, "Sticky Lives"; Hamilton, "Bad Flowers"; Bates, "Cutting Together-Apart the Mould."

68. Marcus, *Para-sites*; Kirksey, *Multispecies Salon*.

69. Bussolini, "Toward Cat Phenomenology"; Lestel, Bussolini, and Chrulew, "Phenomenology of Animal Life."

70. On etho-ethnology, see Lestel, Brunois, and Gaunet, "Etho-ethnology and Ethno-ethology."

71. On polite modes of research with others, see Despret, "Sheep Do Have Opinions"; and Despret, "Responding Bodies and Partial Affinities."

72. Despret, *What Would Animals Say?*; Haraway, *When Species Meet*; Mukherjea and Bussolini, "Lil Bub and Friendz."

Immersing oneself in multispecies worlds often necessitates forming collaborative teams to bring together complimentary skills and expertise. While fields like cultural anthropology, philosophy, and history have long privileged the solo-authored manuscript in academic knowledge production, multispecies scholars are exploring collaborative writing practices within single disciplines[73] while also forming new multidisciplinary associations.[74] Collaborative associations are starting to move beyond earlier approaches in science studies that put biologists themselves under the microscope, to create projects with scientists that might frame experiments addressing shared questions and concerns or recraft existing empirical methods.[75] Biologists and ecologists have become "critical friends" for multispecies scholars[76] as new modes of collaboration and engagement enable promiscuous movements over borders that had, during the Science Wars of the 1990s at least, seemed like fixed boundaries. It is not surprising, therefore, that many of the contributions to this collection are coauthored. Some of the teams comprise artists, philosophers, and ethnographers: in one case we learn how to use live frogs to experiment with the speculative gap that emerges with human pregnancy; in another we encounter devastated landscapes shaped by complex multispecies assemblages. Other teams include philosophers and biologists, for example, in the exploration of shepherding in France; yet another brings together ethnographers with experience in elephant and microbial worlds to explore their meetings and remakings in elephant virus outbreaks.

None of this empirical material—from scientific data to the work of artists—can simply be regarded as unmediated knowledge. Multispecies studies scholars are consequently exploring how these diverse approaches might be engaged responsibly. Often, multiplying perspectives leads to conflicting understandings, values, priorities, and ultimately worlds. In this context, it matters which questions we ask,[77] which modes of inquiry we adopt, which practices of mediation, performance,[78] making,[79] and translation[80] we employ—as well as which stories we tell. Multiplying perspectives is not simply about assembling diversity, nor is it about the adoption of an easy relativism; rather, it is about "staying with the trouble"[81] in an effort to meaningfully navigate

73. Matsutake Worlds Research Group, "New Form of Collaboration in Cultural Anthropology"; Helmreich, *Sounding the Limits of Life*.

74. Kirksey, *Multispecies Salon*.

75. Kelly and Lezaun, "Urban Mosquitoes, Situational Publics"; Swanson, "Methods for Multispecies Anthropology"; Kirksey, *Emergent Ecologies*.

76. The term *critical friends* comes from the collaborative work of Jenny Reardon and the Working Group of the Science and Justice Research Center at the University of California, Santa Cruz. See scijust.ucsc.edu/working-group/areas-of-inquiry-themes.

77. Despret, *What Would Animals Say?*

78. Abram and Lien, "Performing Nature at World's Ends."

79. Papadopoulos, "Generation M."

80. Callon, "Some Elements of a Sociology of Translation."

81. Haraway, *Staying with the Trouble*.

one's way through the complexity of worlds in process. This navigation is fundamentally a question of ethics and politics. It is to this question that we now turn: how do different knowledge practices—different modes of attentive immersion—bring different worlds into being?

Multispecies Worldings

Refusing the choice between unreconstructed realism and an easy relativism—between a singular world "out there" awaiting description and an idealist free-for-all—the notion of worlding insists on the coconstitution, the material-semiotic interplay, that shapes what is.[82] There is a particular variety of realism—what Karen Barad has called an "agential realism"[83]—at play here: while tables, atoms, and cauliflowers are very much real, they are also shaped by modes of understanding and engagement. From this perspective, any absolute division between epistemology and ontology breaks down as worlds emerge and are continually reshaped through dynamic intra-actions.[84] As such, ways of knowing and understanding have profound consequences: they shape worlds. Not single-handedly, not once and for all, but through the messy, collaborative work that some have referred to as social construction. As Latour reminds us, the social is not the stuff or material of this construction; rather, it names the process of assembly in which diverse agencies each exert their own force in the shaping of outcomes.[85] As Laura A. Ogden, Billy Hall, and Kimiko Tanita put it, work in multispecies studies "seeks to understand the world as materially real, partially knowable, multicultured and multinatured," emerging amid "contingent relations of multiple beings and entities."[86] In short, while worlds are made, they are not "made up";[87] they are crafted in the multiple: more than one but less than many.[88]

Grounded in these insights, careful and critical attention to the specificity of other species' lifeworlds offers an important avenue for scholarship in the humanities and social sciences during an era of escalating change. Departing from a previous, often relentless focus on *anthropos*, work in multispecies studies joins other scholarship—traveling under such names as nature-cultures and posthumanism—that aims to critically refigure the human while problematizing and working across nature/culture and nature/human dualisms.[89] This work is strongest where the impulse is not simply to

82. Haraway, *When Species Meet*.

83. Barad, *Meeting the Universe Halfway*, 225.

84. Ibid.

85. Latour, "Promise of Constructivism."

86. Ogden, Hall, and Tanita, "Animals, Plants, People, and Things," 6.

87. Haraway, *Modest_Witness*, 129.

88. Mol, *Body Multiple*. What is at stake here, among other things, are forms of accountability in which ways of knowing are never innocent—never simply the reporting of an "external reality"—but, rather, are situated, embodied, and historical practices. See Haraway, "Situated Knowledges."

89. Wolfe, *What Is Posthumanism?*; Haraway, *Modest_Witness*; Whatmore, *Hybrid Geographies*; Castree and Braun, *Social Nature*; Latour and Porter, *We Have Never Been Modern*; Papadopoulos, "Insurgent Posthumanism"; Plumwood, *Feminism and the Mastery of Nature*.

dissolve the distinctions between these categories and create an amorphous flatness. As Mick Smith notes, referencing Jacques Derrida, this scholarship "recognises 'the fragility and porosity of the limit between nature and culture' not so as to collapse these categories into each other (as, for example, sociobiology does) but to 'multiply attention to differences' at all levels"[90]—that is, to pay attention to differences of all kinds as well as to the powerful work that various modes of differentiating and distinguishing do in shaping worlds. With this in mind, multispecies approaches are precisely about multiplying differences and modes of attention, about the specificity of lived natural-cultural entanglements in thick contact zones, with their own very particular histories and possibilities.[91]

Eschewing generalization and abstraction, this kind of passionate immersion in the lives of others opens up a host of possibilities. Critically, attention to the particular requires us to ask how specific worldings come to matter, and to matter differently, for given beings.[92] To ask this question seriously, work in multispecies studies insists on the biosocial multiplicity that resides within various "kinds." Species involve intergenerational dances where entangled agents torque one another in ongoing loops of multispecies intra-action.[93] Emerging from the middle, a milieu from which it grows and overspills, a species never sits still.[94] This complexity is grappled with in the biological sciences and other taxonomic traditions in a range of ways, creating multiple, or what John Dupré calls promiscuous, species concepts that are more or less appropriate for different spheres of life.[95] Furthermore, modes of enacting distinctions between self and other, between like and different, extend well beyond the human: for example, wasps selectively pollinating and therefore constituting what might count as a particular fig species.[96] If some influential philosophers assume that nonhuman species are trapped in bubbles,[97] scholars in the field of multispecies studies are attending to the lives of "ontological amphibians" who are undoing the cage of misguided assumptions that lock organisms to environments.[98] If we pay attention, all around us emergent multispecies assemblages are undermining these visions of stasis and enclosure, as viral swarms, multitudes of feral animals, and other flighty agents coalesce to form new worlds[99] while performatively crafting and recrafting what will count as their kind.[100]

90. Smith, "Ecological Community," 27; see also Derrida, *Beast and the Sovereign*.
91. On contact zones see Pratt, *Imperial Eyes*; and Haraway, *When Species Meet*.
92. On coming to matter see Butler, *Bodies That Matter*; and Barad, "Posthumanist Performativity."
93. Kirksey, "Species"; van Dooren, *Flight Ways*, 21–43.
94. Deleuze and Guattari, *Thousand Plateaus*, 21.
95. Dupré, "Species."
96. Kirksey, "Species."
97. Sloterdijk, "Atmospheric Politics"; Sloterdijk, *Microspherology*.
98. Kirksey, *Emergent Ecologies*, 18–23.
99. Lowe, "Viral Clouds."
100. Chrulew, "Sacrificial Reintroduction"; Buchanan, "Bear Down"; van Dooren, "Authentic Crows."

At the same time, in paying attention to others we cannot help but gain a new understanding and appreciation of the human. At every level—from the individual organism, through diverse forms of community and collective life, to the species itself—humanity is coconstituted inside dense webs of lively exchange. For example, emerging findings about the microbiome reveal that, within our bodies and stretching out well beyond them, each of us is a species multiple: each of our bodies is crowded with diverse kinds of parasitic and symbiotic forms of life.[101] This work gives a new twist to Annemarie Mol's claim that a body is "an intricately coordinated crowd."[102] In the words of Gilles Deleuze and Félix Guattari, bodies have become "multiplicities of multiplicities forming a single *assemblage*, operating in the same *assemblage*: packs in masses and masses in packs."[103] Breaking down the separation between interior bodies and external environments, scholars are studying multispecies assemblages where organisms are copresent and heterogeneously connected to themselves, being pulled in different directions, always in the process of becoming multiple and parallel, beside themselves with dissolution, intermittently present to themselves, each of them a para-self.[104] In his contribution to this collection, Jamie Lorimer connects these internal ecologies and their emergent possibilities for microbial rewilding with larger processes of knowledge, community, and wealth making.

Beyond what we might call the biological functioning of bodies, the contours of human lived experience are shaped through diverse and consequential entanglements. There is no human in isolation, no form of human life that has not arisen in dialogue with a wider world. Along related lines, Lestel and Christine Rugemer have argued that we must understand "the animal origins of human culture." From this perspective, human cultures are not departures, or outgrowths, from a more fundamental biologic nature but are, rather, another expression of that nature: "Humans have not emerged from the state of nature but have explored an extreme niche of that nature."[105]

While this is all certainly true in the abstract—the human is not at all what many of us have been led to believe[106]—again, attention to the particular requires us to ask how this coforming relationality comes to matter differently. Having escaped the tunnel vision of *anthropos* to the great world beyond, multispecies studies scholars are also working to carefully avoid a reductive, homogenizing conceptualization of human life. While humans may all be connected to others, they are not all tangled up in the same ways: "The specificity and proximity of connections matter."[107] As such, much of this

101. Haraway, *When Species Meet*; Paxson, *Life of Cheese*; McFall-Ngai et al., "Animals in a Bacterial World." Also see Lorimer, this issue.

102. Mol, *Body Multiple*, viii.

103. Deleuze and Guattari, *Thousand Plateaus*, 34.

104. Rotman, *Becoming beside Ourselves*, 104.

105. Lestel and Rugemer, "Strategies of Life," 8.

106. Haraway and Gane, "When We Have Never Been Human."

107. van Dooren, *Flight Ways*, 60.

work has sought to explore, in rich historical and ethnographic detail, the unequal labor, risks, positionalities, and exposures, as well as ways of being and knowing, of different individuals and communities.[108] Histories of gender and race, of political economy and colonization are layered into multispecies worldings—how could they not be?—shaping possibilities for everyone.[109] We see this in the realities of neocolonial waste management for Inuit peoples and a range of "trash" animals in the Canadian north, and on the other side of the world in the unequal impacts on indigenous laborers and captive elephants who are, both in their own way, "working for the forest" in the Indian state of Kerala.[110]

These messy, uneasy, unsettling, and always uneven realities demand that multispecies studies be more than mere description and celebration of entangled communities and processes of cobecoming. Taking a cue from Haraway, "The point is to make a difference in the world, to cast our lot for some ways of life [death, being and becoming] and not others. To do that, one must be in the action, be finite and dirty, not transcendent and clean."[111] The phrase "in the world" matters here: work in multispecies studies begins from the proposition that there is no space outside the action from which to gain absolute or universal knowledge, and yet we must still act. But it also matters in the sense that participation in a world of cobecoming necessarily implicates us: insofar as we all help to shape worlds, we are accountable for how and what they become. As Barad puts it, "Ethics is therefore not about right response to a radically exterior/ized other, but about responsibility and accountability for the lively relationalities of becoming of which we are a part."[112] Or as Beth Carruthers maintains, we are "acting as if everything matters."[113]

Refusing the tired opposition between three incommensurable demands—social justice in a humanist vein, ethics focused on the well-being of individual entities (usually nonhuman animals but to a lesser extent plants, fungi, stones, and others), and an environmental ethics concerned primarily with the health of ecosystems and species—work in multispecies studies has embraced relational ethical approaches to grapple with diverse competing claims. This work draws inspiration from rich traditions of ethical thought in feminist science and technology studies, feminist and continental philosophies, and their intersections. Staying with the trouble, it aims to hold onto competing ethical obligations, multiplying perspectives on what counts as "the good." There are no neat and final answers here, nor are there any trump cards that shut down the

108. Münster, "Working for the Forest"; Parreñas, "Producing Affect"; Kirksey, "Living with Parasites"; Tsing, *Mushroom at the End of the World*.

109. Muñoz et al., "Theorizing Queer Inhumanisms"; TallBear, "Beyond the Life/Not Life Binary"; Goldberg-Hiller and Silva, "Sharks and Pigs"; Instone and Taylor, "Thinking about Inheritance"; Pacini-Ketchabaw and Nxumalo, "Unruly Raccoons and Troubled Educators"; Todd, "Fish Pluralities."

110. Zahara and Hird, "Raven, Dog, Human"; Münster, "Working for the Forest."

111. Haraway, *Modest_Witness*, 36.

112. Barad, *Meeting the Universe Halfway*, 393.

113. Carruthers, "Praxis: Acting as If Everything Matters."

political process through appeals to incontestable principles or expertise.[114] But nor are easy relativisms allowed. This kind of relativism—you have your truth and I will have mine; you inhabit your world and I will inhabit mine—is both lazy and dangerous. At the end of the day, decisions must be made about how we will get on inside a world that is, however multiple, also shared, finite, and (in many ways) struggling. Resources must be distributed; claims to rights and justice will be heard or ignored. The frames of meaning making, of valuation and verifiability, under which deliberations are made or routine responses executed, matter.

Contesting for better worlds requires learning to take others seriously in their otherness, finding modes of muddling through that eschew the fantasy of universal translation or a singular criterion—usually "ours"—of evaluation or verification. It also requires learning new modes of taking account of and with enigmatic others who cannot be—or perhaps do not want to be—represented or even rendered knowable or sensible within any available mode of understanding.[115] And so, as Hugo Reinert argues in his contribution to this collection, this work must also hold open "a question of who—and what—is taken to exist and of how certain modes of existence are (and are not) made to count." None of this is simple, and nor does it mean that there is no right or wrong; rather, it means that right and wrong must be carefully crafted, again and again, inside larger processes of contestation. This ethics requires an ongoing questioning, an effort to cultivate new modes of attentiveness—"innovating novel practices of listening as risky techniques of cosmopolitical care"[116]—that might help us to live well inside relationships that can rarely be settled to everyone's satisfaction and never once and for all.

From this perspective, ethics is at the core of multispecies accounts—not an addition, bolted onto the side. Embracing and reworking the Deleuzian notion that ethics is ethology,[117] multispecies approaches are grounded in the understanding that careful attention to diverse ways of being and becoming is inseparable from the work of ethics. As Thom van Dooren and Deborah Bird Rose argue in their contribution to this issue, ethology/ethography is an act of bearing witness: attention to others is vital to responding appropriately, while the telling of their stories also has the potential to draw others into new relationships and accountabilities. Like all other accounts, multispecies stories are active technologies of worlding: "Stories are means to ways of living."[118] In this way, rather than simply celebrating multispecies mingling—a basic fact of life—this work also engages with the more analytically interesting and politically charged questions that follow from asking cui bono: who benefits when species meet?[119] In so doing, work in multispecies studies is concerned with the cultivation of what we have called arts of

114. Latour and Porter, *Politics of Nature*.

115. Watson, "Cosmopolitics and the Subaltern." Also see Lowe and Münster, this issue.

116. Watson, "Derrida, Stengers, Latour," 91.

117. See Despret and Meuret, this issue.

118. Haraway, *Primate Visions*, 8.

119. Star, "Power, Technology, and the Phenomenology of Conventions"; Haraway, *When Species Meet*.

attentiveness. This attentiveness is a two-part proposition: both a practice of getting to know another in their intimate particularity—steadily applying one's observant faculties and energies, as the *Oxford English Dictionary* puts it—and, at the same time, a practice of learning how one might better respond to another, might work to cultivate worlds of mutual flourishing, that is, in the somewhat dated language of the *OED*, how one might be "assiduous in ministering to the comfort or pleasure of others, giving watchful heed to their wishes." In short, the arts of attentiveness remind us that knowing and living are deeply entangled and that paying attention can and should be the basis for crafting better possibilities for shared life.

This collection is an effort to draw together some of the diversity that we have outlined above. While cross-fertilization is already taking place among various multispecies approaches, in the spirit of this journal we are interested in what might be gained by bringing together scholars from distinct disciplinary perspectives. This collection primarily includes contributions from philosophers, anthropologists, geographers, and artists, but cultural studies, literary studies, and history are all drawn into the conversation, too. The collection takes us into the worlds of sheep and shepherds, of stones, worms, salmon, and forest-devouring beetles, of viruses and their elephants, of seals, crows, and lava flows in Hawai'i, and of frogs as pregnancy tests and possible agents of pathogenic fungal spread. Each contribution practices particular modes of immersion, arts of attentiveness, and in so doing invites us to understand the world a little differently, to see what difference a curious and careful attention to others might make.

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Cosmoecological Sheep and the Arts of Living on a Damaged Planet

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Abstract In recent decades, in the South of France some young people from urban backgrounds have chosen to become shepherds and to learn to reconnect with the herding practices that many livestock breeders had abandoned under the pressure of agricultural modernization policies. In some cases they have found themselves entrusted with sheep that are as naive about herding as they themselves were. Before their introduction to transhumance—seasonal movement between pastures—these animals were primarily confined and fed indoors or in small fenced areas. The shepherds had to learn how to lead, how to understand other modes of living, how to teach their sheep what is edible and what is not, and how to form a flock; the sheep had to learn how to "compose with" dogs and humans, to acquire new feeding habits, a new ethos, and moreover, new ways of living in an enlarged world. These practices cannot be reduced to a livestock economy: shepherds consider herding a work of transformation and ecological recuperation—of the land, of the sheep, of ways of being together. Learning the "arts of living on a damaged planet," as Anna Tsing has termed it, humans and animals are making their own contributions to a new cosmoecology, creating cosmoecological connections and contributing to what Ghassan Hage has called *alter-politics*.

Keywords cosmoecology, cosmopolitics, sheep, shepherds, multispecies, ethology, ethics

I have especially been swayed by Donna Haraway's conviction that there is something about our everyday engagements with other kinds of creatures that opens new kinds of possibilities for relating and understanding.
—Eduardo Kohn, *How Forests Think*

For centuries on the Olonbulag, when a herder died, people stripped him naked and tied his body up in a roll of felt, although sometimes they left the corpse clothed so they could forego the felt. Then they loaded the corpse onto a cart on which a long board had been laid across the shafts and made secure. In the predawn hours, two senior

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> male members of the family, each holding one end of the board, drove the cart to the sky-burial site, where they whipped their horses into a gallop. Inevitably, the deceased bounced out of the cart, and that was the spot where the soul would return to Tengger. The two relatives dismounted and, if the corpse was naked, unrolled the felt and lay the deceased out on the grass, facing the sky, exactly the way he (or she) came into the world, naked and innocent. At that moment, the deceased belonged to the wolves, and to the gods. Whether or not the soul of the deceased would enter Tengger depended on the virtues, or their lack, of the life lived. Generally speaking, that would be known within three days. If, by then, nothing but bones was left of the corpse, the soul of the deceased had entered Tengger.[1]

This excerpt is from an autobiographical novel by the Chinese novelist Jiang Rong, *The Wolf Totem*. The story takes place in northern Mongolia, where the author was exiled and where he lived for a few years with a group of nomadic pastoralists at the end of the 1960s. Though the wolves are the intercessors between humans and gods, these relationships are far from peaceful; they can even be extremely violent. However, wolves are an integral part of the lives of these nomadic pastoralists. Without them, neither their bodies nor their souls would survive. The survival of the Mongols mostly depends on their cattle, which feed in large pastures; these lands are regularly crossed by large groups of migrating gazelles that devastate the pastures. Wolves protect grasslands by chasing away excessive herds of gazelle. The Mongols have learned to trust them. When a group of gazelles passes through the land, wolves kill some of them. They feed on them and leave some of the corpses behind, which will be frozen. Humans in turn collect some of the corpses, but they always take care to leave enough for the wolves—if they did not, the sky would be offended. But they also know that their survival rests on the wolves' survival. Without the wolves, they would not be able to feed their cattle, and they would lose their one and only stairway to Tengger. But the wolves sometimes attack the cattle too, so they have to be kept at bay, and sometimes have to be fought. Some wolves are killed; some horses, sheep, and dogs that live with and perhaps protect local people succumb to their attack. And from time to time, some herders also lose their lives. Humans and animals are tied together by noninnocent bonds of respect, in the sense that Donna Haraway gives to the word, reminding us of its etymology: "To hold in regard, to respond, to look back reciprocally, to pay attention"—"to hold in regard" also in the sense of holding at bay, taking care, and being careful: to "live with," and without innocence.[2] Bodies, souls, pastures, steppes, cosmos, humans, sheep, dogs, horses, gazelles, and wolves are entangled in a net that connects the sky and the earth: ecology and cosmology are knotted in a common story, forming a cosmoecology

1. Rong, *Wolf Totem*, 162–163.
2. Haraway, *When Species Meet*, 19.

of multiple beings, gods, animals, humans, living, and dead, each bearing the consequences of the others' ways of living and dying.

Isabelle Stengers writes: "Whenever a being raises the problem of its conditions of existence, it lies within the domain of ecological approaches."[3] The ecological question is about the needs that ought to be met in the ongoing creation of rapports and connections. The question ecologists raise is not, therefore, does this being really exist, or is it not a representation? Rather, the questions are how does this being achieve the task of holding onto its existence, and what does this achievement require? This is why every ethology is first and foremost an ecology and, even more precisely, a cosmoecology. This is because we may never know, safely and reliably, either ahead of time or a posteriori, which beings will bear the consequences, or will enjoy the consequences, of the concrete attention we give to them.

These interconnected lives, each of them having their ever-evolving requirements and habits, have nothing to do with the balance of nature, a machine analogy that became central for ecologists around the 1950s together with the concept of the ecosystem.[4] It is better to remember here that no one, neither human nor gazelle, will ever meet an ecosystem. As Robert O'Neill has put it, "The ecosystem is not an a posteriori, empirical observation about nature. This is a paradigm, a convenient approach to organizing thought. Like any paradigm, it is a product of the human mind's limited ability to understand the complexity of the real world."[5] Over decades, environmentalists and researchers in ecology have been qualifying *Homo sapiens* as the major invasive pest on Earth, the one that almost constantly, if not deliberately, disturbs integrated, equilibrious, homeostatic ecosystems. But this is a myth—*Homo sapiens* is not an external disturbance; we are a keystone species within the system. In the long term, it may not be the magnitude of extracted goods and services that will determine sustainability. It may well be our disruption of ecological recovery and stability mechanisms that determines system collapse.[6]

Thinking about our life and behavior in distinct societies not as disturbance but as integrated parts of systems has great implications. We are invited to pay attention to the health of ecosystems from the inside. Throughout millennia, as a keystone species, humans have influenced the shape and functioning of most landscapes, from savannas to some rainforests as well as, of course, agricultural and urban ecosystems.[7]

A true politics of attention does not confine itself simply to taking another into account—it demands more. A true cosmopolitics requires us to expand the scope of obligations. Other beings obligate us, in the sense Stengers gives to the word *obligation* when she equates "being obligated by a situation" and "giving the situation the power

3. Stengers, "Penser à partir du ravage écologique," 154.

4. Odum, *Fundamentals of Ecology*.

5. O'Neill, "Is It Time to Bury the Ecosystem Concept?," 3276.

6. Ibid.

7. Provenza, Meuret, and Gregorini, "Our Landscapes, Our Livestock, Ourselves."

to obligate you." And, she adds, "without guarantees. Never the slightest guarantee, neither the judgment of God, nor a conceptual guarantee. It's all about fighting against the demand for a guarantee, it's about compromising oneself."[8]

It matters to us to acknowledge and to question the particular mode of existence of what obligates; doing so bears witness to an extension far beyond living humans of what/who it is that is able to obligate. When anthropologist Eduardo Kohn writes that forests think and that the very possibility for us to think that forests think rests upon the fact that forests think, he announces what will be the core of his book: to make us feel the possibility of a thought that goes beyond human thought, to make us sensitive to other modes of thought that dwell at the edge of thought.[9] To Kohn's project of creating an ecology of thinking, we would like to add an ecology of obligations that makes us capable of being better obligated to and obligated by other beings, on other trajectories. This is how, for example, we understand Deborah Bird Rose (quoting James Hatley) when she writes about the narratives the deceased make us create: "What is important about death narrative is that one's own passing away becomes a gift for those who follow, as well as an address to them. Death narratives are vocative; they call to one's survivor for some mode of response."[10] They obligate, in many ways.

The research that we have been undertaking together leads us to seek, in the most terrestrial paths, the multiple ways people are obligated. In doing so, we follow the philosopher Emilie Hache when she writes, relaying William James, that the pragmatist philosophy is an art of consequences. She distinguishes moral and moralist proposals:

> It will be important to describe carefully the moral situations, be they existing or "in the making" [as James writes]. I wish to testify for that and those to which/whom actors themselves are attached. That means that I will not say what ought to be done, but I will try to describe the best I can *what people do*. Not to prescribe which ways of living ought to be changed but to testify for those who do change their way of living; not to suggest that scientists should address lay people differently but to be interested in the changes that happen to some of these scientists.[11]

That is what led us to seek situations in which human and nonhuman beings become obligated through new connections. New shepherding practices, as they recently reemerged in the South of France, appeared to be a good example of this kind of cosmoecology, and in its complex political interactions we all might learn to craft new ways of being obligated and new ways of helping life to flourish.[12] These practices interest us

8. Stengers, Massumi, and Manning, "History through the Middle."

9. Kohn, *How Forests Think.*

10. Quoted in Rose, *Wild Dogs Dreaming*, 20.

11. Hache, *Ce à quoi nous tenons*, 15.

12. This article rests on the survey materials that one of us (M.M.) collected while conducting interviews with shepherds in the South of France. For the complete story, see Despret and Meuret, *Composer avec les moutons*.

in particular because of the way that these shepherds take an active role in what Tsing has termed the "arts of living on a damaged planet."[13]

Worlds to Re-member

Shepherding is a practice with long histories and traditions that in many parts of the world, including France, are often passed between generations of humans and of sheep. But the shepherds that fascinated us in this study are all of urban origin; none of them is the son or daughter of shepherds. As such, they were often left to learn on the job, with the sheep. We discovered with them that their practices fulfill multiple obligations that are not restricted to the well-being of their animals or their own livelihoods, however important these dimension are. These additional obligations fall under the realm of ethical and aesthetic relations to the world, obligations that belong to cosmoecology as *alter-politics*: "a politics that grows not from opposition to or critique of our current systems but one that grows from attention to another way of being, one that involves other kinds of living beings."[14]

To talk about sheep when so many species have already disappeared or are at the edge of extinction might be seen nonsensical. However, extinction should not be restricted to the death of species, as Thom van Dooren so convincingly shows in *Flight Ways*. In relation to the cranes that are mobilized in a captive-breeding conservationist program, he leads us to ask, Aren't these cranes that are supposed to keep the crane species among us in some ways already extinct? Do they still enjoy a life that is worth living as a crane? And will their offspring, and the offspring of their offspring?

It was upon this intuition that one of us (V.D.) fabulated the refusal of Martha and her companion, the last passenger pigeons, to reproduce. Why did they refuse to breed? Wasn't it because a life without others did not seem worth living?[15] "There are many kinds and scales of death," Kohn writes. "There are many ways in which we cease being selves to ourselves and to each other."[16]

What the shepherds were confronted with, and what they resisted, were particular forms of extinction: not the form that makes a species, in the sense of quantifiable biodiversity, disappear but those that make worlds die, worlds that were hitherto shaped and characterized by practices, by modes of inhabiting, by landscapes that are no more. The ewes confined in a small pen are, of course, still living. However, their world is so impoverished that it cannot be seen as what we call an existence, because to exist (*exsistere*) for a living being is to step "out of self," to be connected by multiple bonds, to compose a world, and to be associated with a world—as Gilles Deleuze translated the *Umwelt* of Jakob von Uexküll, "a world associated."[17] Extinction begins when the world

13. Title of a conference that Tsing and her colleagues organized at the University of California Santa Cruz, May 8–10, 2014: "Anthropocene: Arts of Living on a Damaged Planet."

14. Kohn, *How Forests Think*, 14, relaying Ghassan Hage.

15. Despret, "P Is for Passenger Pigeon."

16. Kohn, *How Forests Think*, 18.

17. Deleuze and Parnet, *Dialogues II*, 61.

to which an animal was associated is reduced to nothing, or almost nothing. Extinction begins when the ways an animal composes the world and composes with the world are ended, when the ways he or she makes a world exist, according to the ways his or her ancestors had created it, have disappeared.

This process of loss began in the 1960s in France, when a program of agricultural modernization began to promote so-called rational fenced grazing on cultivated grasslands and to suppress shepherding on natural meadows and rangeland.[18] More efficient animals, due to intensive selective breeding, were endorsed as key to producing meat or milk in abundance. These animals needed richer and steady diets, obeying new rules of standardization. Industrial foods replaced grass and other grazed plants for animals in stables, and for those that still enjoyed being outside, field crops and cultivated forages were being standardized. For decades, breeders would be advised to keep their herd in stables or in small fenced areas, in simplified and predictable environments. And so the world changed, and previous configurations, previous cosmoecologies slipped out of existence.

But in the 1990s this system met its own limits. The price of lambs dramatically dropped, due to competition from meat imported from other countries, especially New Zealand. Simultaneously, because of the influence of financial speculation in cereals, the feed price for livestock increased. Breeders went back to the practices of herding, and sheep went back to hills and mountains, to rediscover cheap grasslands, abandoned fields, scrubby rangeland, and undergrowth. Together they tried to relearn the arts and practices of winter long-range transhumance in southern France.

Nobody, however, knew how to do it. With the breach in transmission, most of the new shepherds were coming from urban areas. They chose this profession for different reasons than their predecessors. But they all say that they have always loved being with animals, and they all claim that the world, as it was going, was becoming uninhabitable. These are political and ethical choices. Moreover, these choices are *ethological*, in the sense Deleuze gives to the word. In his teaching on Spinoza, Deleuze notes:

> Ethics is better known to us today under another name, the word ethology.
>
> When one speaks of an ethology in connection with animals, or in connection with [hu]man, what is it a matter of? Ethology in the most rudimentary sense is a practical science, of what? A practical science of the manners of being. The manner of being is precisely the state of beings (étants), of what exists (existants), from the point of view of a pure ontology.
>
> In what way is it already different from a morality? We are trying to compose a kind of landscape which would be the landscape of ontology. We are manners of Being in Being, that is the object of an ethics, i.e. an ethology.[19]

18. Hubert, Deverre, and Meuret, "Rangelands of Southern France."
19. Deleuze, "Lectures."

Deleuze clarifies what should be considered manners of being—ethology is the practical science that studies what beings can do: "Of what tests is it capable? . . . What does it do?" What is it capable of? In his book on Spinoza, he adds: "The *Ethics* is an *ethology* which, with regard to men and animals, in each case only considers their capacity for being affected." Ethology defines bodies, animals, or humans by the affects they are capable of, and "the approach is no less valid for us, for human beings, than for animals, because no one knows ahead of time the effects one is capable of; it is a long affair of experimentation, requiring a lasting prudence."[20]

According to this ethology, or practices of manners of being and manners of being affected, these shepherds cultivate an aesthetic in the sense of a practice that learns to compose with the world in various ways, in the sense of an ethos. They invent ways of inhabiting a world that is being destroyed while resisting, locally and actively, this destruction.

Put simply, these shepherds had to learn the practices of herding.[21] They had to learn how to lead, how to understand other modes of living, how to teach their sheep what is edible and what is not, and how to form a flock. The sheep had to learn how to compose with dogs and humans, to acquire new feeding habits, a new ethos, and moreover, new ways of living in an enlarged world. These practices cannot be reduced to a livestock economy: shepherds consider herding as a work of transformation and ecological recuperation—of the land, of the sheep, of ways of being together. And they had to teach their sheep to live a very different life. It was hard and painful. They told numerous stories. One recalled that when he came with his car, on the first day, the ewes tried to get in—they were used to traveling by truck. Another recalled that when the young ewes were out of the stable for the first time, they seemed to wonder, what world are we in? They were scared to walk on fresh grass. Some were afraid of the wind shaking the trees, others of crossing a slope surrounded by bushes. All of them were scared of humans on foot and of dogs. Some, coming from a different flock, did not want to join the newly formed herd and instead wanted to live their lives on their own, sometimes taking advantage of the mist to hide. It took this shepherd and his dog two long and exhausting months running everywhere in the mountains to find them and convince them that it was better and safer to stay nearby.

When asked how they learned, most of the shepherds answered with stereotypical responses like "practice makes perfect" or "you have to *do* your craft." This is an example of what the sociologist Marcelle Stroobants recognizes as the sign of a metamorphosis: one does not remember when one did not know.[22] She notes that learning experiences that belong to the sphere of know-how transform the ones who go through them so deeply that the memory of the former state is effectively erased. The learning of

20. Deleuze, *Spinoza: Practical Philosophy*, 27, 125.

21. Jallet, Labreveux, and Bel, "Herding Schools"; Meuret and Provenza, "When Art and Science Meet."

22. Stroobants, "Transduction," 311.

reading illustrates this clearly: once you can read, you cannot help but do so. You do not know how you do it; you just do it. This is the hallmark of metamorphosis.

Of course, they remember failures and difficulties: the lost ewes, the ones that were caught by wolves, the herds that got lost. They especially had to learn what should not be done. They also say that they had to unlearn what they had been taught in their schooling.[23]

And all this was possible because they learned to observe. To learn is to learn how to see and to pay attention. This is a transformation of ways to feel; the shepherds learned a new way of being in the world. What Stroobants calls the metamorphosis resulting from this learning happens to be, as she suggests, "the creation of a new relation to the world and to another world, a way to inhabit a new milieu."[24]

Learning New *Savoir Vivre*

This is also what Stengers, relaying Gilles Deleuze and Félix Guattari, refers to as *involution*. Stengers writes: "Involution is neither progression nor regression, since these judgments relate to an evolution by the means of descent and filiation, be it about species, disciplines, or technics." According to her, involution creates, between heterogeneous critters, a relation that brings into play their hereditary identity, that is, "the ways they 'naturally' differentiate themselves from each other."[25] We choose the term *involution* to refer to the achievement of the shepherds because it highlights the ways this metamorphosis was noticeable to us.[26] We noticed while rereading transcripts from the interviews, at some point, that the shepherds were talking about their ewes with a very particular syntax. They were using the personal pronoun *I* or *we* and speaking from the ewes' perspective: "I eat a plant and crickets are jumping on my nose"; "I see the dog, I pant, and I kick"; "It is a nice place here, let us rest"; "Oh no, this doesn't interest me, I'll lie down and wait for something better."

The shepherds did not become sheep, but they did begin to talk with them and for them—they became *with* them, and they now form a flock. One of the shepherds gave a very interesting definition of the flock as a "character." He then added: "The flock is a memory, a collective memory of the sites and a collective memory of itself, as a flock." Another says that he forms a "body" with the sheep.

In talking about involution, we aim to avoid tired psychological interpretations in terms of identification or symbiosis and instead stress the transformation of various identities as a result of the creation of the herd. Identities are transformed but not confused: each critter still differentiates, but differentiates differently—this is involution,

23. Of course not in herding schools. (France has five schools; see Meuret and Provenza, "When Art and Science Meet.")

24. Stroobants, "Transduction," 311.

25. Stengers, "Penser à partir du ravage écologique," 178.

26. For an inspiring story that led us to feel the importance of this concept, see Hustak and Myers, "Involutionary Momentum."

an ongoing process. There is a flock, a collective memory, because a human became shepherd in relation to these ewes and because the ewes had become a character in relation with that shepherd. They differentiate differently in the process of creating trust. They became others with other others, and they differentiated otherwise.

What has changed is the way they created a relationship with time and space. They inhabited another time and another space. Time is of the utmost importance when one creates a flock. A common time, different from the previous flow of time, is established, and this common time, this shared time creates the flock—it is a herding time. Moreover, they changed the way they inhabited the space, the way they composed with the space. We say *compose with* because to inhabit is at once to be transformed by the environment and to transform it. Long-range transhumance is one of these ways of inhabiting and so composing with a place, a space in time.

In this case, to inhabit the land is also to relearn to inhabit well, to relearn a *savoir vivre* so urgently needed with these badly raised sheep. It is also to relearn how to eat well. Shepherds are very talkative on that matter. One of us (V.D.), as a philosopher, experienced some problems with the issue of food. Philosophers usually tend not to worry about food. Read Plato's *Symposium* and you will never discover what was on the guests' plates. It is not worth mentioning—philosophers are there to talk about love; food should not matter. Of course, reluctance to pay attention to issues relating to food is not only due to philosophical ethos. It may also be partially due to what the primatologist Thelma Rowell taught us when she noticed that in scientific literature about sheep, food was the first, and usually the only, question addressed. Most of this research focused on what sheep eat, how much they eat—how, in other words, they convert grass into meat.[27] This focus, as Rowell notes, worked to confirm the idea that sheep are stupid. But we also have Haraway, and the cosmoecology we want to map is a practical science of the ordinary, of the mundane, a practice of earthly companionship (with its roots in *cum panis*, "with bread").[28] Eating should matter, opening up questions of with whom, how, and what. *To eat* is a relational verb, so it is inseparable from all these questions.

None of the shepherds considered that his or her role should be reduced to the question of the weight and size of their ewes and lambs, of making them grow. To make them beautiful, yes—they mentioned this often. No one talked about kilos but, rather, about beauty. But this is not simply a question of the beauty of the ewes. To eat, and to raise sheep for eating, was not just about producing meat; it was, rather, part of a larger crafting of beautiful relations, a way to inhabit and, moreover, to give added value—we would say *to honor*.

27. This is retrieved from the interviews with Rowell by one of us (V.D.) in June 2003, which were conducted for research leading up to the making of the documentary *Non Sheepish Sheep* (dir. Vinciane Despret and Didier Demorcy, 2005), prepared for the exhibition *Making Things Public: Atmospheres of Democracy* (Bruno Latour and Peter Weibel, curators, Zentrum für Kunst und Medientechnologie, Karlsruhe, Germany, March 19–August 7, 2005).

28. Haraway, *When Species Meet*, 17.

As such, their shepherding practices aimed to create beauty: a beautiful flock, a beautiful way of inhabiting, a beautiful way to shape the milieu and to become with. A flock is an embodied memory of this creation. One of the shepherds said that a flock is a consistent entity. To achieve that consistency, each member would transmit, generation after generation, the places where they sleep, where they eat, where they drink, where they find shelter from the north wind and the south wind, all the information that forms a collective memory. And each year the young would learn with the older and more experienced sheep. In this way, the flock is a memory of the land.

During the period when sheep were largely kept confined, many of the sites they had previously used disappeared, becoming developed, overgrown, or inaccessible. As lands lost their meaning for the sheep, the meanings they had with the sheep, these lands lost some of their ways of being, some of their modes of existence. The memory of the flock, in some ways, gives to the land a part of its existence. By the concrete memory of the mouths, the eyes, the guts, the bodies, the legs, and the feet, the flock multiplies the ways lands, paths, bushes, springs, and rocks exist. Haraway would call the current process of re-membering one of "partial recuperation."[29]

These shepherds take great care to lead the flock to places where difficult food abounds. They say that, with time, the land will be rehabilitated. To rehabilitate is not just about making a place livable again. In feeding in these places, the sheep will restore them. Their work in eating what is difficult or less palatable—thorns, weeds, coarse grasses, and shrubs—also contributes to another aim, that of learning a *savoir vivre*, which literally means "knowing how to live" with the land. It is learning not to waste, for example. Some shepherds say they ask their ewes to learn to taste and to eat everything. It is, they also say, like raising children—those who want to eat only green and tender grass behave like spoiled rich kids.

European policies have sought since 1992 to promote and financially support the management of agropastoral areas, resisting the large trend toward the homogenization of landscapes and the industrialization of conventional agriculture.[30] Targeted grazing is now promoted to help manage vegetation dynamics that may otherwise lead to loss of biodiversity and wildlife habitats.[31] In the past, the situation was one of too many shepherds, herders, and wood collectors. That led to severe overgrazing and damage to landscapes, especially in dry mountain areas. After that, national forest services, especially in France, that owned large parts of the land evicted the shepherds and planted pine trees to restore the soils, sometimes creating a "green desert." But foresters did not get enough funding to manage their plantations, to fight against undesirable shrub dynamics, and to prevent wildfires. This is why shepherds are now called to the rescue, to limit encroachment dynamics and to re-create, through targeted grazing, a

29. Haraway, "Sympoièse," 50.

30. Hubert, Deverre, and Meuret, "Rangelands of Southern France."

31. Launchbaugh, Walker, and Daines, *Targeted Grazing*.

more diversified and less flammable landscape. Regional and national park managers, nature conservationists, and wildlife reserve managers mostly promote grazing contracts. As a result, many remarkable species, such as rock partridge, red grouse, alpine ibex, and bearded vulture, have found safe habitats in these areas. Pastoral activities maintain mosaics of natural swards, shrublands, and wooded grasslands, thus providing and renewing many amenities for those who appreciate flowering plants, insects, reptiles, and amphibians.[32] Elsewhere in the world, a similar story is taking shape, with the same kinds of grazing knowledge and practices being utilized and documented by scientists and land managers.[33]

To recuperate and to rehabilitate now converge. These shepherds care for the idea of a possible beauty on Earth, and they want their sheep not to waver in their commitment. Sheep do better: they perform the idea—they realize it, in the sense of making it real. Sheep and shepherds make the beauty real: beauty of the lands, beauty of diversity, their own beauty, beauty of relationships. And they do so with their mouths, their stomachs, their bodies, an art of living on a damaged planet.

But is this return of herded sheep flocks to grassland and woodland, with the aim of restoring habitats and biodiversity, approved by everyone, by all living beings? Gray wolves are approving. They came back to France in the 1990s under a strict protected status. These wolves are provided with large numbers of naive and tasty animals, herded by unarmed shepherds. Despite guard dogs and electrified night paddocks, sheep and goats, as well as calves, heifers, and sometimes horses, are much easier to catch than their wild counterparts, especially when they are grazed within landscapes of fear, that is, mosaics of small woods and open stretches of land, hedged meadows, and woodland undergrowth.[34] For their part, it is almost certain that wild boars do not approve of these changes. They prefer very dense, shrubby vegetation, mostly to avoid their predators: hunters. In France, the firsts (the wild boars) are more numerous, better reproducing, and more agile than the latest (the hunters). This is why wild boar populations grew so much when foresters evicted shepherds to plant their pine trees. Some other animals also likely do not appreciate sheep: wild birds that have mountain valley floors and foothills as common nesting habitat. Grazing sheep can destroy their eggs by accident, adding a supplementary stress for these birds that already have several predators. For this reason, grazing contracts restrict the use of valley floors during birds' nesting and early juvenile periods. Lastly, some flowering plants may also suffer from repeated grazing, mostly those that reproduce through seedlings. But even within the plant kingdom the impacts of increased sheep numbers are variable. For example, most orchids from calcareous grasslands in France are boosted by grazing that limits the extent of tall grasses as light competitors.

32. WallisdeVries, Bakker, and Van Wieren, *Grazing and Conservation Management*.

33. White, *Revolution on the Range*.

34. Laundré, Hernandez, and Ripple, "Landscape of Fear."

These stories are far from being, as Haraway writes, "comfortable narratives of subjects in encounter, two by two."[35] She continues: "More often, the configurations of critters have other patterns more reminiscent of a cat's cradle game of the sort taken for granted by good ecologists, military strategists, political economists, and ethnographers."[36] The patterns of rapport and connection that are emerging here have nothing to do with morality, and certainly not a morality with a firm or universal basis. Final and universal judgments, alongside innocence, are not possible here.

Instead, an ethics in the Deleuzian sense is nothing but experimentation: ways of being that raise the questions, what are you capable of, and what might we be capable of together? This is the true meaning of cosmoecology: other ways of being obligated by those to whom you give the power to obligate you. What affects you, and whom does your way of living, your manner of being, affect in turn? This is, in other words, experimental cosmoecology: learning to hold possibilities open, learning attentiveness to the infinite ways of being affected and of affecting, where no one may know ahead of time the affects one is capable of or the kinds of forces and entities that will constitute landscapes and worlds with us. The cosmos emerges, again and again, out of diverse ways of composing worlds, of crafting attachments and connections that link soil and earth, compost, humus, mud, grass, dogs, sheep, humans, and more. All of this is to say that there are some places on Earth where the cosmos passes through the mouths of sheep.

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35. "And no answers will make one feel good for long" (Haraway, *When Species Meet*, 41).

36. Ibid.

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The *Xenopus* Pregnancy Test

A Performative Experiment

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Abstract There is an appreciable distance between the biochemistry of being pregnant and the experience of recognizing oneself as pregnant—a speculative gap that technology can serve to narrow or widen depending on how one chooses to choreograph an ontological state. Conducting an outmoded pregnancy test with live *Xenopus* frogs, we probed the contours of this gap. As we took an antiquated bioassay out of medical archives, we conducted a performative experiment—an intervention that blurred the boundaries between performance art, science, and ethnography. Like queer enactments of gender, performative experiments exhibit the performativity of conventional science and thereby make scientific modes of knowledge production and claims available for critical inspection. Moving beyond the domain of human self-fashioning and debates about the ethics of animal experimentation, our experiment also considered speculation linking the *Xenopus* pregnancy test to the extinction of other frogs. Amphibian biologists once hypothesized that *Xenopus* frogs brought a pathogenic fungus out of Africa. We found that this outbreak narrative projected colonial and racial stereotypes into the domain of animals and limited the scope of the scientific imagination. DNA test kits enabled us to determine that the frogs used in our study were not carrying the pathogenic chytrid fungus. Getting past stigma attached to particular species and locales, we found that parasites are nonetheless emerging within the biotechnology marketplace. Global commerce is generating hypervirulent strains of disease that threaten to disrupt human dreams and schemes.

Keywords multispecies ethnography, ontology, science and technology studies, queer theory, pregnancy testing, animal experimentation, extinction, art

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On the morning of August 29, 2012, we conducted a pregnancy test at home with a live African clawed frog (*Xenopus laevis*). Under the watchful gaze of interested artists, a radio journalist, and frog enthusiasts who gathered in a Brooklyn cooperative house, we injected a woman's urine into a dorsal lymph node of a frog named Loretta. Held firmly between sterile gloved hands, Loretta did not seem to notice when the fine needle of the syringe pierced her skin. But as a milliliter of fluid entered her body she contracted her legs and extended her claws in an apparent expression of discomfort. A wave of anxiety and mixed emotions passed through the room as Loretta's movements quieted and she was returned to her water-filled tank, where she would be monitored for the following twenty-four hours via a live webcast on Ustream. We generated public field notes on a blog as we settled in to wait for Loretta to lay eggs—an event that would indicate that the woman was pregnant.

At first blush the decision to conduct a pregnancy test in a semipublic forum, to unnecessarily extend its duration over a twenty-four-hour period, and to use a live animal long retired from this particular line of biomedical service appears ridiculous, even unethical. Our performance exhibited human debts to *Xenopus* frogs—creatures that continue to be widely used as model organisms in the fields of developmental biology, endocrinology, and neuroscience.[1] By injecting a frog in a semipublic space, we intended to render visible the ongoing violence taking place in laboratories behind closed doors. *Xenopus* frogs have long suffered so that humans might craft new social realities and science fictions. Starting from a position of noninnocence, confronting the routine violence of experimental practices face-to-face with a captive frog, we considered how humans have become dependent on complex entanglements with animals, ecosystems, and emergent biotechnologies.[2]

The *Xenopus* pregnancy test was used by one of us who wanted an answer to a very personal question: am I pregnant? By restaging this outmoded test, we denatured assemblages of technology, biology, and knowledge that standardize answers to this question. We considered how technology can expand or contract the temporal gap between the biochemical condition of being pregnant and the social experience of pregnancy. We explored this gap with what philosopher Dehlia Hannah calls a performative experiment, an appropriation of conventional scientific practice for purposes of art or parodic performance.[3] Performative experiments take place in contemporary art worlds when material practices of scientific experimentation become aesthetic forms. In addition to drawing on theoretical resources from what has been called the performative turn in science and technology studies, the notion of the performative experiment also

1. Between 1998 and 2009 the number of published studies using *Xenopus* in PubMed, the US National Library of Medicine's definitive database of biomedical research, increased fivefold. Green, *Laboratory* Xenopus.

2. Wolfe, *What Is Posthumanism?*; Haraway, *Modest_Witness@Second_Millennium*; Haraway, "Manifesto for Cyborgs."

3. Hannah, "Performative Experiments."

draws on queer theory—particularly the work of Judith Butler.[4] Like queer enactments of gender, these art interventions exhibit the performativity of conventional science and thereby make scientific modes of knowledge production and claims available for critical inspection.[5]

Bringing forgotten twentieth-century scientific techniques into the domain of art, our experiment considered how human existence has become contingent on the use and abuse of animals in biomedical laboratories.[6] Our performance was haunted by what Joseph Dumit calls *implosion histories*—stories, accounts, and connections that were initially paralyzing because of their enormity. Dumit insists that we remain ever attentive to the riot of stories that hover around everyday objects and scenes: "Following connections is the only way to proceed, no matter how worrisome the result."[7] Rather than stick with a clearly articulated hypothesis, we traced the contingencies of unexpected connections in multispecies worlds. Delving into the scientific literature, we found studies showing that *Xenopus* frogs, which originate from Africa, can be asymptomatic carriers of a deadly fungal disease. *Xenopus* became linked to an out-of-Africa hypothesis of disease emergence that repeated tired colonial tropes about the "diseased continent."[8] While studying how this outbreak narrative predictably stigmatized individuals, populations, locales, and lifestyles, we became determined to better understand the fungus. While humans are not harmed by this fungus, it has driven amphibians extinct as it spread around the world. As we conducted the *Xenopus* pregnancy test, to learn about our bodies and ourselves, we also used DNA test kits to search for fungal spores. Our mode of inquiry thus remained resolutely empirical, even as we explored the contours of hope and anxiety in biotechnical assemblages.

Bringing scientific tools to the art gallery, staging confrontations with complex facets of empirical reality, also opened up an opportunity to imagine how the world might be otherwise. Tim Ingold has recently called on anthropologists to develop their "speculative ambitions." The task for the anthropologist, according to Ingold, is "to open up a space for generous, open-ended, comparative yet critical inquiry into the conditions and potentials of human life. It is to join with people in their speculations about what life *might* or *could* be like, in ways nevertheless grounded in a profound understanding of what life *is* like in particular times and places."[9] Departing from the discipline of anthropology, this article opens up a number of methodological questions: What sort of tactics and techniques must be added to the toolkit of multispecies studies? Rather than pretend to stand apart and aloof from our subjects of study, how might we more

4. Crease, *Play of Nature*; Butler, *Gender Trouble*; Pickering, "After Representation."

5. Hannah, "Performative Experiments."

6. Dumit, "Writing the Implosion"; Kirksey, Costelloe-Kuehn, and Sagan, "Life in the Age of Biotechnology."

7. Dumit, "Writing the Implosion," 349.

8. Wald, *Contagious*, 235.

9. Ingold, *Making*, 4.

fully embrace the performative aspects of multispecies research practices? How might we use performative experiments to probe speculative horizons?

"There can be no science without speculation," in the words of Michael Fortun, just as "there can be no economy without hype, there can be no 'now' without a contingent, promised, spectral and speculated future."[10] Speculation in the biological sciences has linked the discovery process to commercial agendas. New findings have resulted in the production of lucrative drugs or biomedical interventions.[11] As human reproduction became technologically mediated, consumers of emergent "hope technologies," in the words of Sarah Franklin, found new possibilities for parenthood and kinship.[12] But these same liberatory reproductive technologies generated new eugenic trends in humans and produced new forms of suffering in animals. These technologies also generated mass death in ecological assemblages. Working from a position of noninnocence and complicity—inheriting histories of animal experimentation and living with ecologically destructive processes—our performative experiment explored a series of speculative questions: How do biotechnical assemblages structure human hopes? Can we share the suffering created by our hope technologies? As biotechnology and global commerce change the conditions and potentials of life, how might we bring a renewed sense of responsibility to the realm of ontological choreography?

Ontological Choreography

Working at assisted reproductive technology clinics in the 1990s, Charis Cussins developed the idea of "ontological choreography" to describe "the coordinated action of many ontologically heterogeneous actors in the service of a long-range self."[13] Thompson described how different actors were "coordinated in highly staged ways" to produce parents and children.[14] This "deftly balanced coming together of things" united actors "that are generally considered parts of different ontological orders (part of nature, part of the self, part of society)."[15] If reproductive technologies now standardize the ways that humans are produced, our experiment with *Xenopus* frogs illustrated how we might choose to destandardize this production process.[16] Delving into the archives, we explored historical alternatives to choreographing the ontology of pregnancy.

The peculiar biotechnical affordances that make *Xenopus* useful in human pregnancy testing were discovered by South African researchers in the mid-1930s. If a potentially pregnant woman's urine contains human chorionic gonadotropin (HCG), a hormone that is produced by the human body after a fertilized egg attaches to the

10. Fortun, "Mediated Speculations," 146.
11. Sunder-Rajan, *Biocapital*; Haraway, *Modest_Witness@Second_Millennium*.
12. Franklin, *Biological Relatives*, 258.
13. Cussins, "Ontological Choreography," 600.
14. Thompson, *Making Parents*, 8.
15. Cussins, "Ontological Choreography," 600.
16. Rapp, *Testing Women, Testing the Fetus*; Franklin, *Biological Relatives*.

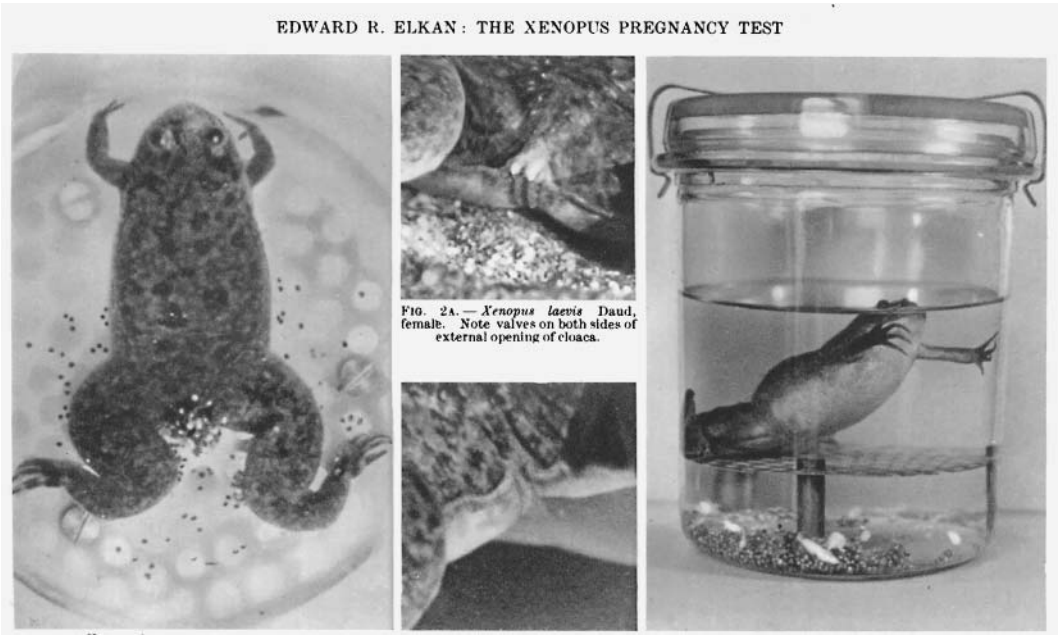

Figure 1. Images from a 1938 article in the *British Medical Journal* by Edward R. Elkan that helped popularize the *Xenopus* pregnancy test among physicians.

uterine wall, then an injected frog lays eggs (fig. 1).[17] The frog pregnancy test became part of standard medical diagnostic protocol, a hope technology for expectant mothers, which was used behind closed doors by doctors throughout the United States and Europe. *Xenopus* frogs can live up to thirty years in captivity if treated well, and each individual frog can be reused for a pregnancy test every two to three months, as soon as the female becomes gravid with eggs. In contrast to other early twentieth-century pregnancy tests, which required killing and dissecting the animals, the frogs were not permanently harmed during this bioassay.

Ontologies of human pregnancy have shifted over time, as multiple species have appeared and disappeared in distributed biotechnical assemblages. Before the *Xenopus* test, in the late 1920s, the "A-Z test" was widely used, which involved repeatedly injecting five female mice with a woman's urine over several days. The mice were killed, dissected, and then examined to see if their ovaries were enlarged. Swollen ovaries signaled a pregnancy.[18] The Friedman test substituted rabbits for the mice in the late 1920s and led to the association in popular culture of rabbit killing with pregnancy testing. *Xenopus* initially became popular because it offered faster turnaround time and better sensitivity compared with earlier animal models, enabling diagnosis of pregnancy shortly after a missed menstrual period—as early as two weeks after implantation of

17. Elkan, "*Xenopus* Pregnancy Test."
18. Kelley, "Aschheim-Zondek Test for Pregnancy."

the fertilized egg.[19] The fact that *Xenopus* did not have to be killed in order to determine the status of a pregnancy also "improved the public face of pregnancy testing beyond the laboratory."[20]

New kinds of pregnancy tests produced what Franklin calls "biological relativity" in a topsy-turvy world with an oscillating, fluctuating, and unstable sense of normality.[21] Pregnancy tests with animal models were gradually abandoned in the 1970s and 1980s as chemical tests became the norm in laboratories and later in the home. David Lynch, the director of the edgy and uncanny television series *Twin Peaks*, helped popularize the plastic pee-on-a-stick test with his 1997 television advertisement for Clearblue Easy. Lynch took the commission because it involved "the psychological torture of a beautiful young woman, a theme he has explored in other media."[22] Lynch's Clearblue Easy advertisement played with the speculative gap that emerges with pregnancy tests—capturing the agonizing suspense of waiting (in private) through a white woman's face reflected in a bathroom mirror. "When you're waiting to find out if you're pregnant or not, nothing else in the world matters until you know," the narrator of Lynch's commercial says, while a clock ticks loudly in the background and possible results flash on the screen: "yes, no, yes, no, yes, no. . . . " Sarah Abigail Leavitt's careful exegesis of this commercial considers the intense affects that bounce around during these sixty seconds: "Though it takes only a minute, it will be the longest minute of this woman's life, for so much hangs in the balance."[23] The viewer does not learn whether the smile on the woman's face at the end of the commercial is one of relief or anticipation.

Time slowed down as we took the *Xenopus* pregnancy test out of the archives. This bioassay requires waiting much longer than the pee-stick test. Results with a frog can take as long as twenty-four hours to emerge. The *Xenopus* pregnancy test also delays the moment in a woman's cycle at which knowledge is possible. It works reliably only two or three weeks after a missed period, in contrast to a plastic pee-stick test, which can deliver a result even before an anticipated period. While using this test, we viscerally experienced the appreciable distance between the biochemistry of pregnancy and the complex, embodied, and interpersonal experience of being pregnant. *Xenopus* frogs and the pee-stick test both detect HCG. Quantitative tests of HCG, performed after blood is drawn at a doctor's office, can detect elevated hormone levels even earlier than the plastic pee-stick. The *Xenopus* test is thus slightly less sensitive than the pee-stick, which is itself less sensitive than a blood test. Therefore, the test itself—the chemical technology or animal assay—determines the temporal point in the progression of pregnancy at which a yes or no answer can be given. In other words, these pregnancy testing

19. Elkan, "*Xenopus* Pregnancy Test."

20. Olszynko-Gryn, "Pregnancy Testing in Britain," 2–3.

21. Franklin, *Biological Relatives*.

22. Reproductive themes and sexual undercurrents were also prominent in Lynch's early work—such as *Eraserhead*, a 1977 cult classic that features images of flying sperm creatures and monstrous infants.

23. Leavitt, "Private Little Revolution," 333.

technologies can serve to narrow or widen a speculative gap, depending on how one chooses or happens to choreograph an ontological state.

Speculative Gaps

Playing with speculative gaps, the uncertain and difficult space between the present and the imagined future, can yield unnerving results. As one of us began trying to conceive a child, the speculative ambitions of this project took a very personal turn. We experimented with possibilities of queer kinship and self-fashioning while pushing the work of participant observation into uncomfortable realms—exposing private dreams to public inspection and critique. Dreams of fostering a potential human life were harbored by one of us who was partnered in a lesbian relationship. The imagined child took shape in the couple's eyes and minds as they bought clothes and toys suitable for various stages of life—tiny shoes that she would outgrow before she could walk, a dress that would be out of style by the time she grew into it, a fierce fuchsia ski jacket that they agreed would only work for a boy. They looked around at the children of heterosexual friends and neighbors, envying the ease with which biology helped to decide for them the shape of their eyes, the color of their skin, whose relatives they resembled. Every male friend became a candidate in the category of "uncle" or bio-daddy, whose influence in the imaginary child's family constellation they would chart with quick back-of-the-envelope calculations. Men on the street were reduced to their genes. Potential sperm donors were everywhere, and nowhere, to be found.

Amid indecision, a tattooed dyke doctor told the couple "whatever you'll do, you'll regret it—so just get some sperm and get on with it!" Ultimately, the couple purchased sperm in the summer of 2012 from a commercial bank, a queer marketplace where genetic material is coded by markers of race and class. The business plans of these facilities involve adding value to raw DNA—making it better by enhancing associations with the genetic inheritability of desirable phenotypes and social traits.[24] A relentless onslaught of choices presented themselves for queer self-fashioning. In the end, the couple chose a donor with whom neither of them shared ancestry simply because they thought he was the most beautiful. As their reproductive project proceeded, the couple embraced relations of kinship and affiliation that extended beyond their monogamous partnership.

Biological ties are often decentered in gay and lesbian notions of kinship, according to Kath Weston's book *Families We Choose* (1991), since they are based on choice and love rather than shared genetic inheritance. Likewise, multispecies families—which involve companions like birds, dogs, cats, or frogs—involve queer sensibilities because they involve relations of care and love that reach beyond fixed blood ties.[25] Power asymmetries among species, like the power asymmetries that bind children to parents in

24. Moore, *Sperm Counts*.

25. Kirksey, *Emergent Ecologies*, 135–36.

Figure 2. An African clawed frog (*Xenopus laevis*) resting underwater in an aquarium at Ueno Zoo, Tokyo. Photo by Peter Galaxy. Creative Commons Attribution-Share Alike 2.5 Generic, 2.0 Generic, and 1.0 Generic license.jpg

human families, meant that Loretta had no choice but to participate in our experiment. We purchased her with a credit card from 1-800-*Xenopus*, the toll-free hotline for a specialty laboratory animal supply company (fig. 2). Still, Loretta helped illustrate a deep kinship shared by humans and frogs—a similar biochemical makeup shared across divergent evolutionary lineages, with reproductive functions triggered by shared hormones. Once viewed as primitive creatures by experimental biologists, *Xenopus* frogs were formerly thought to be unable to experience feelings of pain or fear. But recent research has led to the revision of these earlier assumptions. According to a laboratory manual published in 2010 by the Taylor and Francis Group, "*Xenopus* have all of the neuroanatomical pain pathways as seen in mammalian species, and thus, like mammals, they are capable of experiencing pain."[26]

Sharing suffering, according to Donna Haraway, involves paying attention to lab actors in precarious situations and "the practical and moral obligation to mitigate suffering among mortals."[27] With this in mind, we injected ourselves with saline solution

26. Green, *Laboratory* Xenopus, 110.

27. Haraway, *When Species Meet*, 70.

before beginning our experiment with Loretta. The injections stung a little. They felt like a tuberculosis test, where a little bit of liquid is injected under the skin. By involving our own bodies in this art project—by being on the receiving end of saline injections, and by turning a potential pregnancy into a public spectacle—our intention was not to celebrate the heroics of self-experimentation. Rather than harbor a fantasy of ending all suffering by laboratory animals, or even claiming to "feel the pain" of the individual frog in our care, our intent was to situate human modes of self-fashioning within long legacies of animal experimentation. We experienced disquiet as our own bodies were turned into art objects. Our disquiet redoubled as we imagined and speculated, across species lines, about Loretta's own subjective experiences during our experiment.

Pulling Edward R. Elkan's 1938 article out of the archives, we carefully followed his instructions during our performative experiment. We purchased our equipment—syringes and rubber gloves—from a corner drug store in New York City, no questions asked. State law mandates that anyone in New York can buy up to ten syringes a day, even without a prescription. Rather than protect us from any infections that Loretta might have had, the gloves were to protect her from any toxic soap or detergent lingering on our skin. After we collected urine from our potentially pregnant team member in a clean cup and suctioned up the urine in a syringe, we injected Loretta. After placing her back in her tank and starting a live public webcam feed on Ustream, we went our separate ways to await the results. The prospective parents sent out an e-mail to friends and family, inviting them to become part of an expanding public witnessing the experiment:

> Dear Friends,
>
> Please join us in an extended moment of suspense: two weeks ago, X was artificially inseminated with sperm from an anonymous donor and she may be pregnant. This morning a small group of academics, artists, journalists and frog enthusiasts convened in Brooklyn to stage a historical reenactment of a pregnancy test that was developed in the 1930s. We injected one cubic centimeter of X's urine into a pet adult female *Xenopus laevis* frog named Loretta. If she is pregnant, the frog will respond to the presence of human chorionic gonadotropin (HCG) in her urine by laying its own eggs within the next 24 hours.
>
> We invite you to follow a live-streaming video of Loretta as she sits in a tank in Brooklyn. You'll see the white amphibian with distinctive little black claws doing very little. (That doesn't mean the link is broken; it just turns out that the frog doesn't do much.) If you see anything odd in the tank, please feel free to comment on the blog—or better yet, call us!
>
> We thought this would be a more interesting, communal, and differently synchronous way to think through animal labor, reproductive history, gender norms, and the many other different constellations of kinship, human and animal alike, that get formed in the process of reproducing. And it was a lot more stimulating and interactive than dropping ten bucks at our local drug store for a home pregnancy test.
>
> With anticipation,
>
> X & Y

The e-mail excerpted above initiated the transformation of a private query into a participatory public spectacle. The eighteenth-century experimental demonstrations of London's Royal Society—where, for example, birds expired within the vacuum of a glass jar—also involved staging spectacles for a live human audience.[28] If these earlier experiments were performed for a restricted public of "modest witnesses," white adult males of the upper class, our own enactment of the *Xenopus* pregnancy test was open to the more democratic and unruly public space of the Internet.[29] While a restricted public gathered to witness the injection of Loretta, the public webcast circulated among an extended network—which included some of our colleagues and children, their friends, and friends of friends—some 130 people according to Ustream's viewer statistics. Our performance brought the typically private matter of conception to an experimental arena where approaches to witnessing competed with social norms for engaging with art, colleagues, roommates, friends, and strangers.

As we all followed the Ustream webcast in real time, a riot of questions emerged: Who is watching, and who may witness? How are desire and aversion informing the scene? How easy will it be to achieve consensus about the mechanical operations observed? With the e-mail imploring friends and family to "call us if you see anything," the couple was redistributing the authority to witness, bringing queer eyes to scientific territory that has historically been dominated by straight guys. The first blog post, just hours after Loretta was injected, opened up technical issues: "OK, so we've found images of the frog eggs on Google and they are not easy to miss. Look for little tiny marble-like formations at the bottom of the tank. If you do see anything, text and let us know!! Eager eyes be on and offline all night awaiting Loretta's produce." Others quickly chimed in:

> "Is that something?"
> "No wait, I think that is a smudge on the screen"
> "Move Loretta! See if she moves then we can tell. I wish she could hear me."
> "Did something just happen on the live feed?"
> "That looks like egg mass . . . "
> "WAAAAAAAAAAAAAAAAAAAAA!!!!!!!!!!!!!!"

At this point the expectant couple placed a call to Grayson Earle, a new media artist who was looking after Loretta and the live video feed. They asked Grayson to "ground truth" the online observations. After taking a peek in the tank, Grayson reported that there were no eggs: "There's a little algae in there though, not sure. I'm so glad you two decided, after all, to take the traditional route to having a baby. :-)" After waiting overnight, the couple consulted with a medical doctor who advised that they take a home

28. Shapin and Schaffer, *Leviathan and the Air-Pump*.
29. Haraway, *Modest_Witness@Second_Millennium*.

Figure 3. The negative pee-stick tests used by the couple after their performance of the *Xenopus* pregnancy test.

pregnancy test. "Once we knew we'd have to do it, we ran over to a friend's house as fast as we could to find out," the couple wrote in a blog post.

> Sadly, after peeing on three sticks, we had to accept that Loretta had been right all along. It was shocking, somehow, after such a wonderful day of waiting, and it was hard to know that we now would have to share our disappointment with so many others who'd come along for this wild ride with us. But all things considered it was quite amazing to have shared this moment of hope with everyone who turned up and tuned in to this process.

Plastic sticks can produce loneliness, isolation, and alienation—when used in a bathroom, separated from friends and family (fig. 3). Turning one's private life into a public spectacle certainly also involves issues and dilemmas. Pee-stick tests can also afford women much-needed freedom from scrutiny. The lesbian couple at the center of this particular performative experiment had the difficult experience of sharing their disappointment with an emergent public that had come together around a moment of hope. Even still, the results of our performative experiment include not only a negative pregnancy test but the emergence of a constellation of enduring intimacies—a breaking down of barriers that usually separate species, academic disciplines, and private/public distinctions in interpersonal and professional spheres. As the speculative space containing the couple's fragile hopes collapsed into disappointment, our performative experiment explored stories about ecological entanglements that were initially paralyzing because of their enormity. We began to investigate speculation that the *Xenopus* pregnancy test had gone wildly awry to cause the mass extinction of amphibians.

Multispecies Migrations

Drastic declines in frog populations were noticed worldwide starting in the 1970s—particularly in Australia and the Americas. Upward of 165 species of amphibians are believed to have already gone extinct. About 1,895 amphibians, more than one-third of all described frogs, salamanders, and caecilians, are formally listed as threatened or endangered.[30] Scientists described a new species of fungus in 1999, a kind of chytrid called *Batrachochytrium dendrobatidis*, and identified it as a key threatening agent responsible for frog declines. Biologists immediately began to search for a mechanism facilitating the global spread of this chytrid fungus. Ché Weldon, a South African scholar, published a peer-reviewed article in 2004 linking the *Xenopus* pregnancy test with the emergence of this deadly amphibian disease. Taking tissue samples from amphibian specimens in South African museum collections going back to 1871, Weldon found that the earliest frog testing positive for pathogenic chytrids was collected from the Western Cape in 1938, just as they were being exported from this site for use in pregnancy tests around the world. By transporting *Xenopus* around the planet, Weldon surmised, humans inadvertently helped spread a plague among frogs.[31]

Weldon's out-of-Africa hypothesis of disease emergence followed the predictable script of an outbreak narrative by stigmatizing particular locales and lifestyles as dangerous, dirty, and diseased.[32] Africa, long imagined as the "diseased continent" in popular culture, often appears in the epidemiological literature as the source for diverse maladies—like the Ebola virus and HIV/AIDS.[33] Histories of colonialism and Cold War politics have produced the idea of the Third World as an epidemiologically risky space. While popular films and fictions paint Africa as a diseased continent, dominant narratives often fail to account for the global political and economic arrangements that foster health and well-being in so-called civilized nations and allow for the proliferation of illness in underdeveloped countries. With Weldon's out-of-Africa hypothesis, *Xenopus* frogs were stigmatized in the scientific and popular literature. The name of this creature means "strange foot" (*xeno* = strange, *pus* = foot) in Latin, and it began to feature in xenophobic outbreak narratives that wove mythic colonial tales together with the authority of science.[34] *Xenopus* was branded as the "Typhoid Mary of amphibians."[35]

30. "Frightening Statistics," Amphibian Ark, www.amphibianark.org/the-crisis/frightening-statistics/ (accessed September 14, 2004).

31. Weldon et al., "Origin of the Amphibian Chytrid Fungus."

32. Wald, *Contagious*.

33. The familiar phrase "there is always something new coming out of Africa" originated in Greece no later than the fourth century BC. Whereas *something new* meant strange hybrid animals to Aristotle, twentieth-century writers and filmmakers began using the phrase with a sense of admiration. Feinberg and Solodow, "Out of Africa," 255.

34. Wald, *Contagious*.

35. Lisa Brenner Katz, "An Animal Once Used as a Pregnancy Test May Be 'the Typhoid Mary of the Frog World,'" May 16, 2013, www.scpr.org/blogs/news/2013/05/16/13693/an-animal-once-used-as-a-pregnancy-test-may-be-the/ (accessed January 14, 2016).

Working to disrupt dominant scientific accounts and popular outbreak narratives, Eben Kirksey designed a performance art piece to think with care about how *Xenopus* is helping generate ongoing changes in distributed ecological assemblages. This piece, called "Multispecies Migrations," was part of a group exhibit at Proteus Gowanus gallery in Brooklyn probing how "movements are affecting our future on the planet, bringing crisis and calamity aplenty."[36] Living *Xenopus* frogs, purchased for $2.88 each from local pet stores, were displayed in mason jars alongside pictures of microscopic spores of the pathogenic chytrid fungus. Posting a free classified ad on *Brokelyn*, a web magazine for New York City residents, Kirksey offered to demonstrate basic laboratory skills that would enable ordinary people to conduct pregnancy tests in their own homes:

> New York City pet stores sell *Xenopus laevis* frogs for cheap. In the 20th century this frog was widely used as a pregnancy test. Unbeknownst to anyone in this era, *Xenopus* can carry a deadly frog disease, the chytrid fungus. Help us discover if *Xenopus* is spreading chytrid around New York City. Please visit your local pet shop and buy a frog! Sold under the common names of "Underwater Frog", or "African Clawed Frog", baby *Xenopus* are available for just a few dollars in stores in all five boroughs. Choose the color you'd like—white albinos and speckled brown frogs are both available. Write down the phone number and address of your local store and bring a frog along to the Proteus Gowanus gallery. We'll test to see if your frog has the fungus, and show you how to treat your new friend if it is a carrier. We'll also show you how to do the frog pregnancy test in the comfort of your own home. This crowd sourced research project will be part of an academic study. All participants are potential coauthors of a paper that will be submitted for publication.[37]

This artwork, in part, had a didactic intent: the gallery performance explored speculation about the technological and ecological assemblages that were resulting in the extinction of amphibians. Using DNA test kits from the Amphibian Disease Laboratory at the San Diego Zoo, we also checked the microbiomes of all the frogs—a total of twenty-one animals, including Loretta—for pathogenic chytrid fungi. We used the DNA test kits to test outbreak narratives orbiting around *Xenopus* frogs. None of the frogs in our crowd-sourced fungal survey tested positive for chytrid spores. All of the frogs collected from New York City pet stores and the 1-800-*Xenopus* hotline were free of this pathogenic fungus. This performative experiment in Proteus Gowanus thus added a new twist to the entangled tale of frogs and their chytrid companions.

The empirical evidence from this experiment helped destabilize the story about an outbreak from the "diseased continent" facilitated by a pregnancy test gone awry.[38] Biological scientists have since argued against Weldon's hypothesis with their own evidence. For example, one team found the deadly chytrids on the skin of a Japanese giant

36. "Migrations," *Multispecies Salon*, www.multispecies-salon.org/migrations/ (accessed January 14, 2016).

37. The ad was posted on brokelyn.com/, July 15–August 15, 2012.

38. Wald, *Contagious*, 235.

salamander collected as a museum specimen in 1902, much earlier than Weldon's specimens from South Africa. Widespread and low-level infection patterns in Asia suggest that this chytrid species has been there for a long time, which would confound the out-of-Africa scenario. Genome sequencing data, from a study published in March 2013, reveal much genetic variability and ontological indeterminacy within different chytrid strains. One strain of these dynamic microbes, the global pandemic lineage, is highly pathogenic and has been killing frogs in Europe, Africa, Latin America, and the United States. Other chytrid strains are relatively benign and restricted to particular locales—one is isolated in Brazil, another is restricted to southern Africa and Spain, while another is found only in Switzerland. This study of pathogenic chytrid genomes reports that "it is premature to conclude a geographic location for the origin of *Batrachochytrium dendrobatidis*."[39]

While Weldon's hypothesis was wrong in some of the details and was shot through with tired colonial narrative tropes, perhaps he was on the right track with his speculative ambitions. By noting the possibility that a twentieth-century biotechnology scheme might have gone wildly awry, Weldon helped focus attention on how the life sciences are inadvertently contributing to ecological problems. Promiscuous liaisons in marketplaces for biomaterials and live foodstuffs, involving the mixing and mingling of cosmopolitan animals from diverse corners of the globe, have likely become places that have generated new deadly kinds of chytrids. Global capitalism has intensified the speed of chytrid spread. Specialty food markets—involving the global trade of live bullfrogs (*Rana catesbeiana*) for frog legs as well as Louisiana crayfish (*Procambarus clarkii*)—are constantly whisking chytrids around the world.[40] The global pandemic lineage likely emerged as a result of human commerce.[41] Researchers "predict the evolution of further hypervirulent fungal lineages across a diverse range of host species and biomes in the absence of tighter biosecurity."[42]

The velocity of the biomaterials marketplace and the vested interests promoting the global circulation of chytrids along with multiple species of live animals are paralyzing. We find it difficult to imagine a plausible future when government regulations will definitively bring the tighter biosecurity needed to stop the spread of pathogenic fungi.[43] By reenacting the *Xenopus* pregnancy test, we situated ourselves within worrisome histories, producing a confrontation with surprising, intolerable, and unbearable consequences of contemporary political and economic arrangements. As power continues to function predictably, perhaps it is time to scale up the scope of our imaginings while engaging in concrete practices of care in multispecies worlds.

39. Rosenblum et al., "Complex History," 9385.

40. Schloegel et al., "Novel, Panzootic, and Hybrid Genotypes"; McMahon et al., "Chytrid Fungus *Batrachochytrium dendrobatidis*."

41. Rosenblum et al., "Complex History."

42. Farrer et al., "Multiple Emergences," 18732.

43. Ibid.

Conclusion

Science fictions and speculative fabulations, as Haraway has eloquently demonstrated, can engender the capacity to care for "critters of technoculture" rather than just "point toward future utopia or dystopia."[44] Even though the deadly chytrid fungus did not originate from Africa, and the frogs in our own study were fungus-free, *Xenopus* can still harbor asymptomatic fungal infections. This fact led some national and state governments to propose final solutions. Xenophobia led to xenocide. After finding escaped *Xenopus* frogs in Golden Gate Park, the California Department of Fish and Game initially proposed to drain the park ponds, killing the ecosystem along with the "fiendish amphibians."[45] Instead, park workers began using nets and traps baited with chicken, euthanizing some twenty-five hundred frogs with nerve poison after yanking them out of the pond.[46] Despite this eradication campaign, chytrids and wild *Xenopus* frogs continue to proliferate in California, Europe, and beyond. Escaped *Xenopus* frogs now live in unusual circumstances all around the world: drainage systems along the US-Mexico border, the canals of Holland, and underground water cisterns of Welsh castles.[47] Thinking with care about these errant critters of technoculture should avoid the perils of apocalyptic visions as well as the seduction of proposing final solutions.[48]

We live in a time when a multitude of terrifying and paralyzing stories compete for our attention. Global climate change is outpacing all attempted solutions. Capitalist enterprises that are rapidly destroying forests and wetlands in diverse corners of the globe may well be unstoppable. Social and economic inequalities—structured by pervasive racisms and legacies of colonialism—are being exacerbated in metropolitan centers of power and on the margins of the modern world system. Technologies continue to promote the reproduction of some kinds of people and certain charismatic species while pushing others toward death. These facts have led many to feelings of futility and complacency. Performative experiments, which need not be confined to the domains of biology and technology, can help address the imaginative dimensions of these problems. Staging performative ethnographic interventions in multispecies worlds, in the words of Kirksey, can help transform "feelings of futility into concrete action, cynicism into happiness and hope."[49]

Our present study used an experiment to diagnose problems—related to changes in ecological dynamics in distributed assemblages, animal experimentation, and the choreography of pregnancy and queer kinship. Looking beyond this particular intervention, our research practice also offers an opportunity to speculate about how other

44. Haraway, "Speculative Fabulations," 248–49.

45. Matier and Ross, "Killer Frogs of Lily Pond."

46. Ibid.

47. Tinsley and McCoid, "Feral Populations of *Xenopus* outside Africa."

48. Haraway, *Modest_Witness@Second_Millennium*; Haraway, "Speculative Fabulations."

49. Kirksey, *Emergent Ecologies*, 219. See also "Desert," *Anarchist Library*, theanarchistlibrary.org/library/anonymous-desert (accessed September 19, 2014).

inherited technologies might also be reconfigured with a reflexive do-it-yourself spirit.[50] Scholars working in the field of multispecies studies have the opportunity to design and implement their own future performative experiments to imagine what life mediated by technoscience *might* or *could* be like.[51] Performative experiments offer an opportunity to study elusive facets of life and multispecies contact zones with new techniques and dispositions.[52] Collaborations with experts from other fields, or even other species, can help multispecies scholars pursue a range of epistemological and political aims: sensing the world in new ways, interacting with other modes of being, and animating emergent modes of flourishing in multispecies worlds. Frontier practices of the twenty-first century are always announcing new worlds, proposing the novel as the solution to the old, figuring creation as radical invention and replacement, rushing toward a future that wobbles between ultimate salvation and destruction but has little truck with thick pasts or presents.[53] Conducing performative experiments against this backdrop might help generate responsible science fictions and speculative fabulations.

Our experiment explored the contours of hope and anxiety in personal and biopolitical worlds. We found that technology can serve to widen or narrow speculative gaps, depending on how one chooses to choreograph an ontological state. Pregnancy testing technologies come prepackaged with different speculative affordances. While promising speedy results and early detection, contemporary tests inadvertently prolong a state of indeterminacy—yes, no, yes, no—spreading out feelings of uncertainty over the course of several weeks. These tests have made it possible to detect early biochemical changes in a woman's body, making the social and psychological experience of miscarriage more common. Reproductive technologies have thus put women into a difficult social state that Barbara Katz Rothman describes as a "tentative pregnancy."[54] These technologies produce provisional, unsettled, and speculative states of being.[55] Contemporary pregnancy tests are thus just the beginning of a long period of indeterminacy, or being "a little bit pregnant."

Standardized reproductive technologies impose biopolitical norms: legions of unborn disabled children with chromosomal anomalies and neural tube problems have been eliminated from the human population by technical procedures that prompt parents to abort nonnormative fetuses.[56] Reproductive technologies foster certain kinds of bodies while pushing others toward different conclusions such as termination.[57] Against the backdrop of scholarship about how technological standards produce different kinds of humans, our enactment of the *Xenopus* pregnancy test extends the rights of

50. da Costa and Philip, *Tactical Biopolitics*.
51. Ingold, *Making*.
52. Hodgetts and Lorimer, "Methodologies for Animals' Geographies."
53. Haraway, "Speculative Fabulations."
54. Rothman, "Tentative Pregnancy."
55. Ibid.
56. Rapp, *Testing Women, Testing the Fetus*.
57. Casper and Moore, *Missing Bodies*.

reproductive choice beyond women's bodies. Women now have the opportunity to choose among distinct biotechnical assemblages with distinct ontological and ethical affordances. By choosing the *Xenopus* pregnancy test, women can opt to minimize the uncertain and indeterminate state of the tentative pregnancy.[58] Choice, however, can be as much an ethical burden as an opportunity for forms of freedom. Women can choose to come face-to-face with animal laborers, to learn how to care for living diagnostic technologies, to experiment with modes of living differently within multispecies assemblages.[59]

The *Xenopus* pregnancy test can be enacted responsibly only when one uses frogs that are certifiably fungus-free. Even if these frogs are not involved in an out-of-Africa story of disease emergence, they can still be asymptomatic carriers of pathogenic chytrids—reservoirs of microbes with the potential to kill other species of frogs. DNA testing technologies that can detect pathogenic chytrids are relatively cheap and can be purchased online from Pisces Molecular.[60] Infected frogs can be easily treated with a diluted solution of over-the-counter antifungal cream.

The *Xenopus* pregnancy test illustrates how humans have become fundamentally "prosthetic creatures" with an ontology that has "coevolved with various forms of technicity and materiality, forms that are radically 'not-human' and yet have nevertheless made the human what it is."[61] The animal familiars who make us what we are, the companion species that have helped stabilize our bodies and our selves, inherit complex entanglements.[62] Taking the *Xenopus* test out of the medical archives and reanimating it in the present offers an opportunity to learn new technical skills—to acquire knowledge of unfamiliar bodies and epidemiological networks that might allow for more responsible modes of living with others in multispecies worlds.

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58. Rothman, "Tentative Pregnancy."
59. Haraway, *When Species Meet.*
60. Pisces Molecular, LLC, www.pisces-molecular.com (accessed January 14, 2016).
61. Wolfe, *What Is Posthumanism?*, xxv.
62. Haraway, *When Species Meet*.

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Gut Buddies

Multispecies Studies and the Microbiome

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Abstract Recent work in the life sciences presents the human as a superorganism, composed of and kept alive by diverse microbial kin. We learn that this life is changing fast as a result of modern lifestyles and that missing microbes are causing epidemics of absence. There is a growing interest in restoring components of the microbiome. This article explores some of the implications of these developments for multispecies studies through a focus on helminth therapy—the selective reintroduction of parasitic worms as "gut buddies" to tackle autoimmune disease. It first traces the visceral vectors, cycles, and assemblages through which people are differentially entangled, disentangled, and reentangled with helminths. It then analyses these entanglements with reference to literature on the science and politics of (auto)immunity. The article places helminth therapy in the vanguard of new ways of enacting immunity. Scientists writing about helminths are reworking binary, martial models of immunity as the defense of the self to consider immunity as the tolerance, recruitment, and creative experimentation with microbial symbionts. Here immunity is enacted in contrasting multispecies assemblages that illustrate the communal and the immunitarian characteristics of contemporary biomedicine. In conclusion the article reflects on how the probiotic relations of helminth therapy suggest new ways of thinking of companionship and hospitality as more-than-human, but not posthuman, achievements.

Keywords microbiome, helminths, immunity, helminthic therapy, multispecies studies, post-Pasteurian

Life in Us

Recent findings from the Human Microbiome Project suggest that a great deal of "us" is not us.[1] In oft-cited figures, we are diminished to only 10 percent or 1 percent human, depending on whether our essential identity is pinned to human cells or genes,

1. The Human Microbiome Project was a US National Institutes of Health initiative that ran from 2008 to 2013. It aimed to identify and characterize all the microorganisms found in association with both healthy and diseased humans. Comparable projects were also undertaken in Europe and Asia. See Turnbaugh et al., "Human Microbiome Project."

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respectively. The rest of us comprises bacteria, fungi, archaea, and a few animals invisible to the naked eye.

Scientists interested in this microbiome present the human as a superorganism, accommodating, infected, and kept alive by diverse microbes in dynamic ecologies.[2] Once feared as universally pathogenic, microbes are now ascribed central roles in the performance and maintenance of a healthy body. Stefan Helmreich writes of a general "microbiomania" that has gripped popular science.[3] Microbes have been linked to the successful functioning of our metabolic, immune, and endocrine (hormone) systems, and there is growing interest in how they shape mood and cognition.[4]

This figure of *Homo microbis* queries the coherence of the modern human,[5] understood as an individual and ontologically separate island.[6] It suggests that being human is a multispecies achievement, dependent on the "corporeal generosity"[7] of microbial life. Anxieties have been expressed that the human superorganism is degrading. "Missing microbes,"[8] we are told, make us vulnerable to "epidemics of absence."[9] These changes have been linked to dramatic recent increases in allergy, autoimmune, and inflammatory diseases, while novel internal ecologies marked by microbial dysbiosis create opportunities for the emergence of pathogenic superbugs.

To make matters worse, many of these new diseases have been linked to excesses of modern hygiene. Archetypal modern developments, such as urbanization, antibiotics, cesarean sections, and sewage and water treatment, have all been associated with shifts in the microbiome.[10] There is a growing sense that antibiotic efforts to purify the human by rationalizing, simplifying, and eradicating nonhuman life can be as pathogenic as situations of microbial abundance.

As a consequence, nascent therapeutic efforts are emerging that seek to reengineer internal ecologies, securing the human through probiotic, or what Heather Paxson terms "post-Pasteurian," forms of "microbiopolitics."[11] These involve careful processes of "controlled decontrolling,"[12] using microbes to reorganize ecologies to secure desired systemic properties. Examples include bacteriotherapies like fecal transplants to shift antibiotic bacteria[13] and vaginal seeding to replicate birth canal bacterial colonization

2. See, for example, Turney, *I, Superorganism*.

3. See Helmreich, *Sounding the Limits of Life*; and Paxson and Helmreich, "Perils and Promises of Microbial Abundance."

4. Smith, "Tantalizing Links."

5. Helmreich, *Sounding the Limits of Life*.

6. For discussions see Hird, *Origins of Sociable Life*.

7. Diprose, *Corporeal Generosity*.

8. Blaser, *Missing Microbes*.

9. Velasquez-Manoff, *Epidemic of Absence*.

10. Blaser and Falkow, "What Are the Consequences?"

11. Paxson, "Post-Pasteurian Cultures."

12. See Keulartz, "Emergence of Enlightened Anthropocentrism."

13. Fecal transplants have been the subject of a great deal of popular interest. See Velasquez-Manoff, "Should We Bank Our Own Stool?" Several citizen science projects are now developing do-it-yourself guides and reservoirs of donor feces. See, for example, www.thepowerofpoop.com.

for babies born by cesarean section.[14] They encompass various paleo, pro-, and prebiotic diets designed to work on the gut microbiome[15] and novel personal and domestic hygiene products that actively seed the skin and built environment with stable colonies of good bacteria.[16]

This article contributes to nascent investigations of the implications of the emergence of *Homo microbis* and post-Pasteurian modes of microbiopolitics for multispecies studies. It focuses on helminthic therapy, the controlled (re)introduction of (what are commonly termed) parasitic worms into human bodies to tackle allergies and inflammatory and autoimmune conditions.[17] While programs to deworm the world continue apace in the rural Global South,[18] a growing number of Northern citizens[19] and scientists have recast some helminths as "gut buddies"[20]—salutary symbionts capable of recalibrating dysfunctional bodily relationships. Clinical trials are under way,[21] but these have been overtaken by a burgeoning "hookworm underground."[22] This online community links patients, researchers, and advocates who share and sell animals, equipment, and expertise.[23]

In telling the story of gut buddies, this article is structured in two sections. I first introduce helminths and helminthic therapy, tracing the visceral, multispecies vectors, cycles, and assemblages through which people are differentially entangled, disentangled, and reentangled with helminths. The second section analyses these entanglements with reference to literature on the science and politics of (auto)immunity. It situates helminth science in the vanguard of new ways of conceiving immunity. Scientists working on helminths expand upon binary, martial models of immunity as the defense of the self to consider immunity as tolerance, recruitment, and creative experimentation with microbial symbionts. I trace how immunity with gut buddies is enacted in contrasting multispecies assemblages that illustrate communal and immunitarian characteristics of contemporary biomedicine. In conclusion the article reflects on the character of these forms of post-Pasteurianism and suggests that the probiotic relations of helminthic therapy offer new ways of thinking companionship and hospitality as more-than-human, but not posthuman, achievements.

14. Molloy, "Mothers Facing C-Sections."

15. For some popular works, see Pollan, *Cooked*; and Sonnenburg and Sonnenburg, *Good Gut*.

16. Examples include www.motherdirt.com and www.pro-b.co.uk.

17. For an introduction, see Velasquez-Manoff, *Epidemic of Absence*.

18. For an overview, see Hotez, *Forgotten People, Forgotten Diseases*.

19. Interest seems to have grown in the last decade. A recent survey estimated that six thousand to seven thousand people are currently self-treating with helminths. See Cheng et al., "Overcoming Evolutionary Mismatch."

20. This is the title of the blog authored by one hookworm user: gut-buddies.com.

21. For a review, see Wammes et al., "Helminth Therapy or Elimination."

22. I take this phrase from Velasquez-Manoff, *Epidemic of Absence*.

23. The article draws on review of scientific publications, coupled with ethnographic research with users and providers of helminthic therapy. This involved interviews with key informants and observation and participation in discussion forums and other social media.

Entangling with Worms

A political ontology of entanglement (and disentanglement) has emerged as something of a leitmotif in recent work in multispecies studies, especially in work concerned with human and animal disease.[24] Entanglement describes a world that has never been modern, human, or populated by discrete individuals. Instead it figures humans, animals, and other nonhumans as components of dynamic, nonlinear assemblages in constant processes of mutual becoming. It offers an ontology that attends to the commonplace interspecies exchange of microbiota, viruses, and genetic material while critically interrogating the political ecologies and biopolitics through which different lives are ordered, secured, and abandoned. Advocates are optimistic that an attention to the inevitability of entanglement will help enrich an ethic of living well with nonhuman others.

There has been little examination of the types of deliberate *re*entanglements that feature prominently in this story. In this and subsequent sections I develop this work by tracing the historical (dis)entanglements of humans and helminths that led to the recent emergence of helminthic therapy. Humans evolved and most still largely live in a "wormy world."[25] Corporeal companionship with a range of helminths has been a common part of our species history. Parasitologists have recorded more than three hundred species of helminths that live in humans. Many of these are rare or accidental, but about ninety species are commonly found in human bodies.[26] Few helminths are host specific. Instead, many of our parasites are zoonotic—transmissible between humans and other vertebrate animals.

Helminths have three main life-cycle stages: eggs, larvae, and adults. Adult worms infect definitive hosts (those in which sexual development occurs), whereas larval stages may be free-living or parasitize invertebrate vectors and intermediate hosts. After infection, larvae grow, molt, mature, and then produce offspring, which are voided to infect new hosts or to reinfect the original host. The four main modes of transmission by which helminth larvae infect animals (including humans) are fecal-oral, transdermal (through the skin), vector-borne (e.g., via a snail), and predator-prey (e.g., by humans eating pork).[27] In short, there are myriad diverse and intimate ways in which helminths entangle us with other life forms and ecologies, and these form part of a wider set of vectors through which we are (dis)entangled with our microbiota.

For a more detailed illustration, we can look at human hookworm (*Necator americanus*), which is currently the most popular of the four helminth species subject to reworming.[28] Paleoparasitologists believe that humans acquired hookworm about twelve

24. For a review, see Nading, "Humans, Animals, and Health."

25. Stoll, "This Wormy World."

26. Cox, "History of Human Parasitology."

27. Much of this overview is taken from the Australian Society of Parasitology's website at parasite.org.au/para-site/contents/helminth-intoduction.html.

28. Other species used for helminthic therapy include human whipworm (*Trichuris trichiura*), which has humans as a definite host but can be taken orally. Some human helminth clinical trials have used pig whipworm

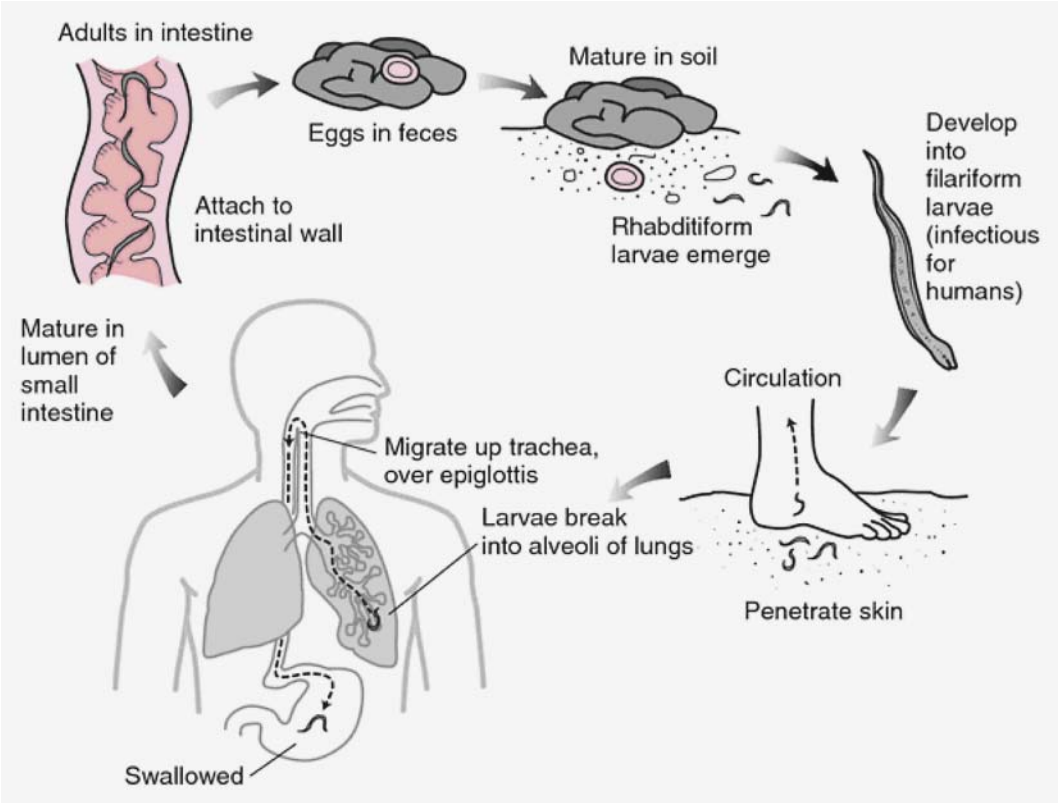

Figure 1. Life cycle of *Necator americanus*. Image from Public Health Image Library, Centers for Disease Control and Prevention (phil.cdc.gov/)

thousand years ago as a result of our increasingly intimate relationships with dogs.[29] This worm is now primarily found in humans and remains one of the world's most common parasitic helminths.[30]

The life cycle of the hookworm is shown in figure 1. Humans first acquire hookworm when the infective larval stages penetrate through the skin. This generally happens between the toes of a bare foot in contact with the soil. Deliberate inoculation involves applying larvae in a bandage to the upper arm. After entering the host, the larvae migrate through the blood vessels to the right side of the heart and then to the lung. They break out of the lung capillaries and ascend the throat where they are coughed and swallowed. From here they enter the gastrointestinal tract and develop into their adult stage. This normally takes about four days, at which point the host may

(*Trichuris suis*), which is genetically related to the human whipworm. *T. suis* ova (or TSOTM) are produced commercially from the feces of pathogen-free pigs, living and dying in laboratory conditions. Biome Restoration sells the cysticercoids (or larval stage) of the rat tapeworm (*Hymenolepis diminuta*), which are harvested in their laboratory from a grain beetle (*Tenebrio molitor*), their intermediate host.

29. Palmer, "Migrant Clinics and Hookworm Science."

30. Schneider et al., "History of Hookworm Vaccine Development."

experience coughing, the flare-up of rashes, fatigue, diarrhea, cramping, nausea, and vomiting.[31] Some users report that a few days later, the worms may cause a "bounce": a sudden improvement in symptoms and a strong sense of calm, focus, happiness, and lightheartedness.

After about three weeks, the hookworms take up residence and feed on blood from the walls of the intestine. The patient's health then often deteriorates. In a therapeutic context, worms start to work, and symptoms begin to ease, at around twelve weeks. By week 20 the worms are usually well established, and by week 45 the worms and body reach equilibrium—providing there is no further infection. Hookworms live in the human intestine for an average of three to ten years. Each female produces thousands of eggs daily, which exit the body in feces. When deposited in soil (or equivalent artificial growth medium) with adequate warmth, shade, and moisture, the eggs hatch within hours and give rise to new larvae. And so the cycle continues.[32]

Unlike other forms of life in us (viruses, bacteria, protozoa, and fungi), helminths need to reproduce outside their definite host. Hookworms tend to develop slowly in vertebrate bodies. When people use toilets connected to sewage treatment systems, there is little risk of hookworms returning to the wild. However, high worm loads can accumulate in political-ecological conditions marked by poor sewage treatment, which leads to high exposure risk. As these conditions are often coupled with poverty, poor nutrition, and other diseases, helminths can cause significant morbidity.[33] Deworming was a major public health priority for the Rockefeller Foundation and then the World Health Organization during the twentieth century,[34] and these efforts have been stepped up under recent initiatives to address "neglected" tropical diseases.[35]

Deworming programs seek to intervene in the life cycle of the target helminth, disentangling its vectors for infection to secure the human body. Hookworm eradication requires investments in sanitation and footwear, coupled with the development of antihelminthic drugs. The former prevent transdermal infection, while the latter purge the body of existing parasites. However, sanitation projects are expensive, and the regular distribution of drugs is politically challenging. Worms also develop drug resistance, and there has been limited investment in developing alternatives now that worms have disappeared from more affluent Northern markets. New drugs appear only as spin-offs from developments in the more lucrative field of antihelminths for domestic and

31. I take this experiential information from a document titled "Timeline following Inoculation with Hookworm," hosted on one of the main support group websites, at www.foodsmatter.com/natural_medicine_comp_therapies/helminthic_therapy/articles/hookworm-timeline-03-12.pdf (accessed March 9, 2016).

32. This description is largely derived from Brooker, Bethony, and Hotez, "Human Hookworm Infection."

33. Hotez, *Forgotten People, Forgotten Diseases*.

34. Farley, *To Cast Out Disease*; Anderson, *Colonial Pathologies*; Palmer, "Migrant Clinics and Hookworm Science."

35. The political geography of hookworm presence and absence illustrates stark political ecological disparities. I discuss deworming and the broader geographies and political ecologies of hookworm eradication and reintroduction in more detail in Lorimer, "Living Well with Parasitic Worms."

agricultural animals.[36] In the prevalent biopolitical regimes of pharmaceutical capitalism, the health of pets and livestock is worth more than that of many people in the majority world. Recent efforts, funded by the Gates Foundation, focus on the development of a hookworm vaccine: a one-shot solution to ensure permanent helminth absence.[37]

Investments in deworming have driven steady declines in the incidence of helminth infection in the Global North and in urban areas of the Global South.[38] However, the desirability of wholesale helminth eradication and human disentanglement has begun to be questioned by a growing body of scientific theory, evidence, and vernacular practice. Epidemiologists have noted for some time an association between general declines in infection and the increase in susceptibility to certain autoimmune and allergic diseases.[39] In 1989 David Strachan offered a hygiene hypothesis to account for these broad trends.[40] This has been refined in recent years into the old friends hypotheses.[41] These suggest that changes in the composition of the human microbiome and the microbial ecologies with which people evolved unsettle basic bodily systems that enable processes like metabolism and immunity.

These hypotheses have informed a wide range of laboratory research using animal models (largely gnotobiotic mice) whose microbial composition is known and controlled. Experiments using murine helminths, comparable to those of humans, try to simulate and explain the links between de- and reworming and the incidence of allergic and autoimmune disease. Wammes and colleagues explain how these mouse experiments "provide strong evidence that helminths can not only downregulate parasite-specific immune responses but also modulate autoimmune and allergic inflammatory responses and improve metabolic homoeostasis."[42] A number of clinical trials have been undertaken first to test the safety of reintroducing helminths into human patients suffering particular autoimmune conditions and then to explore its effects. These trials have shown that these patients can host a modest number of worms with no significant side effects or risk of wider infection. The results of these trials have to date been mixed and inconclusive, and further studies are under way.[43]

In parallel with these scientific developments and in part in frustration at their slow progress, a variety of patients, citizen scientists, and health providers have been experimenting with helminthic therapy. One of the early advocates was the British

36. Hotez et al., "Human Hookworm Vaccine."

37. Schneider et al., "History of Hookworm Vaccine Development."

38. Parker et al., "Prescription for Clinical Immunology."

39. Bach, "Effect of Infections." For specific research on helminths, see Flohr, Quinnell, and Britton, "Do Helminth Parasites Protect against Atopy and Allergic Disease?"

40. Strachan, "Hay Fever, Hygiene, and Household Size."

41. Rook, "Helminths, Immune Modulation, and the Hygiene Hypothesis"; Hanski et al., "Environmental Biodiversity."

42. Wammes et al., "Helminth Therapy or Elimination," 1150.

43. Ibid.

entrepreneur Jasper Lawrence, who was a participant in one of the first hookworm clinical trials in the early 2000s.[44] He found they significantly helped his hay fever. After losing his worms, he traveled to rural Cameroon to walk in some latrines in the hope of picking up replacements. He got the wrong worm, but after a further trip to Guatemala he established his own worm colony. He started a company breeding, selling, and infecting his worms into paying customers. Because it is currently illegal to bring hookworm into the United States outside a human body or to distribute them within the country, Jasper initially based himself in Mexico. It is perfectly legal to cross the border to Tijuana to get infected. At the time of writing, there were four online commercial providers of hookworm, who will send larvae via mail and provide follow-up support to anyone outside the United States.

The driving energy for the subsequent growth of helminthic therapy comes from a vibrant network of online support groups, which link together a globally disparate community that operates independently of scientific researchers and commercial providers. These groups are powered by a small number of early adopters of the therapy happy to share their experience, expertise, and enthusiasm with those interested in experimenting. They have worked long, unpaid hours to collate information into a set of online handbooks, to provide news, and to answer questions. Acting as moderators, these individuals also facilitate and police the sociabilities of this heterogeneous and diffuse community.

Empowered by online resources and their own experiments, some users have learned to grow their own hookworms and other helminths. They use animals originally purchased from commercial providers or those sourced from participation in clinical trials. Some have cobbled together readily available domestic technologies to make their own laboratories. Detailed incubation protocols circulate containing instructions on how to combine soil, heat rocks marketed for reptiles, and various other household chemicals to create surrogate ecologies for incubating and nurturing worms. Making use of cheap microscopes and library images, they harvest and isolate new stock from their feces and count larvae before self-infecting.

Entanglement here involves awkward forms of care,[45] a novel ecosystem of mundane technologies, and a spatially diffuse online network of suppliers, experts, and supporters. This network provides a reserve of hookworm stock that can be called upon in the (all too frequent) case of worms dying or going missing. Incubators are happy to supply others in a multispecies gift economy, though their incubation protocols, advice, and gifts are frequently prefaced with legal disclaimers. There is a high level of scientific expertise within this group, which includes a number of laboratory technicians and practicing microbiologists. These assemblages for helminthic therapy thus perform ecologies. They replicate (and terminate) life cycles and simulate infection vectors in

44. Lawrence's story is reported in more detail in Velasquez-Manoff, *Epidemic of Absence*.

45. Ginn, Beisel, and Barua, "Flourishing with Awkward Creatures."

various professional and makeshift laboratories, affording control over how, when, where, and to what degree patients "hook up" to their gut buddies.

Rethinking Immunity for a Wormy World

We can begin to specify some of the practices and political ecologies of human-helminth (dis)entanglements by drawing on a range of existing literature on immunity. This literature cuts across the humanities and the social and natural sciences, examining shifting scientific understandings of immunity and the ways in which these draw upon and come to inform broader social norms and political practices. Many authors agree that the modern biomedical concept of immunity is premised on a series of binary, martial metaphors in which an immune system works to defend a stable, individual, and essential human self from alien, invading, nonself others.[46] Historians attribute this martial understanding to the emergence of immunology at the end of the nineteenth century, a period characterized by the fight against infection and the prominence afforded the germ theory of disease.[47] Germ theory linked the incidence of disease to the presence of specific microorganisms. Immunity came to describe defense against germs.

Critics have traced the ways in which such conceptions of immunity came to shape biopolitical practices governing human and nonhuman life to secure specific ideas of what is normal and what is pathological.[48] They explain how the figure of the normal self was frequently bound to colonialism, capitalism, and patriarchy. Such norms were also tied to antibiotic models of hygiene—perhaps best exemplified by Pasteur and a Pasteurian approach to public health.[49] Historians and contemporary commentators note the incidence and persistence of binary, martial conceptions of immunity in programs for helminth control and eradication. Warwick Anderson argues that twentieth-century sanitation projects often involved practices of "excremental colonialism": a somewhat obsessive, racialized, and highly moralized focus on hygiene among foreign doctors and administrators targeting the management of human waste to prevent cycles of reinfection.[50] Others have noted how some helminth drug delivery programs that are premised on the imposition of Western models of individual rational subjectivity may be ignorant of local norms and reductionist in the face of political and ecological complexities and injustices.[51]

The pathological consequences of the success of such biopolitical projects in disentangling people from helminths and other microbiota are the central concerns of the hygiene and biome depletion hypotheses. Table 1 offers a list of hygiene practices

46. For a comprehensive account, see Cohen, *Body Worth Defending*; or Martin, *Flexible Bodies*.

47. Tauber, "Immune System and Its Ecology."

48. Cohen, *Body Worth Defending*; Haraway, "Biopolitics of Postmodern Bodies."

49. Latour, *Pasteurization of France*.

50. Anderson, "Excremental Colonialism."

51. Geissler, "'Worms Are Our Life'"; Palmer, "Migrant Clinics and Hookworm Science."

Table 1. Hygiene practices understood to negatively affect human ecology

Change	*Consequence*
Clean water	Reduced fecal transmission
Increase in cesarean sections	Reduced vaginal transmission
Increased use of preterm antibiotics	Reduced vaginal transmission
Reduced breastfeeding	Reduced cutaneous transmission and changed immunological environment
Smaller family size	Reduced early life transmission
Widespread antibiotic use	Selection for changing composition
Increased bathing, showering, and use of antibacterial soaps	Selection for changing composition

Source: Adapted from Blaser and Falkow 2009, 889.

understood to have deleterious consequences on the human microbiota, abbreviated from a paper published by two high-profile microbiologists.[52] The listed changes stem from innovations that are often heralded as fundamental to being developed and modern.

No one is advocating giving up on the real improvements these interventions have brought in the management of infectious disease (at least in certain parts of the world). But anxiety about these changes speaks of a wider crisis in the martial, binary understanding of immunity and the scientific and health care paradigms it informs.[53] One group of immunologists goes so far as to suggest that "practices of industrialized culture aimed at reducing infectious disease have apparently created the single most potent element destabilizing the immune system in hundreds of millions of humans."[54]

New research on the relationships between helminths and autoimmunity is in the vanguard of a paradigm shift in conceptions of the immune system. As Mathilde Versini and colleagues explain:

> It is worth noting that helminthes [*sic*] have co-evolved with their host for millennia; their goal is not to kill their host but to survive as long as possible by creating a state of tolerance. To achieve this, helminthes are able, through various mechanisms, to finely modulate the host immune system to prevent an activation that may lead to their elimination, while not causing too deep an immunosuppression which would cause the host to die from infection. This immunomodulation, by avoiding an excessive activation of the immune system, contributes to host protection against inflammatory disorders. . . . It is becoming apparent that these parasites are acting simultaneously at all levels and on the different key cellular players of the immune system establishing a real network aiming to promote a tolerant environment. Thus, helminthes hamper immune response to

52. Blaser and Falkow, "What Are the Consequences?"

53. See discussions in the collection of workshop papers from the Forum on Microbial Threats, *Ending the War Metaphor*.

54. Parker et al., "Prescription for Clinical Immunology," 1195.

> ensure their own survival and simultaneously protecting the host against the occurrence of chronic immune-mediated conditions by limiting the development of inflammation and autoimmunity.[55]

Understood this way, parts of the immune system are not at war with invaders. Instead they are involved in continuous processes of communication, modulation, and diplomacy. We learn that worms enter into a "continuing dialogue"[56] with the human immune system, establishing a "helminth-induced immune regulatory environment"[57] or "network"[58] to enable permanent residence. This is a world of tolerance[59] in which "intimate biochemical chatter"[60] enables forms of interspecies communication.

Such scientific accounts of interspecies communication and diplomacy agree with how helminths (as gut buddies) are discussed among patients and providers. One company offers a twofold account of beneficial work done by their helminth: worms initially serve to calibrate the immune system, helping its development, especially among young children, and then work to exercise adults' immunity, keeping the immune system sufficiently busy or distracted to avoid its turning against itself.[61] The hookworm underground, as performed in online support groups, presents a range of immunological epistemologies. Recent scientific developments are mobilized in support of lay immunologies akin to those mapped in writings on probiotic and raw milk food cultures.[62] Discussions of worm therapy interface with the probiotic enthusiasms outlined in the introduction. These include other forms of biotherapy, various paleo diets, and a reinvention of early twentieth-century personal and domestic hygiene practices. Earthy knowledges of baking, pickling, and herbalism are well regarded.[63]

We can link these ideological shifts and changing cultural commitments to existing work that documents the emergence of new metaphors of immunity in efforts to understand and tackle autoimmunity. For example, Scott Gilbert, Jan Sapp, and Alfred Tauber suggest that symbiotic conceptions of immunity show an immune system that not only tolerates nonself components but also is engaged in the active recruitment of desirable microorganisms. They depict the immune system managing its microbial (dis)entanglements with two arms. The first arm is the body's armed forces; the second, its passport control: a regulatory network that "has evolved to recognize and welcome those organisms that help the body."[64] David Napier talks of an immune system

55. Versini et al., "Unraveling the Hygiene Hypothesis."
56. Allen and Maizels, "Diversity and Dialogue," 385.
57. Helmby, "Helminths and Our Immune System," 122.
58. Wammes et al., "Helminth Therapy or Elimination."
59. For a discussion of tolerance as a metaphor for immunity, see Anderson, "Tolerance."
60. Sachs, *Good Germs, Bad Germs*, 12.
61. See Biome Restoration's website at www.biomerestoration.com.
62. See, for example, Enticott, "Lay Immunology, Local Foods, and Rural Identity."
63. The broad ethos of North American incarnations of this cultural movement is conveyed in recent writings by Michael Pollan. See, for example, Pollan, *Cooked*; and Pollan, "Some of My Best Friends Are Germs."
64. Gilbert, Sapp, and Tauber, "Symbiotic View of Life," 332.

permitting "creative attempts to engage risk at the borders of self,"[65] actively seeking communication and entanglement as a learning process. Similar metaphors shape the lifestyle experiments for cultivating tolerance through deliberate exposure to potential allergens that are reported and advocated by Emily Martin and Richard Cone.[66]

A great deal of scientific research in this new paradigm focuses on understanding how helminths are able to regulate and downgrade the host immune system. Microbiologists are beginning to trace the complex interactions among human host, helminths, and resident microbiota (especially bacteria).[67] There is a growing sense that helminths manipulate the microbial population of their host for their own ends.[68] Applications of this research have focused on antibiotic techniques for eradicating worms by killing their bacterial symbionts[69] as well as more probiotic experiments seeking to understand helminths as keystone species capable of engineering entire bodily ecologies.[70] This figure of the helminth as a keystone species has some fairly profound implications for humanist conceptions of agency and autonomy. It appears that helminths are capable of reorganizing our bodily ecologies in ways that not only affect our "gut feelings" of immunity and metabolism but also might shape the more refined processes of mood and cognition.[71]

In this understanding, human and worm bodies "learn to be affected" by each other through an ongoing molecular exchange.[72] The ethology of these affectations can be distinguished from much existing work in this part of multispecies studies, which has tended to focus on becomings and attunements between visible and relatively large and discrete beings. The story of worms allows us to rethink accounts of learning to be affected through the figure of *Homo microbis*. Those learning to live with and care for their gut buddies talk of "care-full" management of their bodily ecologies to nurture their symbionts. Diet, medicine, exercise, and even environmental exposures are managed experimentally to protect worms and meet their needs. One hookworm user drew an analogy with her care-full bodily practices while pregnant.[73] Many hookworm users live with chronically dysfunctional guts and hypersensitive immune systems. They have developed means of articulating the sensibilities, temporalities, and emotions of gas, diarrhea, and other disturbing dynamics of fecal movements. They share the heightened affective sensibilities of those whose bodies do not work properly or will not remain in

65. Napier, "Nonself Help," 131.

66. Martin and Cone, "Immune System."

67. See, for example, Bilbo et al., "Reconstitution of the Human Biome."

68. Hayes et al., "Exploitation of the Intestinal Microflora," 1394.

69. See, for example, Coulibaly et al., "Randomized Trial of Doxycycline."

70. Parker et al., "Prescription for Clinical Immunology."

71. Schmidt, "Mental Health."

72. Despret, "Body We Care For," 113.

73. Pregnancy (as the tolerance of nonself in self) has long served as something of an ontological challenge to theories and theorists of immunity grounded in binary and martial concepts. See discussion in Anderson and Mackay, *Intolerant Bodies*.

the background. In their intense personal affective ecologies, worms bring lethargy, hope, relief, and often disappointment.

Figuring worms as needy keystone species calls attention to the interests of the animals that are made subject to de- and reworming programs. It is likely, though little known, that the twentieth century saw dramatic declines in helminth biodiversity. The extinction of hosts sees the extinction of parasites and symbionts, and there has been little interest in parasites in wildlife conservation, captive animal management, and species reintroduction projects.[74] Meanwhile the development of antihelminth drugs will have eradicated significant numbers of domestic animal parasites, such that some domestic animals have begun experiencing comparable outbreaks in autoimmune disease. Nascent programs are under way to conserve human microbial diversity in biobanks,[75] though understandably there is little enthusiasm for conserving free-ranging populations of helminths. Others have suggested domesticating worms through genetic modification both to improve their salutary properties and to tame their infectious agencies.[76] Little is known of the shifting behaviors and sensibilities of the worms themselves as they learn to be affected in taking residence in different bodily ecologies whose molecular and microbial constituents are unused to their presence. Perhaps they struggle with an overactive immune network primed to destroy? Perhaps they are welcomed by microbes keen to communicate and experiment?

What emerges in this story is an ecological model of immunity as involving a multispecies community—maintaining stable systemic states through reactive defense, continuous internal dialogue, and the proactive recruitment of, and experimentation with, new microbes. The immune system both is primed to respond to undesired arrivals and can be unsettled by the absence of a familiar conversant. Securing the immunomodulation benefits of helminthic therapy entangles patients in an immune network that extends well beyond the human body. It can include laboratory animals: the pigs, rats, and beetles used to farm helminths and the mice that are used to test their effects in the lab. It also requires a diverse technological ecology of laboratory and other more mundane equipment, enacting particular geographies through postal services and the virtual texts and interactive possibilities of the Internet. It is through these networks that patients engage in creative experiments in deliberative helminth recruitment. They source, self-infect, and discard organisms in ways that extend Gilbert and colleagues' and Napier's metaphors of recruitment and experimentation beyond the body to expand those forms of sociability at play in securing health.

Hooking up with helminths as gut buddies thus entangles users in sociabilities configured within contrasting political ecological formations. In the hookworm underground we find people sharing and storing worms and offering care, expertise, and

74. Dougherty et al., "Paradigms for Parasite Conservation."

75. Barzegari, Saeedi, and Saei, "Shrinkage of the Human Core Microbiome."

76. See Parker et al., "Prescription for Clinical Immunology."

technology in a community configured around a multispecies gift economy. Here worms are held in common. Most of the commercial providers of helminths are nonprofit, pricing their worms to cover production costs. This model of community would seem to bear many of the hallmarks of that desired by the biophilosopher Roberto Esposito in his recent writings developing an affirmative mode of biopolitics that runs counter to the immunitarian logics of modern, capitalist life.[77]

In contrast, much scientific investment, research, and development on helminths and immunity focuses on finding means for privatizing their immunosuppressant properties. Here there is much excitement about "harnessing the helminth secretome for therapeutic immunomodulators," as the title of one paper puts it.[78] Scientists involved in decoding the hookworm genome speak of a veritable pharmacopoeia of synthetic (and thus patentable) molecules that will become available for a new phase of drug development. New forms of "lively capital"[79] are expected to ensue (somewhat paradoxically) from drugs directed toward either helminth eradication or the replication of their immunosuppressant properties.[80] While these developments are nominally about creating safe, hygienic, palatable, and convenient means of delivering helminths' benefits, they also work to overcome the legal challenges of privatizing a living organism that is currently classified as a dangerous pathogen. These interventions would enable the commodification of what the hookworm underground currently holds in common. They are contested and resisted by scientists concerned with biome restoration and many members of the hookworm underground.[81] There is a general concern that profit-centered efforts to privatize the hookworm secretome may undermine patient-centered benefits already accruing in helminthic therapy.

Probiotic Multispecies Relations

The figure of *Homo microbis* depicts humans as superorganisms, entangled with other animals and bacteria in a range of multispecies economies.[82] We learn of the fundamental dependence of our basic bodily systems on symbionts, our continued vulnerabilities to parasitic and pathogenic infection, and the deleterious consequences of missing microbes. The human superorganism emerges as an unstable and permeable ecology, tipped toward undesirable dysbiosis by situations of both intense abundance and rapid decline and absence. A great deal of basic science is still to be done in this area, and many of these understandings are tentative and will no doubt shift in the coming years.

77. Esposito, *Immunitas*. For a useful overview see Campbell, "Bios, Immunity, Life."

78. Ditgen et al., "Harnessing the Helminth Secretome."

79. Rajan, *Lively Capital*.

80. Tang et al., "Genome of the Human Hookworm"; Navarro, Ferreira, and Loukas, "Hookworm Pharmacopoeia."

81. Biome Restoration (www.biomerestoration.com), one company selling helminths, is heavily informed by the work of William Parker. See Parker et al., "Prescription for Clinical Immunology"; and Parker and Ollerton, "Evolutionary Biology and Anthropology."

82. Helmreich, *Sounding the Limits of Life*.

Nonetheless, in conclusion I would like to return to my opening discussion to explore what the story of hookworm therapy and disease contributes to engagements by multispecies studies with the microbiome. I focus in particular on how this work helps specify a post-Pasteurian mode of living with microbial life.

Even the most gung ho advocates of microbial rewilding are post- rather than anti-Pasteurian. In Paxson's terms, they "work hard to distinguish between 'good' and 'bad' microorganisms and to harness the former as allies in vanquishing the latter. Post-Pasteurianism takes after Pasteurianism in taking hygiene seriously. It differs in being more discriminating."[83] Advocates and practitioners of helminthic therapy do not want to give up on the real gains to health that modern hygiene has delivered, nor do they want to undermine efforts to extend these benefits to the large parts of the world where they remain absent. Instead they are involved in careful and reversible experiments to address the absences and perceived excesses of contemporary hygiene.

These experiments contribute to ongoing efforts to develop nuanced, relational, and contextual understanding of the exchanges that take place in human-microbial relations.[84] Immunologists and therapists suggest that recognizing the salutary role of some microbiota in regulating the human immune system calls into question the common, blanket description of helminths as parasites. In many historical and contemporary circumstances it is clear that helminths are parasitic, but in managed reentanglements hookworms also figure in three more affirmative guises (at least from a human perspective). First, both clinical scientists and therapists describe hookworms taken in controlled quantities and conditions as symbionts or, more specifically, mutualists: organisms that flourish in and confer benefits upon their host. Second, hookworms achieve this mutualistic status by acting as a keystone species capable of reorganizing dysfunctional microbial ecologies. Third, future probiotic imaginaries feature helminth domesticates, modified to best deliver their symbiotic potentials. As this article begins to make clear, there are important geographies and political ecologies that shape when, where, and for whom helminths relate in these different guises.

There are also important ethical and political dimensions to the reinvention of helminths as gut buddies. The lay immunologies of practitioners of microbiome restoration demonstrate ambivalence about some dimensions of being modern. They express ecological models of immunity in community similar to those that can be derived from the writings of thinkers like Esposito. But their grounds for microbial hospitality emerge from the protection of the human subject. While Esposito's writings tend to affirm an undifferentiated and posthuman life,[85] here worms are strategically employed as tools for the job of securing individual health. These experiments do not seek to deliver a posthuman subject, where the human is dissolved into a set of symbiotic exchanges and microbial flows; rather, they remain firmly targeted at securing the human—with

83. Paxson, "Microbiopolitics," 118.

84. See, for example, Rose, "Multispecies Knots of Ethical Time"; and Bull, "Between Ticks and People."

85. For a discussion of Esposito's conceptions of immunity and biopolitics, see Wolfe, *Before the Law*, 87–105.

varying normative connotations—in the face of the vulnerabilities of microbial presence and absence.

The story of worms therefore intersects with and offers an important and interesting twist to the emerging interest in multispecies studies with questions of hospitality and companionship in the macrobiome. Here companion species are quite literally those with whom we eat and upon whose agencies digestion depends, necessitating a more expansive and intimate understanding of multispecies gift economies.[86] In the case of worms, hospitality starts on the inside, and being a good host involves being infected well. Participants in the hookworm underground care for their worms as friends. But these are friends without a face, sensed through an invisible corporeal interface.[87] Hookworm users are willing to make bodily sacrifices to preserve their worms' vitality, but only to the extent that the worm functions well as a keystone agent. There is little concern for the independent welfare of the individual worm, as some express for their mammalian pets, or for the wider flourishing of free-ranging helminth species, as some express for wolves or tigers.

Contrary to the posthumanist hopes for a decentered human that can be found in some enthusiastic receptions of the human microbiome in multispecies studies,[88] here the human remains central to the multispecies ethics performed, albeit the human in a fragile, unstable, and untrustworthy form. The central concern is with securing an individual multispecies body or the bodies of close kin and a community of shared sufferers. Securing this human as a multispecies microbial self involves defense, communication, and recruitment, differentiating the good, the bad, and the indifferent in all their microbial diversity. Living well with a stable, background, and unconsidered microbiome is possible only as a result of having a world at home in us. Caring for those without requires attending to those within. Hospitality thus starts at home and involves distinctly painful and awkward acts of care. Becoming hospitable involves selective openings and entanglements in a diffuse and more-than-human community of symbionts and their people.

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86. See Rose, "Multispecies Knots of Ethical Time."

87. For an extended discussion of the ethical potential of friendship between humans and nonmammalian animals, see Bingham, "Bees, Butterflies, and Bacteria."

88. See, for example, Sagan, *Cosmic Apprentice*.

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Lively Ethography

Storying Animist Worlds

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Abstract This article is an effort to dwell with the kinds of writing and thinking practices that we have been developing in our research, especially over the past seven years. This is an approach grounded in an attentiveness to the evolving ways of life (or *ēthea*; singular: *ethos*) of diverse forms of human and nonhuman life and in an effort to explore and perhaps restory the relationships that constitute and nourish them. Our aim is to develop "lively ethographies": a mode of knowing, engaging, and storytelling that recognizes the meaningful lives of others and that, in so doing, enlivens our capacity to respond to them by singing up their character or ethos. Most of our work in this area has focused on extinction, but this approach might readily be taken up in a range of other contexts. This article alternates between two types of writing. One is expository and lays out an analysis of ethos, liveliness, storytelling, "response-ability," and becoming witness. The second is performative, offering short ethographic vignettes that enact some of the qualities and approaches we have discussed. Here each of these vignettes is taken from our recent work in Hawai'i, a deeply generative and often fraught field site that has inspired much of our thinking.

Keywords multispecies, ethography, ethics, storytelling, animism, Hawai'i, ethos, worlding, witness

Seals

Unlike the many other seals at home in cold waters, the Hawaiian monk seal (*Monachus schauinslandi*) has taken to life in the tropics (fig. 1). Members of the *Monachus* lineage, their ancestors evolved in the coastal waters off what is now Turkey and Greece. From there they spread into the Atlantic and the Caribbean and eventually the Pacific, via a waterway that is now closed. Different species of monk seal could once be found thriving in all of these places; today all are in severe decline or extinct. Roughly 1,100 Hawaiian monk seals remain, making the species one of the rarest marine mammals on Earth.[1]

1. "Hawaiian Monk Seal (*Monachus schauinslandi*)," 2013, www.nmfs.noaa.gov/pr/species/mammals/pinnipeds/hawaiianmonkseal.htm (accessed January 11, 2013).

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Figure 1. A monk seal resting on a beach in Kauai. Photograph by Jared Wong

From 15 million years ago until the early centuries AD, Hawaiian monk seals likely knew nothing of humans. Members of our species were late arrivals in the Hawaiian Islands. The great seafaring Polynesians settled in the main Hawaiian Islands only about fifteen hundred years ago. Having evolved in a world without people, monk seals show almost no flight response in our presence—as long as they are not threatened they stay put. This lack of fear is part of what made them vulnerable to incredible commercial slaughter in the past. It is also part of why they remain so vulnerable on land even today.

Alongside such generalized threats as starvation, entanglement in marine debris, and the loss of haul-out and pupping sites (due to development and beach erosion), today's monk seals are not infrequently subject to deliberate and violent attack by people, beaten to death on the beach. Hauling out of the water is a vital part of monk seal life: it is required for mating and birthing and provides opportunities to rest, avoid predators, and feed young pups. Some beaches are glorious multispecies havens, with seals and humans flopped out and relaxing on the sand. But for some people seals are "out of place" among the main Hawaiian Islands, where they compete with fishermen for fish. Attempts at conservation have become bound up with deeply unpopular restrictions on fishing and other marine activities.[2]

2. Rose, "Monk Seals at the Edge."

But into this environment of violence and loss some local people are injecting narratives and practices of care. When a seal hauls out on a beach in an inhabited part of the islands, volunteers are called. They go to the reported site and set up a perimeter with stakes and plastic tape; they put up signs of warning, make sure the event is reported, and stay. They are not as much police as educators, so while they make sure that people respect the sleeping seal's need to be left alone, they also answer questions about monk seal biology, history, future, and behavior. Although the official literature does not put it this way, volunteers are ambassadors for monk seals. Their response, their commitment to being there, is in itself an ethical statement.

In the abstract, the idea of hanging out on the beach all day keeping an eye on a sleeping seal sounds great. In actual fact it is both great and not so great. Sometimes it is wet and cold, sometimes sticky and boring. The volunteers need to be knowledgeable, and they need the patience to have the same conversations over and over, day after day. They need to be able to discuss conflicting views about monk seals in a manner that does not exacerbate conflict. It helps to be a good storyteller as well as a good listener.[3]

Through these grounded acts of care, of witnessing and careful storytelling, these volunteers help daily to enact the dream of a flourishing multispecies community on the beaches of Hawai'i. Unexpectedly, interestingly, compellingly, a seal arrives. The arrival feels like a message from the deep, a statement of vulnerability brought onto land by those who live in the ocean but also need to haul out. In these times of extinction and extermination, this moment is a fissure, a happening that becomes a recursive attractor that announces that maybe, just maybe, other kinds of communities might still be possible.[4]

Ethos

The beautiful word *ethos* (plural: *ēthea*) is not widely used these days, although it holds a place in anthropological discussions of aesthetics, poetics, and performance.[5] In ethnographic usage, Clifford Geertz's definition is a good baseline: "A people's ethos is the tone, character, and quality of their life, its moral and aesthetic style and mood; it is the underlying attitude toward themselves and their world that life reflects."[6] Our point of departure from standard ethnography is the recognition that it is not only humans who are known by their ethos.

Ethos, though, is more shifty and elusive than this already open-ended definition suggests. It comes from old Greek, where it meant such things as character or way of

3. Ibid.

4. These short vignettes only gesture toward the mode of engagement that we have been developing in our recent work. For fuller examples see Rose, "Flying Fox"; Rose, "Cosmopolitics"; Rose, "Monk Seals at the Edge"; van Dooren, *Flight Ways*; and van Dooren, "Living with Crows in Hawai'i."

5. Herzfeld, *Anthropology*, 283–84. It also is alive and well in studies of communication and rhetoric and in the scholarly journal *Ethos* (journal of the Society for Psychological Anthropology).

6. Geertz, "Ethos, World View, and the Analysis of Sacred Symbols," 127.

life but also custom and customary practices and places.[7] Homer wrote of the ethos of horses—their habits and habitats. Today it can also mean spirit, as in the spirit or character of a time: a zeitgeist, or an overarching set of values and practices—a style.

Definitions start to become reflexive—ethos is part of what makes a group or kind distinct; we know (or think we know) that given individuals are a *kind* because they are distinct. Dominique Lestel, Florence Brunois, and Florence Gaunet express this point well in their discussion of animals' individual and shared cultures. They conclude that "there will always be a cognitive or behavioral *style* that will characterize chimpanzees as chimpanzees and distinguish them as much from gorillas as from elephants and humans."[8]

And so it is clear that ethos arises through the interplay of sameness and difference. If there were no differences, there would be no background and foreground, no pattern to distinguish, no figure to become meaningful. Ethos involves knowledge, sense of self and other, discernment among kinds.

In short, we are using the term *ethos* to designate broad styles or ways of life. Our interest is in life in all of its diversity. While Lestel and colleagues focus on the "cognitive or behavioral style" of particular animal species, our approach aims to draw in worlds of life beyond the animal kingdom with all of the diverse modes of engagement, entanglement, and cobecoming that this implies. In many of these contexts it does not make sense to focus on cognition and behavior—at least not in their standard (animal, or perhaps human) forms. Myriad other kinds of difference and distinctiveness are to be found: How does a mistletoe plant make its way in the world, attracting and sharing nectar with some and boring into the branches of others? What kinds of relationships do fungi strike up with wind, soil, tree roots, and countless others to shape a world of "intricate but [perhaps] unintended designs"?[9]

Here we are reminded that the wider distinctiveness of ēthea is crafted through relational and participatory intra-action.[10] Ways of being are not formed and sustained in isolation. Each ethos is also a style or way of being and becoming *with others*. Ēthea are not essences but emergent and performative happenings, never isolated or fixed, bleeding into and coshaping one another, and yet somehow maintaining their distinctive uniqueness.[11] This coshaping takes place at multiple levels and across diverse time

7. Thus *ethos* (ἦθος, ἔθος; plurals: *ethe* [ἤθη], *ēthea* [ἤθεα]) is a Greek word originally meaning "accustomed place" (as in ἤθεα ἵππων, "the habitat of horses"; *Iliad* 6.511), "custom, habit," equivalent to Latin *mores*.

8. Lestel, Brunois, and Gaunet, "Etho-ethnology and Ethno-ethology," 171. Although our focus here is general differences at a species (or perhaps population/cultural) level, our approach—like that of Lestel and colleagues—also makes room for individual variability among both humans and nonhumans. See also Lestel, Bussolini, and Chrulew, "Phenomenology of Animal Life."

9. Tsing, "Strathern beyond the Human," 233.

10. On "intra-action" see Barad, *Meeting the Universe Halfway*.

11. Of course uniqueness in this context can be and is gauged in different ways. In some cases it is possible to be curious about how others, human and nonhuman, recognize kinds (their own and others): Vinciane Despret urges us to consider how it is that lions understand lionness, how they decide who is and is not a lion

frames. In addition, as *embodied* ways of life ēthea are not a cultural element somehow added onto a preexisting biology. Rather, they are the product of the differential biosocial becomings—the evolutionary and developmental intra-actions—of organisms and their species in coconstitutive relationship with others.[12]

Ultimately, our focus on diverse ēthea leads us into an ecological animism. To be attentive to ēthea is inevitably to encounter an animated world, woven through with coforming patterns of responsiveness, attention, desire, and communication. Our approach to animism shares much with indigenous understandings (but we do not explore these similarities here).[13] However, we come to animism via our own worldly encounters, read through the refractive lenses of Western science and philosophy.[14] Our focus is on what Emma Restall Orr has called the "relational awakeness" of the world, an awakeness that resides in the multiple and diverse forms of intentionality—of

("Becomings of Subjectivity in Animal Worlds"). Eben Kirksey pays attention to some of the ways that wasps, fig trees, and frogs distinguish between those who are and are not the right "kinds," developing their own taxonomic praxiographies; see Kirksey, "Species." In other cases we simply do not know enough about what matters to others to ask this question seriously. On species as performative cobecomings see van Dooren, "Authentic Crows." The present article is part of a set of two exploring related themes. The other focuses in particular on ethos and witness and includes a fuller discussion of the way in which distinctions among kinds might be made and problematized: Rose and van Dooren, "Encountering a More-than-Human World."

12. See Oyama, Griffiths, and Gray, *Cycles of Contingency*; Oyama, *Evolution's Eye*; and Haraway, "SF." The modes of sociality of any given ethos are rooted in specific biological capacities. While many animals' social lives are immediately recognizable to us (although their existence has nonetheless often been denied), plants, microorganisms, and various others are also deeply social beings in their own ways, exchanging signs and meanings, communicating in ways that we often underestimate (discussed further below). As one of us has argued elsewhere,

> in this sense, sociality is perhaps a common feature of all life and should not be restricted to those organisms who possess modes of interaction similar enough to those of humans to be immediately recognizable as such. In other words, our being social creatures, as well as the specific forms that this sociality takes, are in important ways features of our biological makeup. At the same time, however, biology has itself evolved within the context of very material processes of intergenerational life in the company of others. . . . There is no sociality outside of its specific biological possibilities; nor is there any biological form that has not been shaped by its own particular social milieu. (van Dooren, *Flight Ways*, 163)

It is in this complex space that ēthea emerge.

13. Long histories of indigenous thought have addressed the animated character of the perceptible world, and it is at that scale that people say other beings have culture. Living beings are "culture creatures," and knowledge of this fact is, on the face of it, not at all arcane. See Rose, "Death and Grief in a World of Kin." One sees some birds dance; one hears others sing; one watches them finding their food, making their nests, raising their young—the way of participatory ethos is not hidden. Indeed, given the relational and participatory qualities of life, it could not be hidden—but nor is it always addressed to, or perceptible by, humans. And of course it may involve hiding, deception, and many other modes of communication and resistance. These indigenous animisms are grounded in the recognition, as Graham Harvey has put it, "that the world is full of persons, only some of whom are human, and that life is always lived in relationship with others" (*Animism*, xi). Also see Rose, "Val Plumwood's Philosophical Animism." Together we are also beginning work on a larger project that aims to further flesh out this particular approach to animism.

14. On refraction, see Haraway and Goodeve, *How Like a Leaf*; and Metcalf, "Intimacy without Proximity."

perception, striving, desiring, sensing, adapting, and responding—that we see evidenced all around us.[15]

Moving well beyond the obvious examples of intentional behavior in our close relatives in the animal kingdom, biochemist Daniel Koshland notes: "'Choice', 'discrimination', 'memory', 'learning', 'instinct', 'judgment', and 'adaptation' are words we normally identify with higher neural processes. Yet, in a sense, a bacterium can be said to have each of these properties."[16] In a similar vein, recent work on plant intelligence has increasingly indicated the widespread existence of sentience and agency of diverse kinds. Plants emerge from this work as beings that sensitively detect and respond to their environments in highly adaptive and communicative ways, drawing in resources as well as warding off herbivores, perhaps by synthesizing chemical deterrents or even by releasing other chemicals that provide cues to potential predators of problematic grazing insects.[17]

Ecological animism responds to a world in which all life—from the smallest cell to the largest redwood—is involved in diverse forms of adaptive, generative responsiveness. This responsiveness may happen in the immediacy of the moment (as two albatrosses sing and dance to form a pair bond); it may happen through drawn-out developmental processes (as a plant slowly grows toward the sun), or perhaps even over evolutionary time frames that remake entwined morphological and behavioral forms to better inhabit their worlds. However it happens, though, life is saturated in diverse forms of purposeful attentiveness and responsiveness.[18]

In paying attention to these processes, ecological animism is grounded in *recognition* as a mode of encounter that "aims for the greatest range of sensitivities to earth others."[19] But more fundamental than any specific set of ideas about what plants, bacteria, and others are and do is the cultivation of a kind of openness toward the world. As Jim Cheney and Anthony Weston note, "The kind of practice asked of us is to venture something, to offer an invitation . . . and see what comes of it. We are called, in fact, to a kind of etiquette . . . in an experimental key: the task is to create the space within which a response can emerge or an exchange coevolve."[20] In short, this is a commitment not to assume that we know, that we could know, all of the ways in which our

15. Orr, *Wakeful World*. Others have called this mindfulness. In this context, the point is to move away from a dualistic, Cartesian construction of mindfulness that separates it sharply from the body and sees its fullest expression in abstract forms of rationality. We should not assume that we know what mindfulness is, and certainly not that there is only one proper form of it (that associated with the rationality of the [unmarked] human).

16. Quoted in Margulis and Sagan, *What Is Life?*, 219.

17. Hall, *Plants as Persons*; Hustak and Myers, "Involutionary Momentum"; Trewavas, "Plant Intelligence"; Trewavas, "Aspects of Plant Intelligence"; Marder, *Plant-Thinking*.

18. Val Plumwood explores similarly expansive, more-than-human forms of intelligence and sentience in "Nature in the Active Voice."

19. Plumwood, *Environmental Culture*, 177.

20. Cheney and Weston, "Environmental Ethics as Environmental Etiquette," 126.

world is lively and responsive. Ecological animism is not a doctrine or orthodoxy but, rather, an opening into a mode of encounter.

Lava

The Hawaiian island chain is a place of immense biological diversity. Spending time in the forest or the surrounding seas, one can easily be overwhelmed by the sheer abundance, energy, and vitality of life. But out on the lava fields, surrounded by black as far as the eye can see, other kinds of life, other patterns of coming into and out of the world, are also taking place. They may be harder to see at first glance, but the lava fields of Hawai'i are equally places to celebrate living processes.

The vibrancy of these places starts with the island-forming potential of the lava itself. For many Hawaiian people this is the work of Pele, who both creates and destroys. Pouring out of fissures deep beneath the ocean's surface, lava cools and accumulates over millions of years to build islands that eventually rise above the surface of the water. The youngest member of this island chain, the Island of Hawai'i, is now roughly two million years old. Moving northwest along the chain, we pass through progressively older islands. Geologic processes over immense periods of time birthed these islands from deep within the fertile Earth. This is a different kind of fertility, a geologic fertility—sterile in biological terms but lively and generative in the world of rocks.

Processes of decay operate in this world, too. Traveling out beyond the islands in the main Hawaiian chain, we encounter islands that are just clinging to life and some that are gone altogether with only faint traces to mark their former presence. As these islands move away from the hot spot that birthed them—as a result of shifting tectonic plates—processes of erosion by wind and wave gradually return them to the sea. Far out in the chain, Midway Atoll is now nothing more than an accumulation of sand around coral reefs that once encircled a volcanic island long since disappeared. Here, the biotic holds the geologic, its form and its memory. Different processes of living and dying, of coming together and dissipating, are working themselves out at temporal and spatial scales that vary across diverse geologic, evolutionary, and organismal processes: the life cycles of island chains and that of fleeting coral polyps in intimate entanglement.

But coral and the many creatures—such as monk seals—that form marine communities around it are just some of the biota made possible by these lively rocks. As lava cools it becomes a clean slate in which new possibilities might take root. The lichen are usually the first to take up this offer (fig. 2). Circulating in immense quantities in Earth's atmosphere, most of their spores will never germinate—the numbers are against them. But every now and again, "a spore settles onto a patch of bare rock of the right age and texture and with enough moisture and sunlight that it germinates and, if it is lucky enough to find its symbiotic partner, grows."[21] This symbiotic partner is an alga or cyanobacterium that provides photosynthetic capabilities to a fungus. All lichen are cross-kingdom collaborations of this kind.

21. Flaspohler, "Delicate Web of Life."

Figure 2. Fern and lichen on lava in Kipahoehoe Natural Area Reserve. Photograph by brewbooks

Over time, lichen growth and death produce the biological material that, in combination with the elemental weathering of rock, produces soil. Plants like *o'hia* (*Metrosideros polymorpha*), expertly adapted to these environments, find cracks in the lava where moisture and nutrients can accumulate and a seed can germinate. As they grow, they contribute to the slow production of soil as their roots further help to break up the rock while their vegetation adds new organic material.

Eventually, bare rock becomes a flourishing and diverse forest full of the incredible variety of lichen, plants, birds, and others that is now found in this island chain. But this is only one life story, or set of stories. From another perspective this is a story about the vibrancy of rock, as successive forests come and go beneath fresh waves of hot lava. But also it is perhaps a story about water, a story that moves from ocean to ocean as islands come and go. Above all, therefore, this is a story of entanglements, of the lively biotic, geologic, atmospheric, and oceanic processes that are our changing planet.

Liveliness

Working from the foundation that our world is constituted out of countless interwoven ēthea, the question becomes, how might we practice and embody this mode of responsive encounter in our own work? Ethnographers try to capture humans' distinct ways of

being and becoming, writing them up as ethnographies. Might our encounters in the larger-than-human world be brought into written form as ethographies in a way that would give others vitality, presence, perhaps "thickness" on the page and in the minds and lives of readers? This is an approach that might start with Geertz's understanding of man [*sic*] as "an animal suspended in webs of significance he himself has spun"[22] but that would quickly insist that humans are not the only beings suspended in such a way and that no one—no group or species—ever spins alone.[23]

The intention here is not to slip into the hubris of claiming to tell another's stories but, rather, to develop and tell our own stories in ways that are open to other ways of constituting, of responding to and in a living world. In this context, stories are powerful tools for "connectivity thinking."[24] Unlike many other modes of giving an account, a story can allow multiple meanings to travel alongside one another; it can hold open possibilities and interpretations and can refuse the kind of closure that prevents others from speaking or becoming.[25] Of course, not all stories do this in practice. Good ethographic accounts refuse to become the kinds of stories that shut out, or normalize, all others—rendering invisible the conditions of their own telling.[26] They are active sites for the ongoing weaving or braiding of stories, efforts to inhabit multiply storied worlds in a spirit of openness and accountability to otherness.

Telling these kinds of stories is an inherently multidisciplinary task, one that draws us into conversation with a host of different ways of making sense of others' worlds. In Anna Tsing's terms, it is about "passionate immersion in the lives of nonhumans."[27] Our particular approach draws heavily on a subsection of the natural sciences

22. Geertz, "Thick Description," 5.

23. We understand these ethographies as part of the broader field of multispecies studies that this special issue explores, populated by a range of related but distinct approaches, including multispecies ethnography (Kirksey and Helmreich, "Emergence of Multispecies Ethnography"), etho-ethnology (Lestel, Brunois, and Gaunet, "Etho-ethnology and Ethno-ethology"), anthropology of life (Kohn, *How Forests Think*), anthropology beyond humanity (Ingold, "Anthropology beyond Humanity"), extinction studies (Rose and van Dooren, "Unloved Others"; Rose, van Dooren, and Chrulew, *Extinction Studies*), philosophical ethology (Buchanan, Bussolini, and Chrulew, "General Introduction"), and more-than-human geographies (Lorimer and Driessen, "Wild Experiments at the Oostvaardersplassen"; Whatmore, "Introduction"). For a fuller discussion of this general space, see the contribution by van Dooren, Kirksey, and Münster in this issue. The particular approach outlined in this article has much in common with these other approaches, placing particular emphasis on responsiveness, both in the sense of attentiveness to diverse forms of lively activity and ways of life and as an ethical imperative, a response-ability (discussed further below).

24. Weir, *Murray River Country*; Muecke, *No Road*.

25. Smith, "Hermenuetics and the Culture of Birds." For a discussion of the way in which nonhumans might write their own stories in/on the landscape as well as in humans and our stories, see Benson, "Animal Writes."

26. On stories that normalize all others see Haraway, "SF."

27. Tsing, "Arts of Inclusion," 29. Our particular approach takes inspiration from James Hatley's work on narrative and testimony in the face of the Shoah (see Hatley, *Suffering Witness*). Hatley forcefully reminds us of the ethical demands of the act of writing, of telling stories. In place of an approach that would reduce others to mere names or numbers, in place of an approach that aims for an impartial or objective recitation of the "facts,"

within the fields of biology, ecology, and ethology (animal behavior) but also geology, chemistry, and more. In telling stories informed by these literatures, ethographies invite readers into a sense of curiosity about the intimate particularities of others' ways of life: how they hunt or reproduce, how they relate to and make sense of (or story)[28] their particular place, how they entice pollinators or throw their spores to the wind.

Beyond the natural sciences, ethographies also make use of the detailed observations and understandings of other peoples who, for a diverse range of reasons, make it their business to understand other forms of life: from the knowledge of hunters and farmers, artists, indigenous peoples, animal trainers, wildlife carers, "cat yoga" practitioners,[29] and many others. In each of these cases, as with the insights of the natural sciences, knowledges must be evaluated for what they teach us as well as, with a critical eye, for the particular political and technical architectures of framing within which they are produced. In short, it matters which stories we use to tell and think other stories with.[30]

While an ethography tends to start with, to be provoked by, other-than-human ways of life, the openness of these accounts inevitably draws humans into the frame. To this end, more conventional ethnographic methods are an indispensable component of an ethography. What does the disappearance of flying foxes mean to *this* community of Aboriginal people in Australia for whom the species is kin? How is the absence of vultures in India experienced by the Parsee community that has traditionally relied on these birds to consume their dead?[31] In this way, ethographic work is attentive to other people's ways of life and understanding (including other animisms), to the biocultural complexity of the worlds that we craft with others. In exploring these and other sites of entanglement, ethographies offer important insights into the many different, and consequential, ways in which, as Tsing succinctly puts it, "human nature is an interspecies relationship."[32]

With relationality and openness in mind, ethographies are always about more than a singular ethos in isolation: these are multispecies stories in which entangled

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Hatley argues for a mode of witnessing that is from the outset already seized, already claimed, by an obligation to those whose story we are attempting to tell. In the context of ecocide and many other forms of mass death, this mode of storytelling is particularly important. Along with the work of remaining true to the facts of the situation, witnessing insists on truths that are not reducible to populations and data, a fleshier, livelier truth that in its telling might draw others into a sense of accountability and care.

28. van Dooren and Rose, "Storied-Places in a Multispecies City."

29. For discussions of cat yoga and other fascinating etho-ethnographic encounters with felines, see the work of Jeffrey Bussolini and Ananya Mukherjea at the Center for Feline Studies/Avenue B Multi-Studies Center, City University of New York.

30. Haraway has made this point in conversation with Marilyn Strathern's work on the ideas we think other ideas with. See Haraway, "SF"; and Strathern, *Reproducing the Future*, 10.

31. We have explored these issues in Rose, "Flying Fox"; and van Dooren, "Vultures and Their People in India."

32. Tsing, "Unruly Edges," 144.

becoming across all of the kingdoms of life is an unavoidable reality. In addition, many entities usually considered to be nonliving are key parts of an ethographic account. The volcanic rock that forms the Hawaiian island chain offers a sense of what is at stake here. This lively rock prompts us to ask questions differently. It draws our attention toward what Kathryn Yusoff has called the "minerality" of the biologic;[33] it undoes any sense of a firm border between the living and the nonliving and throws into question certainty about what this distinction might even mean. And so it is clear that the nonbiotic will always be part of an ethographic account, but we remain deliberately open—prepared to be invited and to respond—to the possibility that the liveliness of such beings might itself become the central focus (insofar as there is one) of an ethographic account. For us, the key issue for ethography is that of taking others seriously in their otherness—whether cultural, biological, geologic, chemical, or something else entirely—and consequently learning to ask and to see how we might be called to respond.[34]

Crows

Tucked away in aviaries on the south side of Kilauea, on the Island of Hawai'i, are some of the rarest birds on earth. Among a range of smaller honeycreepers are some of the only remaining *'alalā*, or Hawaiian crows (*Corvus hawaiiensis*), a species that has been extinct in the wild for more than a decade now (fig. 3). These are big, beautiful birds, and their absence has not gone unnoticed. With so many of Hawai'i's forest birds having already been lost in the last few centuries, it seems that the 'alalā may have been the last remaining seed disperser for at least three plant species: *ho'awa*, *halapepe*, and the *loulu* palms. Beyond simply moving seeds—itself important for plant survival—it seems that some of these seeds germinate better or, in the case of ho'awa, will only germinate if the outer fruit has been removed (something that 'alalā once routinely did).[35] And so it is not surprising that these three plants are in decline: halapepe and the loulu palms are themselves rare or endangered, and most of the ho'awa trees encountered in the forest today are older with a "general lack of seedlings or saplings in the wild."[36] A long and intimate history of coevolution that binds avian and botanical lives is unraveling here, a shared past creating specific and shared vulnerabilities in which coevolution can potentially switch over into coextinction.

In addition to these plants, many local people have also been drawn into the absence of 'alalā. For some (native) Hawaiians, 'alalā is part of the cultural landscape: these birds hold stories and associations in the world. They are an *'aumakua* or ancestral deity for some; and the plants and forests that might disappear or change

33. Yusoff, "Geologic Life."

34. There is a growing body of work on lively materiality beyond the biotic, some of which is likely compatible with this ethographic approach. Also see contributions by Reinert and by van Dooren, Kirksey, and Münster, this issue.

35. Culliney et al., "Seed Dispersal by a Captive Corvid."

36. Culliney, "Seed Dispersal by the Critically Endangered Alala," 21.

Figure 3. A Hawaiian crow in captivity at the Keauhou Bird Conservation Center. Photograph by Thom van Dooren.

significantly without their seed dispersal are themselves also culturally significant in various ways. Many other locals are also drawn into this experience of loss, trying in their own ways to reckon with the affective burden of living in a place where crows are no longer present, a place in which (paraphrasing one biologist) we have lost the most intelligent and charismatic component of our forests.[37]

But ʻalalā have themselves also been altered by more than a decade of captivity. There are now suggestions that their once remarkable vocal repertoire—their raucous calls and mournful songs—is diminishing. Perhaps this is because they have less to talk about, or perhaps juvenile birds simply have not been exposed to enough chatter from their elders.[38] Similarly, know-how about predators and how to avoid them may not be passed between generations in captivity, potentially impacting their future survival when they are eventually released.

And yet release itself is also a complex prospect. Getting the birds ready is one part of the story, but the forest and the surrounding communities into which they might return are also vitally important. Plans by conservationists to fence a section of a local

37. Jeff Burgett (US Fish and Wildlife Service), interview by van Dooren, Hilo, Hawaiʻi, December 19, 2011.

38. For further information, see "Hawaiian Crow," www.animal-acoustics.com/current-research-phd/hawaiian-crow (accessed August 21, 2013).

forest reserve to allow the vegetation to recover as a future release site have been greeted with hostility by some. Fencing itself raises concerns around limited access (concerns that for many Hawaiians are explicitly tied to a long history of occupation and dispossession), as does the proposed removal of pigs and other ungulates that some people hunt.[39]

There are no simple answers here. Crows, plants, pigs, and diverse local people are all bound together in an unfolding story of coevolution, colonization, conservation, and more. Each of these living beings has an ethos; each has a way of life that has emerged and endured in entangled company with others. In a time of ongoing colonization and extinction, these stories call us into response but never in a singular or final way.

Response: Becoming-Witness

It is clear, then, that ethographies do not aim to impartially produce "objective" accounts of the world (whatever these might be). Instead, this approach is grounded in the conviction that making others fleshy and thick on the page, exposing readers to their lives and deaths, may give rise to proximity and ethical entanglement, care and concern. At the core of this notion of storytelling as an ethical practice is the understanding that the stories we tell are powerful contributors to the becoming of our shared world. Explicitly rejecting a simple division between the real and the narrated,[40] we see storytelling as a dynamic act of "storying." As Haraway notes, "'World' is a verb," and so stories are "*of* the world, not *in* the world. Worlds are not containers, they're patternings, risky co-makings, speculative fabulations."[41] Telling stories has consequences, one of which is that we will inevitably be drawn into new connections and, with them, new accountabilities and obligations. In short, these are *lively* ethographies in both message and form—in their commitment to the openness and continuity of diverse ways of life and in their attempt to enact stories as world-making, life-shaping technologies.

Ethographic storytelling is about the arts of becoming-witness, which include both attention to others and expression of that experience: to stand *as* witness and actively to *bear* witness. As we are seized, so we bear witness in order that others may be seized, telling stories that draw audiences into others' lives in new and consequential ways, stories that cultivate the capacity for *response*.

This focus on response enables a more interesting approach to questions of ethics in multispecies worlds.[42] In exploring *response-ability*—the capacity to respond—we move beyond simplistic framings of responsibility as a question of human agency in a passive and inert world. All living creatures, and others too, respond to the world around them. What it means for each being, in each case, to respond is quite different. It is, however, through these responses that worlds are constituted. We are all accountable for—implicated and at stake in—the worlds that our actions bring into being.

39. van Dooren, "Living with Crows in Hawai'i."
40. van Dooren, *Flight Ways*, 12.
41. Haraway, "Jeux de ficelles." Quote here taken from an earlier English-language draft of this essay.
42. Haraway, "Awash in Urine."

Here, the line between response and reaction is not an abyssal divide[43] but a site for the ongoing questioning of the various modes of being with others that are open to different forms of life at different times. Similarly, "the human" does not mark the sole site of responsibility in any straightforward way that again separates us from them. To begin with, we must recognize that our responses to others are grounded in our own particular ēthea. These responses arise from long processes of evolution and the development of emotional and cognitive competencies, many of which are shared with a range of other species. Beyond basic biology, all people, and other creatures too, respond in their own particular ways to given worlds as a result of their own life histories, personal developmental dynamics, and the diverse forms of knowledge and truth that they have inherited and been disciplined into. In short, response is always an achievement, the outcome of a complex process that combines a range of elements that are often glossed as biology, learning, culture, and more.[44]

As such, there is no singular "responsible" course of action; there is only the constantly shifting capacity to respond to another. What counts as good, perhaps ethical, response is always context specific and relational. It is always being rearticulated, reimagined, and made possible in new ways, *inside* ongoing processes of call and response and the worlds that they produce. Here, responsibility is about developing the openness and the sensitivities necessary to be curious, to understand and respond in ways that are never perfect, never innocent, never final, and yet always required. Stories are opportunities to test and explore different modes of responsiveness, to "learn to be affected"[45] in new ways, to cultivate the intellectual, emotional, and critical capacities necessary to recognize our own implication in the world, the consequences of our actions, and possibilities for other kinds of futures.[46]

More than this, though, ethographic storytelling is about responding to others as we encounter them *in the richness of their own stories*. While this response is often grounded in immediacy, more demanding forms of responsibility require a curious attentiveness to another that exceeds the given moment so that we might better understand the other in order to make an appropriate response. As Haraway notes, "Caring means becoming subject to the unsettling obligation of curiosity, which requires knowing more at the end of the day than at the beginning."[47] This form of response takes an interest in what matters to another rather than reading one's own positioning onto them.[48] From this perspective, responsibility is inseparable from a consideration of ēthea: it

43. Derrida, "And Say the Animal Responded?"

44. This situation reminds us that ēthea cannot be neatly mapped onto biological species or any other fixed taxonomy. There are many ways of making cuts within and between what counts as a "way of life." For further discussion, see Rose and van Dooren, "Encountering a More-than-Human World."

45. Despret, "Body We Care For," 131.

46. This project is very much in line with Tsing's call for the cultivation of "arts of noticing" in "Arts of Inclusion" and van Dooren, Kirksey, and Münster's discussion of the "arts of attentiveness" in this issue.

47. Haraway, *When Species Meet*, 36.

48. Rose, "Recursive Epistemologies"; Rose, "Taking Notice."

demands an attentiveness to the ways in which others make and live their worlds; it demands ethography.

But, as we have seen, to witness is also to participate in the world in its relational becoming. In this context, our curiosity about and for others must be definitively expansive, perhaps even explosive. Can our awakening response draw us into this particular story and on into encounters with the many others who are bound up in relationships of nourishment, care, meaning making, and more within a broader "ecology of selves"?[49] Responsibility and ethography are delicately and recursively entangled here. Responsibility requires attention to ethographic context, to others' forms of worldly responsiveness, while ethography draws us into new relations and forms of response-ability. In other words, good storytelling is generative—we don't know quite where it will take us.

Much of our own work has brought us into situations where some fateful combination of ignorance, negligence, selfishness, and deeply conflicting values is spelling disaster for individuals and species. Our arts of witness involve turning toward rather than away. The turning toward is a material and semiotic kinesis that seeks engagement with the world of life. Confronting atrocity, we are acutely aware of the prevalent slippage between explanation and justification; our approach refuses to reduce death work to a rational calculation. We are in the most difficult place of witness, where to say nothing is abhorrent and to say anything is already to risk reductions. And yet we "stay with the trouble"[50] because the trouble has seized us, and we cannot turn our backs. An ethics of refusal grounds this work: it is the refusal, following Emmanuel Levinas, to abandon others.[51] Put in the positive, it embraces the ethical call others make upon us in the *meaningfulness* of their lives and deaths.

Storytelling is one of the great arts of witness, and in these difficult times telling lively stories is a deeply committed project, one of engaging with the multitudes of others in their noisy, fleshy living and dying. It is the aim of lively ethographies to seize our relational imagination. It is an engagement with the joys, passions, desires, and commitments of Earth others, celebrating their ēthea in all their extravagant diversity.

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49. Kohn, *How Forests Think*.
50. Haraway, "SF."
51. Levinas, "Ethics as First Philosophy," 83.

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About a Stone

Some Notes on Geologic Conviviality

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Abstract Can a stone be a critter? Placing multispecies studies in conversation with the geological turn, this article examines the place of a particular sacrifice stone in the ambit of a coastal mining development in northern Norway. The argument develops a reading of resource capitalism as ontological project—using the stone as a lens to explore imaginaries of relational personhood, the distribution of harm, and the limits of vulnerability. In closing, the article relates the "life" of the stone to ongoing discussions about the Anthropocene and how to develop novel, more inclusive research imaginaries—specifically, research imaginaries that address (and subvert) a modern "geontology" that renders the inorganic as passive, inert, and freely available for exploitation.

Keywords stone, mining, harm, capitalism, conviviality, multispecies, geontology

Stone, they say, is "good to think with": ready to hand, natural symbol of permanence, solidity, and duration[1]—evoking the immense spans of geological time, abyssal eternities beyond (and before) life itself.[2] A number of recent interventions have foregrounded this temporal affordance[3]—to reimagine human life through a mutually constitutive infiltration of *bios* and *geos*, for example.[4] There is often a satisfying mutuality to these operations: the hard stone comes alive, soft flesh reveals its geological strata. My concern here, however, is less with anthropocenic reimaginings of the human subject than with the scope of existing relational imaginaries—and with the possible role of stone-human relations in the ontological politics of a present moment defined, increasingly, by catastrophic violence and the unfolding collapse of planetary ecosystems. I situate this question between two research imaginaries: one, the multispecies

1. Douglas, *Natural Symbols*; Cohen, *Stone*.
2. Irvine, "Deep Time"; Rossi, *Dark Abyss of Time*.
3. Raffles, "Writing Culture."
4. Yusoff, "Geologic Life."

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world of critters and lovable (or unlovable) beings;[5] and two, more implicitly, the disconcerting new vistas opened by the geological turn.[6] As a third pole, triangulating the imaginal horizon of this essay, I put both in conversation with the work of Ursula K. Le Guin—on the tacit understanding that speculative fiction is a discipline of the otherwise-possible and, thus, a cognate to anthropology.[7] What kind of critter might a stone be? Does it have a life, or something like it? What modes of passionate immersion[8]—or love, or intimacy—could a stone afford?

In the context of this special issue, my argument addresses itself specifically to the divide between living and nonliving, between life and nonlife (rather than death). The multispecies qualifier operates through powerful conceptual and affective investments in the idea of life. While easy to sympathize with, claims about the nature of life as a superordinate domain also warrant hesitation—particularly where they define life preferentially, through an a priori differentiation from other domains.[9] Claims of this sort risk cutting the world as they assemble it, like a knife—and it is worth keeping in mind that the binary ontologies of modernity are anything but an innocent construct.[10] The material I explore here forms part of a larger project, to read the ongoing dynamics of Northern resource extraction and capitalist modernization through the figure of sacrifice.[11] If extractive resource capitalism is a sort of ontological machine[12]—an engine that continuously remakes the world and its entities as already-given, in ways that facilitate surplus value extraction—then it is all the more vital to question the paradigms that subtend it and produce not just nonhuman life but also *non*life as domains of control, use, modification, and productive investment.[13]

Naturally, this critical orientation also shapes my approach to the multispecies concept, raising issues that I return to in the conclusion—but before I get to that, there is some ground to cover. The argument over the next few sections unfolds as follows. First I introduce a particular stone I encountered during fieldwork. I then situate that stone within some of its spatial contexts and explore some of the economies of harm[14] that are in play around it. The argument treats harm as matter for an exploratory

5. Rose and van Dooren, "Unloved Others"; Haraway, *When Species Meet*; Kirksey and Helmreich, "Emergence of Multispecies Ethnography."

6. Negarestani, *Cyclonopedia*.

7. See Haraway, "SF."

8. Tsing, "Arts of Inclusion."

9. For example, while I find the work of Anna Tsing an ongoing inspiration, I also hesitate when she draws the lines like this: "The yet-to-come is part of the way living things react; we offer our living designs in regard to potential futures. This is not the case with rocks or other non-vital things" ("More-than-Human Socialities," 28).

10. Latour, *We Have Never Been Modern*.

11. Estonian Research Council personal research grant PUT30, "Life in the Sacrifice Zone" (2013–17); Reinert, "Sacrifice"; Reinert, "On the Shore"; Hugo Reinert, "Notes from a Projected Sacrifice Zone," unpublished manuscript, www.academia.edu/19532921/Notes_from_a_Projected_Sacrifice_Zone.

12. Reinert, "On the Shore."

13. Povinelli, "Social Projects of Late Liberalism."

14. Reinert, "Disposable Surplus."

ontological determination: what beings exist, such that they can be harmed? The domain of life does not necessarily coincide with, or exhaust, the domain of vulnerability. This takes me to cosmopolitics and the question of method, the *how* of multispecies research, and prompts an experimental digression that segues into the conclusion, where I return to the issues I have marked out here. The argument thus explores stone relations across three spheres: first, in relational landscape practices; second, through an ontological parsing of harm that tunes description to the question of what entities exist, such that they can be harmed; and third, at the level of method, in the pragmatic question of how nonhumans might be brought into research imaginaries—and given space—in ways that do justice to their modes of existence, both actual and potential.

A Stone

At Stallogargo—half an hour or so south of Hammerfest, in the northern Norwegian county of Finnmark—there is a stone. It leans out across the waters of Repparfjord, a fjord that cuts through the municipality of Kvalsund for about fourteen kilometers. The stone has been there for a long, long time. Written records note its local importance at least as early as the eighteenth century,[15] and it has since been noted (and described) by a range of travelers, ethnologists, and local chroniclers.[16] Locally the stone goes by the name of Stallo, or Stállu, a term borrowed from the indigenous Sámi language of the region, where it denotes a dark or threatening stranger.[17] In northern Sámi the stone is known as Áhkkanjárstábba (*kjerringnesstabben* in Norwegian, literally "the stone of crone cape"). The stone, people say, is a *sieidi*—a Sámi sacrifice stone, part of a threatened but persistent indigenous landscape that predates the centuries of colonization that have washed over the region.[18] There are many such stones across Sápmi, the indigenous territories of northern Scandinavia and northwestern Russia: some are lost, or forgotten, but many of them are still known. Often what marks them is some striking feature: an unusual shape, an isolated location, or an odd color that renders them distinctive—"natural landmarks" in their surrounding landscape.[19]

In their time, *sieidi* stones were recognized as powerful entities—capable not just of transacting with humans but of forming bonds and entering relations, gifting petitioners with luck and material benefits in return for appropriate offerings. *Sieidi* transactions with humans could range from the exceptional—the sorcerous *noaide* who sacrificed a child to a stone to secure power in a forthcoming battle[20]—to the mundane: a cordial greeting, a few coins offered in passing. Some humans entered into lifelong relations with particular stones, as servants or allies. Under the auspices of the Christian

15. Leem, *Beskrivelse over Finnmarkens Lapper*.
16. Qvigstad, "Lappische Opfersteine"; A. Sveen, *En Stein til Gudenes Ære*; Schanche, "Samiske kulturminner."
17. Jernsletten, "Hidden Children of Eve."
18. Manker, *Lapparnas heliga ställen*; S. B. Sveen, "Reinen, reineieren og reinbeitelandet," 54–87.
19. Kuokkanen, "Lahi and Attaldat," 25.
20. Turi, *Account of the Sami*, 83.

colonization—and its continuation into the Norwegian nation-building project, from the nineteenth century onward—relations with *sieidi* stones were suppressed and persecuted as a form of idolatry.[21] Some infer from this that the sacrificial stones themselves belong to a pre-Christian era—but with the Stallogargo stone, as with other *sieidi* in Finnmark, there are signs of sacrificial activity through the twentieth century and beyond. In the 1940s, for example, local children reported finding old silver coins, fish heads, bones, and antlers at the Stallogargo stone.[22] People from the area have told me of sacrifice practices continuing to the present day; I return to some of these below.

Johan Turi, the Sámi scribe, noted that there are several types of *sieidi*: fishing, hunting, trapping, reindeer.[23] Each grants luck in certain kinds of endeavor, in return for a sacrifice in kind. A fishing *sieidi*, for example, might ask for half of a fishing catch in tribute from its petitioners—in return for which, Turi said, the stone would "drive into the net as many fish as they could gut."[24] The Stallogargo stone is known, traditionally, as a stone of this latter type: a fishing *sieidi*.[25] A typical story of its powers runs as follows: A man was out on the fjord, fishing with his friends, when he looked over to the stone on the shore. Addressing it, he said, "Now you must make sure we get halibut. Then I will give you halibut bones and halibut heads." The next day, collecting the nets, the men found a bountiful catch. Laughing, the man dismissed the stone: "Surely you have received enough heads already? You have received for this, and for this." The stone was never repaid. Later that day a storm broke, blocking the way to Hammerfest, and the catch was spoiled before the men could sell it. As the saying goes, "The sacrifice stone gives, but the sacrifice stone takes back if you break your word."[26]

Many stories of this sort are contemporary: one boy sacrificed some chewing gum for luck in fishing, another for luck in a forthcoming sports game.[27] A few years ago, a football trainer from the area insulted a Sámi referee at a game and was (reportedly) cursed. To this day, the story of how he tried to lift the curse by fishing herring to sacrifice at the Kvalsund stone echoes in the popular press[28]—index, perhaps, of the complex and ambiguous modernity of "the north" in national imaginaries. One particularly striking recent story concerns the construction of the new road to Hammerfest, at the end of the 1950s.[29] The chief engineer on the project intended to blow up the stone to make way for the new road. Before the plan could be executed, however, the man died in a brutal car accident. Later, in a dream, his successor met the stone—who told him that

21. A. Sveen, *En Stein til Gudenes Ære*, 10; Rydving, *End of Drum-Time*.

22. As reported to me by local informants; also noted by chroniclers, for example, A. Sveen, *En Stein til Gudenes Ære*, 15.

23. Turi, *Account of the Sami*, 83.

24. Ibid.

25. Although it is also reported to assist travelers; see below.

26. Larsen and Larsen, *Hodeløse menn og ihjelfrosne haikere*, 33–34.

27. Schanche, "Samiske kulturminner," 97–98.

28. Steffensen, "Fotballen full av overtro."

29. Schanche, "Samiske kulturminner," 97–98; A. Sveen, *En Stein til Gudenes Ære*, 18.

"whoever blows me up will lose his head." The exact phrasing varies: in some versions the warning comes not in a dream but from a passing Sámi reindeer herder who pronounced that "if you blow up the stone, Hammerfest will burn."[30] Whatever the engineer heard, however, the story is that he refused the task—and that the road was placed inland from the stone, leaving it in peace.

Stories like this narrate the powers of the *sieidi*, its ability to grant luck and punish transgressors. They also codify the particular moral stance of the stone—it upholds transactional standards, ensuring that promises are kept and obligations fulfilled[31]—just as they confirm and reproduce its presence in the landscape, as a relational entity engaged not only ritually but also in the context of pragmatic everyday encounters. Nils Oskal, a reindeer herder and philosopher, draws a relevant distinction between *sieidi* worship and common politeness: "Common courtesy indicates that you should greet it and wish it well in your thoughts when passing by. It is unheard of to argue with a *sieidi* or enter into conflict with it. It is best to wish it peace and leave it alone."[32]

Accounts of everyday interactions thus parse the *sieidi* less as "supernatural" entities than as a kind of nonhuman neighbor: geological beings, enmeshed in the same networks of transit, contact, interaction, and exchange as humans—networks of relation that constitute the tundra itself as a more-than-human polity, a shared or convivial space defined by an ethos of pragmatic coexistence. A few years ago, during a car ride across the tundra, Oskal summarized this ethos to me as a kind of cosmopolitical imperative—not so different, he said, from the radical principle of Christian charity: an obligation to "extend politeness to all beings that cross your path," whether they be wolf, plant, reindeer, human, or stone.[33] In a recent presentation, Britt Kramvig and Helen Verran interpret the *sieidi* as an institution of moral governance: nonhuman entities that regulate human behavior, inculcating protocols of fairness, politeness, honesty, and respect that fashion appropriately relational human subjects.[34] Equally, the stones might be thought of as a kind of "earth being"—kin to the great mountains and volcanoes of the Andes, whose geological existence weaves into and intersects with the lives of their human denizens in complex ways, irreducible to a geological understanding of stone.[35] Like these mountains, the *sieidi* occupy both human and nonhuman time scales: echoing a time before Christianity and colonization, foreshadowing (perhaps) remote futures beyond the human—but capable also of acting, then as today, within the

30. "Syklende Pensjonister" ("Biking Pensioners"), syklendepensjonister.wordpress.com/2014/07/22/i-og-rundt-verdens-nordligste-by-hammerfest/ (accessed March 15, 2016).

31. Reflecting on the Stallogargo stone, one informant described it as "a being that does not live or think, but which nonetheless responds morally. Words fall short, really."

32. Oskal, "On Nature and Reindeer Luck."

33. See also Reinert, "Entanglements."

34. Kramvig and Verran, "Stones as Entities." The program for the conference is available at www.sv.uio.no/sai/forskning/aktuelt/arrangementer/arctic-domestication-in-the-era-of-the-anthropocen.html (accessed March 15, 2016).

35. de la Cadena, *Earth Beings*.

span of individual human lives. Unlike the Andean mountains, however, the northern *sieidi* have played little role on the political stage—at least, so far.

Landscapes

Once, and still to some, the *sieidi* presided over a landscape in which their power was to offer boons and protection: masters of fish, guardians of reindeer—powers in the land, but also neighbors, lively, convivial, and interactive. With the shifting times, the stones have also come to exercise a range of other functions. One is territorial, linked to the field of heritage. As markers of an archaic human presence, the stones designate and sustain a range of territorial rights and protections rooted in "ancient use."[36] Like the many cairns, graves, campsites, and monuments dispersed across the indigenous north, the *sieidi* function as signposts that anchor present rights in a tangible past. Equally, still within the field of heritage, the *sieidi* are also framed to attract monetizable interest: tourism is a regional growth industry, and ancient landmarks are central to its remapped topography. In the 1990s the Stallogargo stone was included in the "Fotefar mot Nord" project, a mapping and guidance project in which some hundred or so districts in the Norwegian north each spotlighted one key heritage site within their geographic area.[37] Pamphlets were published, signs set up, tourists herded toward attractive sites. Today the stone is the designated patron to an annual cultural festival in Kvalsund, the Stallo Days, which features handicrafts, storytelling, and cultural events. New-age shamans commodify vision quests in which participants visualize the stone and take pebbles from the area for power and inspiration. A signpost near the stone describes it as "gazing" out across the sound; the municipal website reports that the stone was in use as a sacrifice site "by the Sámi people up to the 1800s"[38]—evoking indigeneity as a past presence—and that it has "watched over travellers through Kvalsund"[39] since time immemorial.

Despite the potency of these new framings, however, the *sieidi* also remain more than markers of ancestral use or commodifiable heritage. The heydays of sacrificial practice may have passed, but the stones still command respect. One informant from the Kvalsund area told me how her mother had taught her to attend to the stone at Stallogargo, as she in turn had learned to do before the bridge was built, when the journey across the sound to Hammerfest still required a ferry crossing. The stone was for travel, she told me: in return for an offering of coins, it would protect the traveler. Since

36. As one report puts it, "Sacrificial sites and sieidi are some of the very strongest sources for the documentation of Sámi usage areas" (Norges Offentlige Utredninger, *Samiske sedvaner og rettsoppfatninger*, 295).

37. See "Hva er Fotefar mot nord?," www.fotefar.no/bakgrunn/ (accessed March 15, 2016).

38. See "Kvalsund," Velkommen til Kvalsund Kommune, kvalsund.kommune.no/index.php?id=4502506 (accessed March 15, 2016).

39. See photograph captioned "Stalloen i Kvalsundet har voktet over de reisende gjennom Kvalsund" ("The Kvalsund Stallo has guarded travelers through the sound"), www.kvalsund.kommune.no/viewimage2.php?folder=12308&no=7 (accessed March 15, 2016).

childhood my informant had left offerings when on her way from Hammerfest. Even after the new tunnel was built and the road moved to bypass the stone entirely, her family still sometimes takes the old road so as to drive past the stone—so that her children also have the opportunity to learn the practice of sacrifice. "We usually wave to the stone from the bridge," she said, "so we know it is not forgotten."

Here is sacrifice in one of its elemental modalities: as a gesture that makes relation, instituting a bond between sacrificant and recipient.[40] My informant and her family are certainly not in the majority. Most people in the area would not subscribe (or admit) to such practices—but to some, at least, the stone is still part of a living landscape: half lost or forgotten perhaps but infused, still, with a subterranean presence; sustained in memory, and tales, and observance. Occasionally, across the north, this landscape surfaces. In August 2014, for example, representatives from the Sámi Parliament spent the night on the site for a planned new administrative building, to observe the ancient practice of asking for permission from the "underworlders" before disturbing a place with new construction. "It is important to honor this tradition," said the director of the Sámi Parliament then. "There is much we don't know."[41]

Three coordinates or framings, then, each marking out a different topography and relational context for the stone: land rights, heritage tourism, surviving observance. In each of these the stone is present (and active) in particular ways. In the first two, the stone seems to function in similar ways—as a marker of ancient use, standing in a passive indexical relation to the past[42]—but with the third, the landscape of observance, things are different. Here I am tempted to say the stone exists on different terms, irreducible to the first two: not just in different ways, or differently interpreted, but as a different kind of entity. Following Elizabeth Povinelli, this landscape might be taken as a local "geontology" of its own:[43] a differential imaginary of what earth, land, stone, and living beings are or can be to each other, of what kinds of relation they enter into, of the various ways in which they may shape, influence, and form part of each other. In this landscape the stone is a very different kind of "thing" from what it is in the heritage brochures or in meetings of the planning committee. Taken seriously, it exists in a manner that destabilizes many assumptions about what a landscape is and what it can contain.

Harm

Let me bring this back to the idea of multispecies. For a few years now, a resource boom has been under way across the Scandinavian north, and Norway is an enthusiastic participant. According to many of its leading storytellers, the nation is embarked on an epic

40. Hubert and Mauss, *Sacrifice*.

41. Larsson and Idivuoma, "Sov på tomta til nybygget."

42. This is a simplification, of course. A closer study of the stone—informed, say, by ongoing ethnographic work in the fields of heritage, tourism, material culture, and science and technology studies—would certainly reveal it as a complex, multiple, potentially even agentive entity also in these contexts.

43. Povinelli, *Empire of Love*; see also Povinelli, "Geontologies of the Otherwise."

(re)conquest of the north, a magical adventure of wealth and riches to rival that of the oil finds. At trade shows and conferences, in editorials, interviews, and televised debates, politicians, magnates, developers, and entrepreneurs conjure the north as a vast frontier, a repository of unrealized wealth—a landscape replete with rare earth and precious minerals, awaiting only the transformative labor of human enterprise to yield its hidden riches. Recently, this national growth and enterprise project has brought attention to Repparfjord, to the neighborhood of the Stallogargo *sieidi*. For a few years, a private project has been in the pipeline to reactivate (and expand) an old copper-mining facility near Kvalsund.[44] To ensure profit margins against high operating costs, the company behind the project proposes to use submarine tailings disposal (STD)—a controversial practice, currently used only in a small handful of countries around the world,[45] by which waste from mining projects is deposited at sea rather than in contained landfills. Marine disposal is significantly cheaper than land-based alternatives, and to its proponents there are obvious further advantages: as the saying goes, the waste will be "out of sight, out of mind" (*ute av øye, ute av sinn*). Of the few countries that permit STD, Norway is the only one presently planning new disposal sites of this kind and also the only one to allow deposits in relatively shallow coastal waters. Despite the contested status of the practice, Norwegian politicians are currently lobbying for increased international acceptance of marine tailings disposal.[46]

Locally and nationally, controversies over the project have focused on the environmental consequences of such disposal—for marine life, locally and in the wider Barents region, but also for the multiple (human) livelihoods that depend in some way on the marine environment. In Kvalsund this encompasses fisheries and tourism in particular but also pastoralism and a range of other locally important subsistence and recreational practices. Where submarine deposits lie close to the surface, as they will in Kvalsund, the sheer mass of deposits can effect brute structural changes to the hydrologic environment of the fjord—disrupting nutrient flows, modifying current systems and fish migratory cycles, potentially even blocking transit for surface vessels. More subtle effects occur through the dispersal of complex, synthetic, and often proprietary chemicals utilized by mining companies; the sudden proliferation of naturally occurring toxic or radioactive materials (copper, isotopes) in excessive quantities; and the poorly understood biophysical effects of normally nontoxic materials when ground into nanoscale "floating dust" (*svevestøv*) and released into a complex, turbulent fluid environment. Projections of harm in this context are probabilistic—a matter of guesswork, of scientific

44. Reinert, "On the Shore."

45. As of 2014, the four principal countries to use the method are Indonesia, Papua New Guinea, the Philippines, and Norway. Of these, Norway and the Philippines have both signed the 1996 London Protocol, which regulates marine pollution. Chile and Turkey each have one active STD operation. Dodd, "Submarine Tailings Disposal."

46. "Kjemper aktivt for sjødeponi" ("Actively Fighting for Marine Disposal"), *Bergens Tidende*, www.bt.no/nyheter/lokalt/Kjemper-aktivt-for-sjodeponi-3417454.html (accessed March 15, 2016).

modeling and estimation, and of where the lines are drawn—but still, there are some certainties (or near certainties). Even the most conservative reports indicate extensive damage and loss of life in the areas affected by the deposit. As is often the case, the political question hangs on a calibration of what stands to be lost against what stands to be gained—but what stands to be lost is not a straightforward determination.

Invariably, corporate impact projections posit that the nonhuman life destroyed through marine disposal will "bounce back" within a certain time frame after cessation of disposal activities. Such projections are interesting for a number of reasons—not least for how they render the destruction of *present* populations as morally insignificant; nonhuman life is figured as process rather than individual body, as a kind of background environmental function disrupted only temporarily by human destruction. Only permanent eradication registers as significant; temporary population losses—that is, a sort of "temporary" killing—are acceptable. Harm to nonhumans is understood primarily as a moral externality, relevant only where it leads (in documentable ways) to certain (limited) kinds of harm to humans: economic, physiological. The negative social, psychological, and emotional consequences of destructive environmental interventions—the various syndromes of environmental distress that Glenn Albrecht and colleagues refer to as "solastalgia"[47]—are notable by their absence in the calculus of "social benefits" that underpins government support for the project.[48]

What are the harms that register as significant, and to whom? Against the brutal externalizations of the dominant development paradigm, critical interventions represent the fjord and its environs as a mesh of life and interwoven systems, affected in massive and largely unpredicted ways by the projected disposal and by the possibility (or certainty, rather) of toxic effects. There are the migratory cycles of cod and salmon; the unseen life of seaweed, mollusks, plankton, and deep-water organisms that sustains the surface; the fish that feed on the invertebrates, the birds that feed on the fish, the humans that feed on the fish and the birds and the bird eggs; the reindeer that descend from the inlands to the shore in the summer, to cleanse their throats with salt water; the herders that depend on the reindeer. . . . Imaginaries of multispecies enmeshment are already at work here, tactically drawing out dependencies and effects that are externalized (or ignored) in the dominant political discourse: bioaccumulating toxins, livelihood disruptions, transboundary effects such as the mass introduction of nanoparticulate matter into the Barents Sea food chain. This work of imagination—of extending the mesh, of internalizing the externalities and populating spaces construed as empty—extends beyond a synchronic focus on species interdependence: activists speak of accountabilities to the dead and to unborn generations, to the sea, to life, to Earth itself. Debates flow rapidly, and stances shift. At a protest rally in Oslo in early 2015, a prominent national politician from the center-right takes the stage and articulates—much to

47. Albrecht et al., "Solastalgia."

48. Reinert, "On the Shore"; Reinert, "Sacrifice."

my surprise—a *libertarian* argument against mining projects like Kvalsund: that the devastations they bring will limit the choices available to future generations, impinging on their freedom and economic growth.

Conflicts over the future of the region, and Kvalsund in particular, articulate a complex range of narratives, time frames, and domains of ethical concern.[49] These can be sorted, roughly but usefully, into two camps: "only-human" narratives that focus on progress, wealth, and modernization through the extraction of "surplus value" while externalizing and minimizing the relevance of nonhuman effects; and a range of "more-than-human" narratives that bring into view issues such as interdependence, cascade effects, biological fragility, and cumulative disruption—but also much more complex imaginaries of life, accountability, and possible damage. One key distinction here is the location of the limit: the question of exactly what costs, harms, and effects are externalized, placed outside view and calculation, and why. Does the suffering and destruction of a local fish population *matter*? How, and to whom? The arguments range back and forth, but they also share common ground; the multispecies imaginaries create their own externalities.

Consider the Stallogargo stone, in its capacity to enter relations and transact. Where the inorganic figures in critical accounts as an object of moral concern, it is usually either through the invocation of a planetary totality—say, an accountability to "the earth," usually understood as a living system—or in terms of ensuring its continued capacity to support and enable life. There is very little space, even within the critical narratives, to accommodate the inorganic as anything other than a material substrate that supports organic life. Can a stone be harmed? To many the obvious answer is no—but the stories say the Stallogargo stone can act in self-defense, to protect itself from threats. Some historical sources say the *sieidi* are mortal, that they can be killed, rolled into lakes if they start causing problems.[50] Impact reports for the Kvalsund mine describe, dutifully, the presence of several *sieidi* in the affected areas,[51] naming their "cultural" and "historical" significance. Their mode of existence, here, is easily described: markers of the past, protected by human codifications of right and tradition. Parallel to this, however, the stones also possess other, submerged modes of existence—among which is the one I have described here, which operates through specific, individual accountabilities (and relations) across kingdoms, between biological and geological beings. Is there a space for these relations to emerge—for the stone to play a part, to enter politics as something like a vulnerable subject? The answer to this is bound up in the complex web of colonial erasures that constitute the present moment of Sápmi, with the specific modalities of suppression, stigma, and control that "modernizing" Scandinavian states have deployed, over the centuries, to establish their territorial hold.

49. Reinert, "On the Shore."

50. Toivo Itkonen, *Suomen lappalaiset vuoteen 1945* (*The Lapps of Finland until 1945*), cited in Lahelma, *Touch of Red*, 63.

51. Sweco, *Reguleringsplan med konsekvensutredning*, 77.

Speaking in general terms, the logic of resource capitalism functions within the coordinates of a modern, Cartesian geontology: matter is inherently inert, transformable; resources exist for the use and profit of human subjects; a stone is "just" a stone. Equally, Euroamerican vocabularies of harm and ethical reflection tend to circle within a space of concern that is delimited by the inorganic as its outer limit.[52] In both frames, the inorganic presents itself as a kind of *terra nullius*—an empty space, a beyond from which no voice can come, no legitimate demand issue.[53] This emptiness gives pause, however. Empty for whom, of what?[54] Twenty years ago, discussing the status of Aboriginal ontologies within the late liberal Australian state, Povinelli observed that "reconciliation with multiculturalism ends where a conceptual accommodation to a multieconomism would begin."[55] I am not equipped, disciplinarily, to pass verdict on the Stallogargo stone, to collapse its multiple realities into singular truth. What I am equipped to do, however, is to dwell on its persistent presence—and to slow down, to question, to frame and explore the possibilities this presence offers for an *otherwise*, for alternatives to the present order. To insist that the stone stay in the picture in unreduced fullness—obdurate but not impervious, thorn in the side of reductive framings—is a step toward decentering this supposed emptiness of the inorganic, and perhaps toward repopulating it. Taking the stone seriously in this way helps shift the question of harm, refocusing it from the sacrificial politics of modern statecraft—the ongoing calibration of human harm against the supposed necessities of growth and the profit imperative—toward a broader, exploratory determination: of what might be said to exist, on what terms, and of what such existence entails. Who are the beings? How can they be harmed?[56] What do they require to endure?[57] Riches are promised, growth, modernity, development—the eagerness of capital, the multiple amnesias of development—and yet: some fish bones by the side of the road, an old coin or two; a child, waving to a stone from the back of a car.

An Experiment

I have narrated the Stallogargo stone here as a kind of obdurate relational existent, a "boundary object"[58] in multiple overlapping landscapes, present and active (in different

52. Manuel DeLanda calls this "organic chauvinism" (*Thousand Years of Nonlinear History*, 103). See also Mitchell, "Thinking without the 'Circle.'"

53. See Zaffaroni, *Pachamama y el Humano*.

54. In Sweden, this question has given rise to a broad-based mining protest movement, aimed precisely at challenging the representation of prospective mining landscapes as desolate and empty—and therefore available for resource extraction—through the stories of people who live in them; see the "What Local People" website (www.whatlocalpeople.se).

55. Povinelli, "Do Rocks Listen?," 506. Her argument here foreshadows Latour's more recent observation that the system of capitalism has somehow rendered itself more absolute—"more solid, less transitory, less perishable"—than the world itself (Latour, "On Some of the Affects").

56. Reinert, "Disposable Surplus."

57. Povinelli, *Economies of Abandonment*.

58. Star and Griesemer, "Institutional Ecology."

ways) within each. I have also argued that in parsing these multiple landscapes as distinct geontologies, the continuing presence of the stone helps rephrase the question of harm ontologically: as a question of who—and what—is taken to exist and of how certain modes of existence are (and are not) made to count. This question echoes both a central concern of cosmopolitics[59]—who will be counted in the more-than-human polity, and how?—and the methodological *how* of multispecies research: how to bring nonhuman entities into the research process, not merely as the artifacts of human practice and narration but also, somehow, hopefully, in ways that do justice to other modes of being, to an independent richness of existence. With living beings, even with organic life in general, the leap is not so great: human and nonhuman organisms share a range of basic affinities, affordances, and constraints. They interact with their environments, grow and starve, thrive and suffer; ultimately, they die. Plants communicate threats, slime molds solve problems, crows make tools. Some form of empathy is not so hard to establish, rooted in a shared experience of embodied life: death, pain, joy, even hope are accessible. Valuable as they are, such empathies remain within the confines of what Povinelli calls a "carbon imaginary"—a preanalytical orientation that parses the world through the lens of organic life.[60] To move between the animal and mineral kingdoms is quite another matter.

This brings me to the point of method. Research methods choreograph reality in important ways[61]—predetermining the scope of what can exist, dictating what can be discovered and how, and enlisting researchers in the reproduction of certain dominant ontological coordinates. Take the interview: formalized as a sustained verbal exchange between two human persons, one of whom asks questions while the other answers, its basic protocol already encodes a range of assumptions as well as a concept of truth rooted in the (documented) verbal formulations of an "other." As a technique of truth—not unrelated to the confessional—the epistemology of the interview determines, in advance, not just the range and scope of possible "findings" but also the reality that these findings will eventually describe. The sphere of words is produced as the space in which human truths are articulated—but also, the sphere in which these truths can be *subjectivized* and reduced to beliefs, to ideas, to "culture."[62] Ideologies travel—and replicate—not just as content but as form: in tropes and protocols, templates, methods, patterns, and structured aporias. Multispecies imaginaries work against such orthodoxies at the level of method, often quite explicitly: experimenting with novel assemblages of form, bodies, and technique to generate new forms of knowledge.[63] Deliberately rethinking method in this way lends research a certain insurrectionary potential—to unsettle the given, to challenge orthodoxy and direct attention to the enactment of the otherwise-

59. Stengers, "Cosmopolitical Proposal."
60. Coleman and Yusoff, "Interview with Elizabeth Povinelli."
61. Law, *After Method*.
62. Povinelli, "Do Rocks Listen?"
63. Kirksey, *Multispecies Salon*.

possible. At the same time, in the very gesture of experimentally expanding the methodological repertoire, other orthodoxies may be reproduced.

I take it as granted that one can meaningfully communicate with a cat, or a chimpanzee, or a dolphin—but what about that bridge to the inorganic? Taking advantage of the postdisciplinary space this issue sets up, I want to engage in a brief experiment. Consider the Stallogargo stone. Even at a first pass, the lore I outlined earlier presents three modes of access, three ways in which I might engage and come to know the *sieidi*, even from a position of initial exteriority. The stone might speak to me in dreams, as it did to the engineer. I might make an offering to the stone, an act of sacrifice as an initial move, establishing a relation where there was none before. Following that, I might also deploy a particular modality of interpretation, as a way of reading time and causality through the thread of a hidden agency, connecting the otherwise unconnected. All three are techniques of relation, involved in gaining particular knowledge, not so much *of* the stone as *with* it. As such, they are also techniques of research—albeit external, at least for the moment, to the parametric institutional space of disciplinary inquiry. Taking them seriously here is an experiment, but also a purposive move within the shifting political economies of knowledge and the academy: an attempt to heed Anna Tsing's call for novel "collaborations with researchers"[64] in ways that intentionally problematize the idea of research as a disciplinary or institutional prerogative.

As it happens, a year or two before I first set foot in Kvalsund, I did meet a stone being in a dream. In hindsight, its profile bore a striking resemblance to the Stallogargo stone—but leaving aside the ontological status of informants encountered in dreams,[65] the being in question said nothing of particular relevance here; I note the incident only in passing. A year or two after the dream, however, I arrived in Kvalsund—intent on better understanding the emerging sacrificial dynamics of the northern Norwegian resource frontier. As soon as people learned of my interests, the first thing they did was tell me about the Stallogargo stone: "Did you know there is an old sacrifice stone here, just across the bridge?" This convergence of the literal and figurative[66] was unexpected, so on my second day I went to see the stone and introduce myself. As Oskal noted earlier, it is only sensible to treat the powers of the land with respect. I walked across the Kvalsund bridge and found the stone. While at the site, I introduced myself and made a simple offering: a few coins, some tobacco that I had purchased for the occasion. I have discussed this offering elsewhere:[67] the exact terms are not so important here[68]—except that the sacrifice established the situation in certain ways that were intelligible if not exactly familiar.[69]

64. Tsing, "More-than-Human Socialities."

65. See Heonik Kwon's beautiful work on *Ghosts of War in Vietnam*.

66. Reinert, "Pertinence of Sacrifice."

67. Reinert, "Notes from a Projected Sacrifice Zone."

68. Although for the record, I asked for nothing in particular. The offering was intended as a gift, and I certainly did not wish to attract the ire of the stone by forgetting to repay any incurred debts.

69. Or comfortable—I was raised to be a proper modern subject, after all, faithful to the modern constitution and its ontological commitments.

A year or two pass, after that first visit, and I find myself on the coast of Denmark, entrusted (unexpectedly) with an old property: an ample garden, a house in need of restoration. The work required is enormous. There are floors to take up, foundations to excavate and reinforce, literal mountains of earth and stone to move and remove and fill in. The work is strenuous, and protracted. The digging continues for months, as the land grows my body in the task: making it leaner, adding scars and new muscle. There are new skills, new textures, new machines: jackhammers and scarifiers, mulch and gravel and clay, wet earth and dry earth and roots, metamorphic clay, the radiant heft of setting concrete. There are injuries, trips to the hospital, stitches. As time and the work progress, the land reveals itself to me in new ways: the ground under my feet shifts as I walk it—from planar surface to vertical depth, unseen strata of mulch and roots and glacial sediments. Progressively I become enmeshed in its upper strata. I feed the birds and hedgehogs, water the trees, pay attention to root systems and earthworms and to the time it takes for things to grow, to seasonal shifts and patterns of rain, to water flows as they articulate with the topography of dips and trenches and heights. The wildlife I find crushed by the side of the road becomes something else to me: I recognize them, they walked through my garden, I fed them. I start researching habitat requirements and dietary preferences, relevant predators, seasonal cycles of breeding and hibernation.

Slowly, I begin to think of the property as a sort of experimental space in its own right, a geontological assemblage that is operating *on me*, transforming not just my body but my understanding. Bios and geos churn, mapping into novel reassemblage. In the evenings, classic works on stone and geology reveal new details, transposed in the light of unfamiliar experience. When the property next door is sold, midway through the project, the new neighbors raze the lot to the bare ground. In the space of an afternoon, helpless, I watch a hundred years of trees, plants, hedgehog habitats, and bird nests destroyed. Standing there, stricken with grief, I recollect an informant from Kvalsund: "All this will be destroyed," she said, gazing out across the waters where the tailing deposit was planned; "it breaks my heart." Right there, watching the tall trees buckle and crack in the roar of the machines, I hear something else in what she said—something I did not hear at the time.

Spring turns to summer, summer turns to fall: I work and take notes and as I work, my mind keeps going back to Kvalsund and the Stallogargo stone—and I wonder. In a certain sense the garden has become an experimental space: a parametric environment within which certain phenomena can be made to reveal themselves, so as to be better understood. To date, my own identity and practices have primarily taken the form of a kind of privileged nomadism, enabled by birth, citizenship, and occupation: always the option to move somewhere else, to deterritorialize. Here, the terms of my physical involvement with the land disable this privilege; the pleasures of nascent attachment fold into the vivid horror of watching the habitats next door destroyed without resort

to escape. I register that the process has begun to assemble in me something like a new basis for understanding some of the griefs and attachments associated with land, that it has changed my own understanding of land, rendered the mutual enmeshment of soil and self and beings experiential. This is one sense of *experiment* that I want to isolate here: as the establishment of a kind of controlled parametric space, separate from "the field," that enables certain phenomena to emerge and be studied through the personal. The personal is the prime heuristic of ethnography but often it is left inchoate, as a given rather than an object of intentional, disciplined modification. Conversely, I wonder if its intentional modification—say, in the deliberate pursuit or construction of experiences that broaden the empathic lens—might be formalized into something like an ethnographic analogue to the scientific experiment.

The other sense of *experiment* I want to draw out is more oblique; it arises in the question of how it is possible, and reasonable, to write. Back then I made an offering. Could it be, by some logic of hidden agency, that I invited all this—that in the gesture of offering I opened myself to the stone as an influence that is now turning my life to the geo(nto)logical? Could the stone itself be at work, manifest through some causal intimacy that expressed itself only in the subtle arrangement of events—a footprint in time, a presence as a trail of events, discernible only in the actions of others and in mundane textures of coincidence? There have been remarkable serendipities: people turning up with uncanny timing, events unfolding in chains of dreamlike logic. . . . The thought is possible, even justified, in the current of induced serendipity that runs through and alongside the history of the stone—but it also seems dangerous, an opening on some pareidolic derangement of the modern constitution:[70] a world in which stones act on human lives in ways that hide in plain sight, where action and reaction may be ruled by protocols irreducible to the paradigm of human sentience.

Umberto Eco once warned against the "excess of wonder"[71]—but again, I wonder. In May 2013 the Mauna Loa observatory reported concentrations of atmospheric carbon in excess of 400 parts per million for the first time.[72] By 2015, that figure had become a global average.[73] I write this on a heating planet, marked—scorched—in the triumphant elevation of capitalism from a system of production to a system of reality: a framework of givenness, of "business as usual." Is the problem of wonder, here and now, really one of excess? Is it not rather one of deficit, a crisis of imagination that preempts the otherwise-possible?[74] Perhaps the times have changed. I cannot *know*, of course, but I wonder—and in that wonder, an opening already constitutes itself. Methods choreograph reality, and writing is a method. Its scope is not just to describe but to transform,

70. Latour, *We Have Never Been Modern*.

71. Eco, *Interpretation and Overinterpretation*, 167.

72. Freedman, "Last Time CO2 Was This High."

73. Kahn, "Global Milestone."

74. As Fredric Jameson famously put it, in his essay "Future City," "Someone once said that it is easier to imagine the end of the world than to imagine the end of capitalism."

to open up possibilities that refract the present diagnostically—distilling its conditions of possibility, exposing (and manifesting) its latent potentials. The risks and pitfalls are obvious—fallacies, appropriation, mysticism—but so, increasingly, are the limits of the dominant ontology that renders such experimentations invalid. What is ethnography, after all, if not an instrument for the sustained effort to think otherwise—to chart other possibilities of existence, beyond the dismal cartographies of the present?

"But is it real?" The world is queer, and multiple; it resists binaries. Other questions present themselves, better ones. What happens if I do this? If I follow this lead? In October 2015, just as I am drafting yet another version of this essay—the final one this time, hopefully—an appeal surfaces in my media feed. A Sámi campaign for climate justice has released a protest *yoik*, a traditional Sámi chant, in preparation for the 2015 Climate Conference in Paris.[75] In northern Sámi, this particular *yoik* is called Gulahallat Eatnamiin—which translates as "We speak Earth." The Sámi artist Sara Marielle Gaup Beaska describes how the *yoik* "came to her" while she reflected on issues of climate change, environmental justice, and indigeneity on a heating planet. "Learn this *yoik*," she tells her global audience. "Share it. Sing it in the streets of Paris on December 12." The segment ends with a quote from the Sámi poet Nils-Aslak Valkeapää: "Take a stone in your hand and close your fist around it—until it starts to beat, live, speak and move."[76] I blink. The invitation is almost too timely, with its mingled invocation of life and geological being in the name of an "otherwise" that is anything but abstract, anything but folkloric or residual.

Follow the lead. Not a month later I am in Tallinn, teaching an intensive course on "anthropogenic landscapes." On the first day of the course, coincidentally, a climate manifestation called "Run for Your Life" begins—a continuous, live-streamed, three-week relay race from Kiruna to Paris, with arrival in Paris timed to coincide with the beginning of the Climate Conference. As the first runner descends from the mountain, she faces the camera and presents us with a smooth white stone—and she quotes the poem: "Take a stone in your hand . . . "[77] From Kiruna the stone will travel to Paris, from hand to hand, runner to runner in a collective feat of performative storytelling: from my hostel room in Tallinn I follow its passage, sleepless, mesmerized by this unexpected intersection of geological and biological being, in mutual animation. Four days later, on the last day of the course, shootings in Paris kill more than 120 people: a group called

75. A *yoik*, in the indigenous Sámi tradition, is a short, partly improvisational pattern of chant or song, usually combining repeating phrases and onomatopoetic vocalizations. Phrases may evoke the sound of skis across snow, the call of a bird, the rhythm of the reindeer herd circling in the corral. Traditional understandings of *yoik* defy easy translation into the conventions of Western music; for example, a *yoik* does not so much represent what it refers to—a person, object, place, something else—as it forms part of it. To *yoik* someone or something is thus in a sense to render them experientially present. See Anderson, "Saami Yoik"; DuBois, *Lyric, Meaning, and Audience*.

76. See "Gulahallat Eatnamiin: We Speak Earth," October 14, 2015, www.youtube.com/watch?v=H2LhBAi-Q8I.

77. Todd, "Run for Your Life."

Islamic State claims responsibility. Initially at least, the French state clamps down on security: suddenly the planned climate protests are embroiled in the geopolitics of the Middle East, the fallout from military interventions in Iraq, the refugee crisis, the rise of surveillance states, and the ongoing redefinition of the European project in the name of security and neoliberal fiscal policies. Sheer concatenation has folded the simple poem of the stone not only into the present moment of an emergent, globalizing indigeneity that addresses itself to the planetary—but with that, also into a manifold of war and violence and religion, of tolerance and surveillance, of climate justice and democracy, oil and blood and the raw challenge of coexistence, human and otherwise. "Real," "not real"; my mood—the only mood, it seems to me, that can sustain these manifolds—is subjunctive.[78]

Conclusion

Let me step back a bit. Even within the horizon of its own ethnography, my argument here barely scratches the surface of the issues it raises. In focusing on the Stallogargo *sieidi* I have left out a whole range of other locally relevant stone relations or geontologies: the relationship of geologists to "their" stones, for example, to "their" deposits and quarries and finds; the reindeer-pastoral landscape, with its shifting patterns of seasonal use, its mountains of crossing and barrier and shelter; and the affective biographical bonds that link the people of Kvalsund to land and geology in generational time, the storied environments of memory, trauma, and war.[79] The landscapes of Kvalsund overflow with relational imaginaries, each in its own way a challenge to the dominant ontologies that threaten to eclipse them. These imaginaries converge with particular force in the context of human interventions, present and prospective. "This is hell," one informant observes laconically after an hour's climb into the mountains over Kvalsund, gazing out across an excavated ravine that serves as a disposal site for North Sea drilling waste. If a stone like the Stallogargo *sieidi* can be a relational "other," what then of other stones, say the one traveling to Paris as I write this—and of fjords, rivers, mountain ranges?[80] Even "just" in Kvalsund, doing justice to these issues would require a book; here, rather, my aim has been to open up some space for thinking inorganic relationality otherwise—and to explore some of the ways in which stone-human relations might move across scales (and kingdoms).

The Anthropocene is a complex diagnosis. I am thinking here of how that diagnosis implicates not just us but *me*—collapsing the notional outsides, the barriers that mitigate against my own personal implication in a catastrophe that unfolds on scales so vast as to be practically unintelligible, extending into deep time for thousands of generations, beyond even generational time itself. Patterns of biospheric damage wash across

78. Vannini, "Enlivening Ethnography through the Irrealis Mood."

79. Palmer, *Bare Kirka Sto Igjen*.

80. Povinelli, "Transgender Creeks."

the earth in complex, uneven, and differentiated ways—rescaling the personal as planetary agent: *I* throw away those plastic lighters that stick in the gullets of hatchlings on remote islands; *I* purchase groceries and consumer goods from supermarkets, supporting oil-based transport infrastructures, gruesome industrial production machineries, devastating projects of mineral extraction; *I* travel by combustion engines that churn the atmosphere with ash, turn the seas to acid, drown islands in the Pacific. The cataclysmic violence of the present crystallizes with brutal and intimate urgency—implicating me not just as a person, or a human being, but as a researcher. If the Holocene *is* over—as it may soon very well be, officially—is it not also long overdue to rethink the imaginaries it fostered and quietly took for granted? Not least of these is the Cartesian geontology of modernity: the endless vista of matter as inert, impersonal, and inanimate, laid out to infinity, freely available for disposal, transformation, and use. To those of us who grew up within the coordinates of that ontology, this is also a personal question: what ancient violences are reproduced, what prejudices implied and complicities assumed, in the proposition that I *already know* what a stone is?[81]

This critical urgency of the present also calls forth its own opposite: a demand to slow down,[82] to question, to think otherwise and to think *the* otherwise.[83] To slow down is to make space—for other questions, other arrangements, other possibilities of existence. In the spirit of this, I close with three questions—not so much critiques as issues I believe worth keeping in mind when engaging a term like *multispecies*; not to reject, but to reflect on what to take forward.

1. What is "species," really? The concept belongs to a Euroamerican vocabulary of reality and is historically (and genealogically) implicated in some of the very discourses that the idea of multispecies takes aim at—including colonial projects of domination. It also slips easily into a register of objectivity, installing itself as a kind of scientific (or folk-scientific) metalanguage—as if "species" were a given, a building block of reality rather than a shifting, charged, unstable, and contested construct. Language is powerful. In the gesture of "dividing animate life by species,"[84] might multispecies scholarship risk committing itself to a language, concept, or form that forms part of what it aims to deconstruct?

2. Where does the multispecies concept position itself relative to a capitalist ontology that renders the inanimate and the inorganic as freely available for consumption, transformation, and destruction? With its "softness for life," might the term unwittingly place itself in the service of powers that

81. See, for example, Graeber, "Radical Alterity."
82. Stengers, "Cosmopolitical Proposal."
83. Povinelli, "Geontologies of the Otherwise."
84. Livingston and Puar, "Interspecies," 4.

maintain and police the line between "life" and "not-life"[85]—and that in so doing constitute both as domains for control, production, and the extraction of surplus value?

3. Multispecies studies is not the first project to take aim at the ontology of human exceptionalism. My own sense is that the multispecies concept forms part of a larger movement of ontological deconstruction and that despite the name, its commitment to the species concept is, in a sense, soft—that the term functions as a placeholder, or shorthand, en route to somewhere else. A final question, then, might be this: how does the field of multispecies studies address its own cultural specificity—and contingency—in the encounter with alterity? What is the space for non-speciating ontologies within a multispecies framework? Conceptual reflexivity, here, may well be the measure of a capacity to make allies—to sustain difference without erasure.[86]

In 2014 in Santa Cruz, California, the science fiction author Ursula K. Le Guin gave a striking keynote at the conference "Arts of Living on a Damaged Planet."[87] Le Guin—herself the daughter of an anthropologist, Alfred Kroeber—began with a passage from her 1974 short story "The Author of the Acacia Seeds," which consists of selections from the (fictional) journal of the (fictional) Association for Therolinguistics, a scholarly society dedicated to the study of nonhuman art and languages. In the passage the chairman of the association explores the limits of his field, venturing the possibility that undiscovered arts and languages might lie beyond even the realm of nonhuman animals—in the sphere of plant life, in the slow morphic poetry of lichen or zucchini. In closing, the chairman ventures even further: "May there not come even that bolder adventurer—the first geolinguist, who, ignoring the delicate, transient lyrics of the lichen, will read beneath it the still less communicative, still more passive, wholly atemporal, cold, volcanic poetry of the rocks: each one a word spoken, how long ago, by the earth itself, in the immense solitude, the immenser community, of space."[88]

85. Povinelli, "Transgender Creeks."

86. This last point warrants more elaboration than I can offer here. Much is made these days of indigenous knowledge as an untapped reservoir for the advancement of science, say, in fields like Arctic environmental science. Much more could be made of the radical, destabilizing potentials of such knowledges: both as persistent "otherwises" of their own, surviving through centuries of suppression, and as potential points for collaborative departure, in the generation of novel, urgently needed arrangements of existence. I take the idea of multispecies as a move in the right direction—but as indigenous scholar Zoe Todd points out, with regard to the ontological turn in anthropology, the spaces that contemporary Western social theory moves into are not necessarily empty (Todd, "Indigenous Feminist's Take").

87. For a video of the keynote, see "Ursula K. Le Guin, Keynote 5/8/14," uploaded June 4, 2014, vimeo.com/97364872.

88. Le Guin, "Author of the Acacia Seeds," 14.

Here is geology and the earth itself imagined as language, as an utterance spoken before the birth of life and unfolding still, on time scales so vast they render the human span as the blink of an eye—and yet, perhaps translation is possible. "Gulahallat Eatnamiin," the *yoik* says: "We speak Earth." This takes me back to where I began, to the impulse to rethink the human through geology, bios through geos. Transversally to an image of geology as totality, I have explored here some disaggregations of the geological—in an attempt to think through the relational possibilities of stone as a kind of being, capable perhaps of interacting with human lives in ways that our dominant research imaginaries do not account for (or allow). This is more than a theoretical issue or an idle fantasy on method. Right now, across the earth, vast swathes of organic life are being erased; species disappear at up to a thousand times the background rate. The numbers may be uncertain—but even if "just" a dozen species disappear every day, that is still one every two hours, day and night, continuously. How long did it take you to read this? In Santa Cruz, Le Guin put the matter quite simply: "One way to stop seeing trees and rivers and hills only as natural resources is to class them as fellow beings, kinfolk." Kin is an idiom of conviviality, but conviviality takes work and—particularly where it is denied, not just absent—it has to start somewhere, with a first move: an opening, a decision, a gesture; an offering. A child, waving to a stone from the back of a car. Animism may be an ontology, or an academic construct[89]—but is it not also a tactic, a method, an instrument of insurrection, a war machine?[90] "Subjectify the universe," says Le Guin in her keynote. "Subjectify the universe—because look where objectifying has got us."

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89. See van Dooren and Rose, this issue.

90. de Castro, *Cannibal Metaphysics*.

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The Viral Creep

Elephants and Herpes in Times of Extinction

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Abstract Across the world, elephant endotheliotropic herpesvirus is increasingly killing elephant calves and threatening the long-term survival of the Asian elephant, a species that is currently facing extinction. This article presents three open-ended stories of elephant care in times of death and loss: at places of confinement and elephant suffering like the zoos in Seattle and Zürich as well as in the conflict-ridden landscapes of South India, where the country's last free-ranging elephants live. Our stories of deadly viral-elephant-human becomings remind us that neither human care, love, and attentiveness nor techniques of control and creative management are sufficient to fully secure elephant survival. The article introduces the concept of "viral creep" to explore the ability of a creeping, only partially knowable virus to rearrange relations among people, animals, and objects despite multiple experimental human regimes of elephant care, governance, and organization. The viral creep exceeds the physical and intellectual contexts of human interpretation and control. It reminds us that uncertainty and modes of imaging are always involved when we make sense of the world around us.

Keywords Asian elephants, herpes, viral creep, extinction, care, uncertainty, captivity, stress, conservation, multispecies studies

Introduction: The Viral Creep

In June 2007, Hansa, a six-and-a-half-year-old Asian elephant calf and the first born in captivity at the Woodland Park Zoo in Seattle, died of a new strain of elephant endotheliotropic herpesvirus (EEHV). Halfway around the world, Arun Zachariah, a wildlife veterinarian working for the Indian Forest Department, has identified EEHV as a fatal cause of death among free-ranging elephants and orphaned calves living in camps in the forests of South India, a landscape that harbors the largest remaining free-ranging population of Asian elephants (*Elephas maximus*). Meanwhile, in the new Kaeng Krachan Elephant Park at Zoo Zürich, architectural innovations promote elephant

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"wellness," although zoo director Alex Rübel lives with the constant fear that the virus will kill Omysha, the youngest member of their small herd. Across captive and free-ranging groups of elephants, EEHV is killing juveniles and threatening the long-term survival of the Asian elephant, a species whose numbers have dropped by half in the twentieth century and that is currently facing extinction.[1]

Working together as ethnographers of viruses (Lowe) and of elephants (Münster), in this article we explore how herpes "creeps" across three different settings of elephant care: the conventional and contested elephant enclosure of the Woodland Park Zoo in Seattle, USA; the contaminated and violent "wild" spaces of the Wayanad Wildlife Sanctuary in Kerala, in South India; and the carefully designed "household-like" spaces of the new Kaeng Krachan Elephant Park at Zoo Zürich in Switzerland. Each locality is a place where humans care for individual elephants and their collectives, trying to create favorable conditions for them to live and survive. Each site, situated within particular histories and geographies of conservation, environmental governance, and biopolitics, is a place of compromise and debate in times of rapid species loss and extinction. There are no easy solutions for securing elephant well-being and flourishing in the era of advanced capitalism: trauma, harm, and unpredictability exist all across the virus-elephant-human interface. As "matters of concern"[2] coalesce around viruses, elephants, activism, science, management, architecture, and design, they become "matters of care"[3] transforming the everyday practices, perceptions, and affective relationships of a multiplicity of people, scientists, zookeepers, and animal activists with their elephant and viral others.

This article takes multispecies studies into the terrain of microbial ethnography,[4] a field that looks at the expanding purview of biotechnological and other understandings of newly appreciated microbes while simultaneously emphasizing the scope of their sociality and their engagements with other lively entities. Our ethnography of a virus urges us to look beyond a simpler story of dyadic human-elephant relations. Viruses mutate historically situated ecologies of life and death as they move within and between diverse bodies, sites, and ecologies. Our work in microbial multispecies studies responds to a call for an attentive scholarship that crosses and connects multispecies worlds by linking three stories of human-elephant-viral "intra-action"[5] within distinct, messy, and contested "emergent ecologies."[6] These lively entanglements remind us that neither human care, love, and attentiveness nor techniques of control and creative

1. Baskaran et al., "Current Status of Asian Elephants in India"; International Union for Conservation of Nature, "*Elephas maximus*," *IUCN Red List of Threatened Species*, version 2014(2), www.iucnredlist.org/details/7140/0 (accessed July 1, 2015).

2. Latour, *Politics of Nature*.

3. Puig de la Bellacasa, "Matters of Care in Technoscience."

4. Paxson and Helmreich, "Perils and Promises of Microbial Abundance"; Landecker, "Antibiotic Resistance and the Biology of History"; Lowe, "Viral Clouds."

5. Barad, *Meeting the Universe Halfway*.

6. Kirksey, *Emergent Ecologies*.

management are sufficient to fully secure elephant survival. Viral-elephant-human becomings exceed the physical and intellectual contexts of human interpretation and control.

The family name of EEHV, Herpesviridae, comes from the Greek word *herpein*, meaning "to creep," described in the *Oxford English Dictionary* as to "occur or develop gradually and almost imperceptibly." The concept of "viral creep" we introduce here builds upon the description of the "viral cloud,"[7] the unstable cluster of genomes standing for multiple ontologies transformed amid encounters between viruses, animal hosts, and human institutions in the H5N1 influenza outbreak in Indonesia in the 2000s. While with influenza it was possible to identify the conditions of industrial agriculture where mutations and reassortments created new deadly strains that reworked relations among humans, animals, and microbes, in the case of the herpesvirus we cannot as easily identify the conditions of its emergence. Unlike influenza, too much about the herpes entity and its relations remains hidden from view and "withdrawn"[8] from human diagnosis and orchestration. The viral creep reminds us, in the words of Deborah Bird Rose, that "mystery" and uncertainty are an "essential element of our lives, a part of thought rather than an enemy to be vanquished."[9]

Herpes moves silently; it hides and reemerges, staying latent for many years, often without being noticed. In this article, we are not as much interested in the conditions of possibility for viral emergence as we are in inquiring into the ability of a creeping, only partially knowable virus to rearrange relations among people, animals, and objects despite multiple experimental human regimes of elephant care, governance, and organization.

The term *viral creep* reflects the capacity of Herpesviridae to suddenly and violently take control of the life chances of another individual or species under conditions of stress and disturbance, and then just as quickly recede into the background for an individual or a population. Our argument attempts to recognize the interconnected lives of keepers, caretakers, viruses, and elephants and the ability of the elephant and its viruses to exist, act, and connect outside the parameters of human observation and understanding. This is not a return to the naive naturalism of viral allopathy; the virus is not the sole "cause" of elephant deaths from herpes. Nor, we believe, are more naturalism and scientific study all that is called for. Instead, through the technoscientific animism of new materialist and ontological reasoning, we develop an interpretation of the herpesvirus that enters into relations within complex and emerging ecologies. We call this entering into and out of relations, and the agentive power to change and rearrange relationships, the viral creep.

7. Lowe, "Viral Clouds."
8. Harman, *Towards Speculative Realism*.
9. Rose, *Wild Dog Dreaming*, 46.

The Elephant and the Virus in Times of Extinction

EEHV is a member of *Proboscivirus*, a genus that affects only elephants, in the Herpesviridae family of DNA viruses. EEHV is thought to have branched off from other herpesviruses 100 million years ago and then developed into specific types.[10] The herpesvirus is older than both proboscidians (elephants and their extinct relatives) and our own species, affecting members of the human line long before their split from chimpanzees six million years ago.[11] Familiar human strains in the herpes family are herpes simplex virus (the cause of fever blisters and genital herpes), varicella zoster (the cause of chickenpox and shingles), Epstein-Barr virus, cytomegalovirus, and Kaposi's sarcoma-associated herpesvirus. Herpesviruses affect other mammals, fish, mollusks, birds, reptiles, and amphibians. Macaque monkeys transmit a zoonotic herpes B virus that can be fatal to humans, and new research indicates that herpes might be able to jump between species more readily than had previously been thought.[12] Within their diverse hosts, various herpesvirus types cause a range of pathologies despite a similar molecular structure.

The creeping Herpesviridae is both a substance and a potential; herpesviruses are persistent infections that have latent and lytic phases. In the lytic stage, the virus is detectable in specimen samples and is shed into the environment, and symptoms are active. After initial infection, which often has no pathology, the disease becomes latent, hiding out in the body, and is now nowhere to be seen, though antibodies attest to prior infection. Recurring episodes of fever blisters and shingles outbreaks decades after a childhood case of chickenpox are examples of how herpes creates a lifelong infection that moves slowly and quietly in the body, reactivating with viremia (infection in the blood) and renewed pathology only under inexact and often mysterious conditions of immunosuppression. The herpesvirus can also emerge in new parts of the body, causing such trauma as encephalitis in the brain, pulmonary symptoms, or even cancers.[13]

As philosopher of science John Dupré writes about recent insights in virology, "It is beginning to seem possible that, just as microbes are the expert metabolists of nature, so viruses are the leading evolvers,"[14] and molecular biologists speculate that the herpesvirus has played an important role in human and elephant evolution. While the proboscivirus are ancient, with a deep history with pachyderms, clinical observations of herpes in elephants are recent, and the scientific understanding of EEHV is new and substantially incomplete. Because herpes has found new ways to kill elephants, it is sometimes referred to as an "emerging" virus, despite its ancient history as an elephant

10. Leaman, "What Killed the National Zoo's Elephant."

11. "Herpes Infected Humans before They Were Human," UC San Diego Health, June 10, 2014, health.ucsd.edu/news/releases/Pages/2014-06-10-herpes-origins-in-chimpanzees.aspx.

12. Greenwood et al., "Potentially Fatal Mix of Herpes in Zoos."

13. Brody, "Herpes Now Blamed for More Illness than Any Other Human Viruses."

14. Dupré, *Processes of Life*, 92.

companion species.[15] EEHV was first seen in African elephants through inspection of nodules on asymptomatic elephants in the 1970s. The earliest described death from the herpesvirus was a three-year-old Swiss circus elephant named Lohimi in 1988.[16] In the United States, Kumari, a sixteen-month-old calf who died in 1995 at the National Zoo in Washington, DC, is considered the index case, but a retrospective analysis of studbooks and preserved tissues identified six prior cases.[17] By the late 1990s, veterinarians had acknowledged EEHV as a major problem for captive reproduction, and thus for species survival, in both American and European zoo populations.

EEHV pathology may manifest through benign skin lesions but also through the highly fatal pathway of the elephant pulmonary system. When EEHV turns deadly, it causes violent and sudden hemorrhagic symptoms involving shedding of the endothelium, the inner lining of blood vessels and the heart.[18] Baby and juvenile elephants are the most susceptible and can die very rapidly, sometimes in less than a day. It also causes miscarriage in pregnant elephants.[19] Because reactivation of the virus appears, as with other herpesviruses, to be related to stress causing lowered immunity, the contemporary life histories of elephants and knowing what makes an elephant happy are important for efforts to understand and manage the virus.

The story of Asian elephants today is not a happy one, however. Asian elephants have become what they are under conditions of human-animal conflict, violent confinement, and captivity, where they can be bored, maltreated, deprived of social relations, and depressed, though frequently they are also loved and cared for by dedicated keepers, mahouts, and trainers. Asian elephants exist along a spectrum from free-ranging to captive, and all of them are vulnerable to EEHV. In Asia, elephants persist in small patches of forests where they find refuge within densely populated agricultural landscapes.[20] In the fragmented and degraded forest landscape of South India, they have lost their traditional ranges and migration routes, and their life now involves interspecies conflicts in which both humans and elephants are injured and killed. In addition, an estimated fifteen thousand Asian elephants around the globe currently spend their lives in some form of captive confinement: in zoos or circuses, with private owners, in temples or elephant camps.[21]

While elephants have lived alongside humans for millennia,[22] their current close proximity to humans poses an important obstacle to elephant well-being, reproduction, and species survival. Unlike other close human companion animals, elephants have

15. Haraway, *Companion Species Manifesto*.
16. EEHV Advisory Group, "EEV Info," www.eehvinfo.org/eehv-background/ (accessed July 5, 2015).
17. Ibid.
18. Zachariah et al., "Fatal Herpesvirus Hemorrhagic Disease."
19. Ibid.
20. Baskaran et al., "Current Status of Asian Elephants in India"; Sukumar, *Living Elephants*.
21. Srinivasaiah, Varma, and Sukumar, *Documenting Indigenous Traditional Knowledge*.
22. Locke, "Explorations in Ethnoelephantology"; Sukumar, *Living Elephants*.

never been selectively bred to suit human needs. Historically, when elephants were employed as timber workers, war animals, or temple elephants, they very rarely mated and reproduced.[23] Instead, free-ranging elephant cows carefully choose their mating partners, "smell-tasting" the available bulls in a complex procedure that biologists call female selection.[24] In the company of humans and in situations of captivity, female elephants have limited agency to decide upon their mates, and some cows do not have offspring at all during their lifetime.[25] Historically, elephants' slow growth rate and long birth spacing made it unprofitable for their human keepers to breed them in captivity; across South and Southeast Asia the effort and cost of raising an elephant calf by human nurturing have far exceeded the difficulties of catching free-ranging animals that could be made ready to work in a couple of months.[26]

Elephants' long period of immaturity also makes them especially vulnerable to EEHV since most fatal instances of the disease affect baby and juvenile calves that have not yet had a chance to reproduce. Because EEHV affects the young in this way, it is a serious extinction threat.[27] Along the continuum from free-ranging to captive, elephant fertility declines in step with human proximity and management. The first-year mortality rate for zoo elephants in Europe and North America is 30–40 percent, somewhat worse than the rate for timber camp elephants in South Asia, which is 24 percent for female calves and 16 percent for male calves,[28] and worse still than the rate for free-ranging African elephants.[29] Because they have a long life span, most elephants living in zoos, circuses, and South Asian timber camps today were free-ranging individuals captured and "broken" by mahouts and elephant handlers. Capturing free-ranging elephants has been forbidden in India since 1982, and in both Europe and North America it is illegal to restock zoo populations with elephants from free-ranging populations. Thus some biologists and veterinarians predict that in the next few decades the captive elephant population will go extinct.[30] No population in captivity is self-sustaining,[31] so zoos are trying hard to establish breeding programs where assisted reproduction is part of elephant species survival plans.[32]

23. Kurt, *Von Elefanten und Menschen*, 25.

24. Ibid., 47; Sukumar, *Living Elephants*, 112.

25. Arun Zachariah reported that many of the free-ranging elephant cows he has dissected show no marks of pregnancies in their uterus; only a few, usually the leading cows and so-called matriarchs in a herd, have offspring. Zachariah, interview by Ursula Münster, Wayanad, Kerala, January 1, 2016.

26. Kurt, *Von Elefanten und Menschen*, 25.

27. Virologist Alex Greenwood, Leibniz Institute for Zoo and Wildlife Research, Skype interview by Celia Lowe and Ursula Münster, Berlin and Munich, July 14, 2015.

28. Mar, Lahdenperä, and Lummaa, "Causes and Correlates of Calf Mortality."

29. Wittemyer, Daballen, and Douglas-Hamilton, "Comparative Demography of an At-Risk African Elephant Population."

30. Arun Zachariah, pers. comm. with Ursula Münster, Wayanad, Kerala, January 1, 2016.

31. Kurt, *Von Elefanten und Menschen*, 227.

32. See, for example, Smithsonian Conservation Biology Institute, "Elephant Breeding Report," nationalzoo.si.edu/SCBI/ReproductiveScience/ElephantBreedRepro/ (accessed July 10, 2015).

The virologists, veterinarians, and disease ecologists we worked with and interviewed believe that to minimize the likelihood of infection and the harm caused by the herpesvirus, elephants need to be otherwise well and free of stress. However, wellness emerges not only from their present conditions of living but also from their historically situated biographies, which necessarily include histories of capture, training, display, and assisted reproduction. Nowadays, elephants learn to live their complex psychological, social, cultural, and gendered lives in close proximity to humans. In the South Indian setting, the "matriarch," or oldest female elephant leading the herd, teaches the young ones how to live and survive in an anthropogenic landscape. She leads them to the most nutritious and tasty plants that humans grow in their fields. She shows them how to trespass human infrastructure and to outsmart human technology—to jump over trenches, tear down electric fences, and cross well-traveled roads—to continue on their traditional migration routes. The oldest cow also teaches her offspring how to avoid dangerous places, where farmers defend their fields with small shot charges, lay out poisoned bait, or electrocute elephants with improvised high-voltage fences.[33] Some pachyderms have used their abilities to act altruistically, cooperate, feel compassion, and care for each other to survive alongside humans.[34] Others, often elephant bulls, have taken advantage of their strength, size, and body power to force their way through and across human-dominated landscapes. While the elephants' extraordinary ability to learn has enabled them to survive in these changing environments, this same adaptive intelligence has meant that the traumatic effects of violent human-elephant contact and acquired aggressive behaviors against humans can be passed down from generation to generation. It also indicates that elephants possess what anthropologists call "culture," and the simple ability to biologically reproduce cannot be taken as the only marker of elephant thriving.

In the viral creep, EEHV makes use of elephants' inability to cope with some aspects of their contemporary conditions of living to become a killer of juveniles and a threat to the Asian elephants' existence as a species. During our fieldwork, biologists and people working and intimately dwelling with elephants at the forest boundary identified violent encounters with humans as a primary cause of stress for elephants. In South India, older members of a herd remember and embody the trauma of ivory poaching and capture, which continued in the forests until the 1980s. Younger animals encounter violence in what is commonly known as human-animal conflict. In zoo settings, stress might emerge when elephants suffer from the dullness of quotidian life in enclosure, the loss of or separation from their loved ones, and the lack of movement and activity.[35] Elephants react to traumatic experiences, such as poaching, culling, violent treatment, or isolation, with grief, depression, antisocial behavior, and heightened

33. U. Münster, "Working for the Forest."

34. Kurt, *Von Elefanten und Menschen*; Sukumar, *Living Elephants*.

35. Brown, Wielebnowski, and Cheeran, "Pain, Stress, and Suffering in Elephants."

aggression. They can display symptoms of posttraumatic stress disorder[36] and are known to kill keepers and handlers in fits of rage.

Nevertheless, stress itself is an ambiguous category. We cannot know how any particular individual, human or nonhuman, will react to challenging circumstances. Moreover, while many experts we interviewed were concerned by contemporary conditions of living for elephants, no one claimed to be able to identify specific stressors that would inevitably lead to herpes viremia. As with an eruption of canker sores or fever blisters in human herpes infections, the links between stress and immunosuppression in elephants are multivectored and amorphous. Additionally, "stress" itself can be viewed as a placeholder for all that we do not really understand about the troubled relationships among social life, emotions, and physiology. As anthropologist Jean Langford notes, "When we say *stress* do we really do anything more than obscurely normalize the way that creaturely well-being is imbricated with social experience and what unfolds when both correlatively go awry?"[37]

As the virus takes advantage of the contemporary troubles of elephants, creeping past human infrastructure and barriers and across blurred boundaries between wild and domesticated to take elephant lives, other questions arise. It is still unclear whether the virus is evolving into a form with an enhanced capacity to destroy elephant life or if it is a relatively stable entity that our current observational practices and recent technologies newly allow us to identify, study, and describe. Might the newly apparent virulence of EEHV be an effect of our intense scrutiny of elephants? Recent genomic technologies and the ability to identify the virus in all its variants also coincide with the period when new reproductive technologies have been in place for breeding elephants in captivity. How do the two phenomena—technologically assisted reproduction of large captive mammals and the emerging sciences and technologies of virology—intersect? The inscrutability of the virus, then, is a challenge to the anthropocentric assumption that human care is enough to manage and sustain life in times of extinction.

When Elephants Die: Well-Being versus Species Survival at the Woodland Park Zoo

In the 1980s, zoos and other captive elephant regimes began the demanding project of breeding and rearing elephant calves in confinement, where elephants have been most vulnerable to the viral creep. EEHV is responsible for a quarter of all deaths of captive

36. Late elephant ethologist Fred Kurt observed how traumatized adults living in landscapes of human-elephant conflict are incapable of providing the necessary care and schooling for their calves to develop into responsible and social members of the herd; "disturbed socialization" and hyperaggressive behavior are often the result (*Von Elefanten und Menschen*, 68). Elephant psychologist G. A. Bradshaw reports traumatized and emotionally disturbed African elephants that carefully plan "vengeful" attacks on Masai villagers and their cattle in Africa (*Elephants on the Edge*, 144). Geographer Maan Barua speculates that elephants in Assam raid distilleries for alcohol to use as "a sedative that helps them cope with the pain of postcolonial consciousness" ("Volatile Ecologies," 1473).

37. Jean Langford, pers. comm., December 2015.

juvenile elephants in Europe and North America, and only eight elephants are known to have survived EEHV viremia.[38] These days, when an elephant begins to act oddly, herpesvirus is immediately suspected and feared. Many of these elephants are given a human herpes drug, famciclovir, but dosage is difficult, and no one knows whether the drug actually helps. It is also unknown how the virus is transmitted in captivity, with no clear linear chain of transmission. This has caused some to question the ethics of captive breeding programs where juveniles are certain to be infected and have a high chance of mortality.

When a baby was born to the elephant Chai at the Woodland Park Zoo (WPZ) in Seattle in 2000, I (Celia) recall my own "passionate immersion"[39] in elephant lives as I repeatedly watched a video of the birth on the WPZ website. In the midst of contemplating motherhood myself, I was drawn to the spectacle of the world's largest land mammal giving birth to a calf that was bigger than an adult human and incredibly cute. I recall the placental sack breaking and keepers quickly extracting the baby, moving it out from under its mother's feet to keep it from being trampled. I witnessed the baby's airway cleared with a mechanical suction hose. I later watched online and in person as the adorable infant ran around her enclosure with her uncontrollable new trunk waving about. And I recall friends' children sending in prospective Thai language names for the baby, who was eventually called Hansa, meaning "supreme happiness." I had never heard of EEHV.

Hansa quickly became a draw for the WPZ, which is a paradox of raising elephants in contemporary zoological gardens. While thirty years ago and more zoos were framed as a source of public entertainment, they have now taken on the agenda of conservation and species survival. In addition to ensuring species survival in some minimal form through reproduction, the contemporary conservation rationale for zoos centers on creating affective responses in zoo goers so they will be inspired to help preserve animals in the wild. As WPZ's deputy director David Bohmke describes it, "We believe we should have elephants in captivity for a lot of reasons, primarily because it educates folks about the plight of elephants in the wild, so that hopefully people can do something about that."[40] Some studies have suggested, however, that the educational value of zoos has been exaggerated.[41]

It was with supreme sadness and disappointment on the part of zookeepers and the Seattle community, then, that at six and a half years of age, Hansa died. The death was very quick, and initially the cause was indeterminate. Hansa's medical history and biological samples were sent to the National Elephant Herpesvirus Laboratory in Washington, DC, for epidemiological analysis. Within a month, a new strain of EEHV had

38. Nolen, "Herpesvirus Claims Another Elephant."

39. Tsing, "Arts of Inclusion," 14.

40. Friends of the Woodland Park Zoo Elephants video, November 24, 2009, www.facebook.com/FreeEles/videos/220339974687/.

41. Marino et al., "Do Zoos and Aquariums Promote Attitude Change in Visitors?"

been identified. The death of Hansa was part of the larger phenomena of herpes deaths within relatively newly established zoological captive breeding programs. Through assisted reproductive technologies, artificial insemination, and the transport of animals for breeding, baby elephants are now born in zoos. Nevertheless, pregnancy and survival rates for captively bred elephants are low.

The sudden and painful appearance of EEHV in Hansa brought to light the question of affect and the public. Elephants in captivity, and especially the birth of a baby, are intended to bring zoo visitors into emotional contact with elephants. Visitors should be inspired by animals as representatives of their kind; they are not expected to engage with specific animals and their individual physical or psychological histories, however. They are not supposed to bring the capacity of zoo animals to suffer in captivity into the conversation, nor are they expected to take up the questions of rights and welfare in *ex situ* conservation. Matthew Chrulew writes: "Precisely insofar as zoos are biopolitical institutions devoted to the production and nurture of life, they disturb and ignore the role of death."[42] The death of Hansa could not be ignored, however, and her story became part of an emerging reaction to elephant confinement in the Seattle community.

Friends of the Woodland Park Zoo Elephants (hereafter Friends) was established in 2005 to advocate on behalf of Bamboo, Chai, Watoto, and Hansa, the elephants in the WPZ collection, and to bring to light their suffering in captivity. The death of Hansa and EEHV became a central part of their protest story. Thom van Dooren has illustrated some of the many ways that individual animals suffer for the sake of the larger species entity.[43] Like other animal rights groups, Friends argued that it is impossible to keep elephants in zoo captivity without causing serious harm to individual animals and ignoring their histories as individuals.

Through their political agitation, Friends sparked the "queering"[44] of the scientific management of elephant captivity in Seattle. I witnessed Friends protesters outside the WPZ gates in elephant drag mimicking the swaying and pacing that large mammals display in captivity (called stereotypic behavior). In addition to the boredom and lack of mental stimulation the street theater brought attention to, Friends focused on other forms of suffering: the limited space available to these giant creatures, the foot infections and arthritis the adult elephants experience because of their immobility, the cold climate in Seattle, and the personal incompatibility of Bamboo and Chai leading to stress and conflict.[45] In contrast to the Friend's advocacy for release of the WPZ elephants to a sanctuary, Deputy Director Bohmke made the heteronormative claim that "giving Chai a baby" was her greatest hope for happiness and fulfillment. Prioritizing

42. Chrulew, "Managing Love and Death at the Zoo," 145.
43. van Dooren, *Flight Ways*.
44. Mortimer-Sandilands and Erickson, *Queer Ecologies*.
45. Friends of the Woodland Park Zoo Elephants video.

species survival, the WPZ could not comment about what repeated attempts to fertilize Chai were like for her (or her sperm donors), her miscarriages, or, after she did finally give birth, her experience of the death of her offspring Hansa.

As stories of elephant suffering crept into the Seattle media, new claims and accusations about Hansa's life and death and her mother's experiences in captivity emerged. To be inseminated, Chai had been sent by the WPZ to the Dickerson Park Zoo in Springfield, Missouri, where she was beaten with an axe handle by keepers. Dickerson was eventually fined by the US Department of Agriculture for their treatment of Chai during her stay.[46] While WPZ zoo officials called Hansa a "princess" and "a little spoiled," David Hancocks, a former director of the WPZ who resigned over the conditions of the elephant enclosure and who believes elephants cannot be ethically kept in zoos, revealed that Hansa had been beaten as part of her training when only a few months old and was sometimes kept from sleeping with her mother Chai, traumatic conditions for both mother and baby.[47]

Recognizing EEHV as a prevalent cause of elephant mortality, Friends drew a connection that the WPZ and other veterinarians we spoke with did not, linking the viral creep that killed Hansa to the conditions of her confinement. Indeed, while it is impossible to prove that Hansa succumbed to EEHV as a result of stress, stress and viremia appear to be closely associated across the spectrum of herpesviruses. Friends accused the WPZ of irresponsibly breeding Chai, since there was no way to prevent infection in any child of hers. Friends further argued that breeding Chai was unethical given the suffering of artificial insemination she underwent, noting that she had undergone 112 invasive procedures and multiple miscarriages. Under conditions of inevitable exposure to the virus and the unavoidable problems of confinement, they took the position that elephants should not be kept or bred in zoos.

Despite their obvious concern for the Seattle elephants, Friends lacked an equivalent degree of care for the virus, making meaningful errors in their approach to EEHV. Although conclusively refuted by veterinary studies, Friends argued that Chai's viral infection stemmed from housing Asian and African elephants together. They further claimed that the WPZ had "no infection control in place" to prevent herpes,[48] not recognizing that viable infection control for EEHV does not exist even in elephant sanctuaries, that EEHV is undetectable in its latent phase, and that as yet there is no way to know in advance when a lytic-stage infection will occur. In their activist mode, fighting on behalf of individual elephants, Friends failed to acknowledge the mystery of the viral creep, the fuzziness of the concept of stress, what remains unknown about elephant-virus interactions, and the capacity of the viral entity to withdraw from elephant or human perception.

46. Hancocks, "Hansa's Short Life One of Deprivation."

47. Ibid.

48. Friends of the Woodland Park Zoo Elephants, "What's Wrong," freewpzelephants.org/issues/ (accessed July 2, 2015).

Although certainly concerned with the well-being of its elephants, WPZ, like most conventional twenty-first-century zoos, emphasized species survival and the urgency of elephant reproduction, whereas Friends took up the elephant primarily as an individual that could experience pain, loss, and suffering as well as joy and satisfaction.[49] In accessing different aspects of the elephant, disagreements between Friends and the WPZ centered around contested versions of love and care: while the former emphasized love and care for the individual, the latter emphasized passion for and attention to the species as a whole. While the WPZ staff's love for baby Hansa was evident in their tears when she died, and they insisted on the high quality of their elephant care, Friends argued that the elephants should be sent to the Performing Animal Welfare Society, an elephant sanctuary in California, where they could live out their damaged lives in relative ease. When Friends spoke on behalf of physically and emotionally vulnerable elephants, they were able to access something about elephants as sentient and suffering beings, but they offered little by way of suggestions for the future of the elephant species, which the staff of the WPZ were deeply dedicated, however imperfectly, to conserving. We turn now to the space where the survival of the elephant species has perhaps most frequently and powerfully been fantasized: the "wild."

Postmortem Encounters: Viral Creep in the South Indian "Wild"

My (Ursula's) first encounter with the viral creep was at the laboratory of Arun Zachariah, a wildlife veterinarian and disease ecologist working for the Indian Forest Department at the Wayanad Wildlife Sanctuary in the South Indian state of Kerala. Zachariah draws on necropsy, the fine art of viewing the dead, to render visible the hidden microbial stories of disease and interspecies contact in this ecosystem. After sudden and unusual elephant deaths, he searches the animals' corpses for potentially lethal entities—toxins, viruses, fungi, and parasites—and for such potentially lethal processes as genetic disorders. Knowing the viral creep and how it works within human-disturbed ecologies means becoming an expert in knowing elephants from the inside out, and Zachariah immerses himself in the odors and critters that accompany an already decaying animal. As he demonstrated to me with a series of photographs that turned my stomach, elephant necropsy means literally crawling inside the animal's body in various stages of decay to examine its mucous membranes, teeth, joints, internal organs, and intestinal tract for abnormalities as well as collecting tissue samples from the heart, liver, kidneys, blood, and lymph nodes. If the animal's carcass carries infectious agents that could be transmitted to others or if it shows signs of human poisoning, the doctor and his team burn it in the forest. If the carcass is noninfectious, they leave it in the forest to decay so that other species can feed on it (fig. 1).

49. Similar to the outlook of the WPZ, where the ability to reproduce and ensure species survival gives ultimate value to endangered animal life, Rheana "Juno" Salazar Parreñas attributes an orientation toward reproductive capacity as the highest priority in orangutan conservation in Malaysia; see Parreñas, "Producing Affect." This divide has been similarly explored in Thompson, "When Elephants Stand for Competing Philosophies of Nature."

Figure 1. Elephant carcass at the wildlife sanctuary. Courtesy of Arun Zachariah

Zachariah's viral ontology emerges from laboratory practices as well as from his necropsies. For him, EEHV comes into being through technological advances in molecular biology since the 1980s. Back in his air-conditioned and sterile lab near the wildlife warden's headquarters, PCR diagnostics and DNA sequencing enable Zachariah to detect and render visible the animals' silent cohabitants and genetic particularities. The vet's laboratory work brings into view ancient and endemic herpes strains that have actually coevolved with elephants. Previously, EEHV was only occasionally mentioned in anecdotal stories about elephants in India; the effects of its existence were described through behavioral and morphological symptoms: elephants were reported to suffer from "lethargy, lack of appetite, swelling of the head and around the eyes and blue discoloration of the tongue."[50] Zachariah and his colleagues cannot fully explain the contemporary spatiotemporal viral creep, and the viral object recedes from view. But it is clear to them that EEHV is killing more and more elephant calves and that these killings seem connected to a long history of human disturbance and ecological destruction in the South Asian "wild."

The Wayanad Wildlife Sanctuary stands in for the wild in this story. In this guise, it appears as a principal space of hope for the Asian elephant species, a place where an estimated eight thousand to nine thousand (relatively) "undisturbed" elephants still roam free. This is the landscape that grounds all the classic stories about how nature works and *should* be: stories about how elephants behave and flourish, stories of matriarchal herds, of abundant genetic diversity, of both the past and the future of wildlife. In these stories, like the ones I heard from Zachariah, a virus like EEHV is part of the "balance of nature": it culls the weak for a species that has, apart from the tiger, few if any predators. And yet these simple stories do not capture the viral-elephant-human becomings that emerge from the actual wild in Southern India. Instead, the sanctuary is a space where EEHV creeps across ecological communities, culling in intense and unexpected ways, refusing distinctions between wild, domesticated, and captive. Rather

50. "Herpes Virus Kills Elephant Calf in Wayanad."

than an untroubled wilderness where elephants are preserved and survive in isolation, the sanctuary emerges as a "wild country, where deeply rooted colonial legacies interact with novel forms of wildness—the 'dangerous, risky, and out of control'," just like the emergent ecologies within new regimes of biotechnology that Eben Kirksey, Sarah Franklin, and Jamie Lorimer have powerfully described.[51]

Zachariah's veterinary practices might be understood as enacting and performing the herpesvirus gone wild in the midst of conflict, stress, and imbalance.[52] His postmortem operations reveal the context of EEHV deaths and the broader bodily effects of traumatic human-wildlife proximity. In Zachariah's eyes, the observable rise of disease caused by human disturbance is a sign of stress in the South Indian wild. Elephant stress has increased in the last twenty years as this landscape has become a violent contact zone of interspecies clashes. In Wayanad, the herpesvirus lies latent and becomes virulent in relation to a long history of anthropogenic environmental damage—colonial logging, timber extraction, ivory poaching, human migration, and capitalist expansion—that has disrupted and remade the forest's multispecies assemblages. A growing human population, intensively cultivated agricultural fields,[53] roads, dams, railways, power-generating plants, and houses hinder elephants' ranging behavior.[54] The habitual migratory corridors of South Indian elephants, who travel up to fifty kilometers a day through different ecological communities, are blocked by human presence and infrastructure. Since 2006, twenty-six people have been killed by attacks from wild elephants. Farmers have submitted almost ten thousand applications reporting the loss of agricultural crops that were eaten or destroyed by wild animals,[55] and elephant bulls have been electrocuted by homemade high-voltage fences, initially erected by farmers to keep wild boars from their vegetable fields. Some of the elephant carcasses that Zachariah dissects are riddled with buckshot, which would have been painful throughout the elephant's life.

The viral creep flourishes in these "blasted landscapes."[56] Zachariah told me that, similar to the situation in North America and Europe, elephant populations living in the insular and degraded habitats of South India have little genetic variability. They are thus much more vulnerable to the viral creep and eventual extinction. Securing the flow of genetic material between different elephant clans is essential for maintaining a gene pool large enough to ensure a population that can withstand disease epidemics and viral and bacterial infections. Usually, elephant cows communicate via pheromones to identify, attract, and choose suitable mating partners, and they avoid having sex with their close relatives. Nowadays, severe forest fragmentation creates so-called island

51. Kirksey, *Emergent Ecologies*, 107; Franklin, "Ethical Biocapital."
52. Mol, *Body Multiple*.
53. D. Münster, "'Ginger Is a Gamble.'"
54. U. Münster, "Challenges of Coexistence."
55. Government of Kerala, *Report on Man-Animal Conflicts in Wayanad*.
56. Kirksey, Shapiro, and Brodine, "Hope in Blasted Landscapes."

populations, and female elephants are forced to inbreed. This is very similar to the situation in zoos, Zachariah argues, where female selection has been replaced by the technoscientific arts of human selection. According to the scientist, "nature," in the form of EEHV, now finds a way to eliminate the genotypes of those individuals who are highly inbred. The viral creep, in his perspective, is part of the ongoing process of evolution.[57]

Zachariah's scientific practices are transformed by his encounter with the viral creep. His practices are acts of viral care that perform the Anthropocene and have world-making power: through his work, a world of disturbed wilderness is created, a system in crisis where humans emerge as invasive species encroaching upon "nature." Some of his viral practices have direct biopolitical and material effects, because Wayanad's forest officials largely rely on his scientific expertise with respect to the forest's wildlife. He argues that the most important conservation measure is to strictly set apart human and animal domains and to establish elephant corridors that enable the animals to use their habitual migration routes and prevent inbreeding.

Zachariah's ontological politics play out in a setting where colonial and postcolonial regimes of management, and a long history of separating "nature" from "culture" and humans from wildlife, have left their deep traces in the landscape: setting apart human and animal domains continues to be the most important conservation measure. To make coexistence possible, and to reduce elephant and human stress, the Indian Forest Department has built deep elephant trenches and electric fences to separate forests and fields along the ninety-three-kilometer edge of the sanctuary. In 2013 the Kerala Forest Department also began to relocate more than one hundred indigenous communities' small hamlets inside the sanctuary.[58] Despite their legal forest rights, these people's use of the forest resources continues to be criminalized, and their domestic animals—cattle and goats, potential carriers of diseases and extinction—are denied access to the forest's grazing land. Ironically, these relocations do not seem to fully reduce elephant stress, especially since growing numbers of tourists are allowed to enter the forest in their noisy jeeps.[59] The forest's authoritarian protection regime masks asymmetries, hierarchies, and the diversity of caste, class, and gender in the forest as well as the fact that not all members of the human species are equally responsible for causing degradation, death, and extinction. The sanctuary's biopolitical interventions have not stopped either the viral creep or elephant raids and killings.

Other imaginative and creative solutions are needed for elephant thriving in this landscape. The monoculture teak plantations that cover the Wayanad landscape are not interesting for elephants. They are dry and contain exotic lantana plants, and cattle compete with elephants for grazing space. Some farmers, forest officials, and environmentalists are already working on this by planting fruit trees and human crops that

57. Arun Zachariah, pers. comm., January 1, 2016.

58. Kerala Forest Research Institute, "Voluntary Relocation of Settlements in Wayanad Wildlife Sanctuary."

59. U. Münster, "Challenges of Coexistence."

elephants are fond of, such as jackfruit or mango trees, inside the sanctuary. They also dig elephant water holes in the forest, prohibit tourist vehicles in the core zones of the park, and attempt to reduce sound disturbance, which is important for elephants, who communicate across long distances via infrasound and seismic signals through their trunks and feet.[60] In the Wayanad "wild," the multispecies communities inhabited and shaped by elephants and other beings are simultaneously an artifact of human design.

Since this is the case, some want to ask what other landscapes might be possible that are interesting and healthful for both people and elephants. If Herpesviridae creeps across the captive and wild spaces that dominate possibilities for contemporary elephant lives, if neither of these spaces can offer a site for elephant flourishing, then to what or where can we turn? Is it possible to imagine a space that thwarts viral creep, considers species survival, and attends to animal welfare simultaneously? Zoo Zürich is one important site attempting to answer this question.

Mehr Wellness für die Größten: Zoo Zürich's Elephant Spa

In Switzerland we were introduced to Zoo Zürich's Kaeng Krachan Elephant Park by Alex Rübel, the zoo's director. With its motto "more wellness for the largest" (*Mehr Wellness für die Größten*), Kaeng Krachan is putting into place the philosophies of its late director, Swiss zoologist and animal psychologist Heini Hediger (1908–92). The elephant park is part of an effort to create a site of wellness for the seven Asian elephants in the zoo's collection and for the zoo-going public. Among other aspirations for Kaeng Krachan, Zoo Zürich hopes to thwart the viral creep through its architectural innovations.

Together we viewed a video of the birth of Omysha at Zoo Zürich.[61] Omysha's birth was very different from Hansa's at the Woodland Park Zoo. Instead of a lone mother assisted by zookeepers wielding suction hoses, Omysha's mother gave birth in the presence of two elephant aunties who assisted with the birth. In the video, it is elephants and not humans who care for the future generation; the adult females can be seen kicking the baby forcefully after the birth, trumpeting and growling, seemingly to get Omysha out of the placental sack and make sure she is breathing. For Rübel, although zoo elephants will never reenter the wild and become part of the genetic or behavioral diversity found there, the wild provides standards for elephant behavior. Allowing elephants to practice this unassisted birthing behavior is a way for the zoo to create a good environment for elephants.

Rübel was inspired to attend to wellness by his extensive prior experience with elephants who had lived and died in less than ideal ways. He was the clinician who was called to attend to Lohimi, the three-year-old Asian elephant from Circus Knie in Switzerland who, in 1988, was the first identified death from EEHV in the world. Rübel

60. Sukumar, *Living Elephants*, 141; Kurt, *Von Elefanten und Menschen*, 92.

61. Zoo Zürich, "Geburt von Omysha," www.youtube.com/watch?v=kvxdDBw84nc (accessed July 10, 2015).

took Lohimi's case history and observed blood leaking from her eyes and mouth. He did not suspect a virus at the time, he told us; he believed he was witnessing some kind of catastrophic heart failure. Prior to Lohimi's death, herpesvirus in elephants was known morphologically through surface skin lesions and by intranuclear inclusion bodies in the lungs of African elephants. These were understood as signs of the widespread prevalence of herpes infection in African elephants, but there were no known histories of death from herpes, and it wasn't known in Asian elephants. When Rübel was called to tend to Lohimi, she was showing signs of depression and having trouble moving her trunk after performing in a morning parade and eating her lunch as normal. Just two hours after the onset of symptoms, she collapsed and died.[62]

Zoo Zürich has experienced two deaths from EEHV: Xian in 1999 and Aishu in 2003. But there are other consequential forms of mortality at work here. In 1995, an elephant trainer was killed in an attack by the elephant Komali. When elephants attack, which happens three or four times a year in Europe and North America, the elephant is often euthanized, as Komali was at Zoo Zürich. Kaeng Krachan's innovative architecture was designed to create spaces of well-being in times of loss and extinction, where humans can reestablish their lost bonds with animals, keepers are safe, and elephants can thrive. Perhaps, along the way, the relationship between the elephant and the herpesvirus could be modified so that juvenile elephants survive.

In June 2014, the zoo's new landmark exhibit was inaugurated after five years of planning by renowned architects, landscape designers, zoo curators, and biologists. Its award-winning roof expands like a giant net above the enclosure, designed to resemble the Thai forest canopy. From a bird's-eye view, the spectacular indoor enclosure of Kaeng Krachan resembles Kirksey's "bubble of happiness."[63] Within the bubble, however, the experiences of the visitor and the elephant are approached in different ways. The zoo's aim is to cultivate a nature-like (*naturhafte*) atmosphere for the human visitor entering the building. Visitors are invited to experience (*erleben*) animals in a safe and pleasurable environment that resembles the wild. Like the Woodland Park Zoo, Zoo Zürich is a place where visitors are intended to be affected and transformed through multisensory encounters across species divides. "The zoo, first of all, needs to be a place where human needs are met," Rübel explained, "so that people feel safe, open up for transformative experiences, and learn about the animals."[64]

While the visitors must feel they are seeing "nature," for Rübel the exhibit is not nature and never will be—it is a highly thought-out space designed to meet the needs of elephants, keepers, and visitors at the same time and, it is hoped, keep the elephants' immune systems strong enough to withstand viral emergences (fig. 2). Although the exhibit is eleven thousand square meters, and the elephants have more space than at

62. Ossent et al., "Acute and Fatal Herpesvirus Infection."

63. Kirksey, *Emergent Ecologies*, 54.

64. Alex Rübel, interview by Celia Lowe and Ursula Münster, Zoo Zürich, June 25, 2015.

Figure 2. The Kaeng Krachan Elephant Park. Courtesy of Zoo Zürich, picture by Jean-Luc Grossmann.

the Woodland Park Zoo, space is not all these large mammals need. Rübel compares the elephant exhibit to a well-appointed household: "We like to have good cupboards and a stereo to fit out our space. Elephants need a good well-appointed space also."[65] Rübel has witnessed very large elephant enclosures that he feels are fitted out like bathrooms, with hard surfaces and nothing in them to amuse the elephant. In the Kaeng Krachan exhibit, elephants instead experience what Fred Kurt calls "experiential gastronomy" (*Erlebnisgastronomie*):[66] at forty different locations in the enclosure, they find various kinds of food at different times, sometimes hidden, sometimes hard to reach, which keeps them walking up to seven kilometers a day. While visitors feel they are under a Thai forest canopy, for the elephants the enclosure offers a diversity of "occupations and employment" (*Beschäftigung*). The exhibit's most stunning elephant employment is a swimming pool where elephants can dive in and visitors can watch them swim from an underground viewing area.

Rübel sees himself in the tradition of Hediger, director at Zürich Zoo from 1954 to 1973 (fig. 3). Inspired by Jakob von Uexküll's *Umwelt* theory, Hediger extended the notion of a biosemiotic sphere in which each animal moves, cultivating attention to an animal's "psychotope," its living space (*Wohnbereich*) of psychological comfort, where it

65. Ibid.

66. Kurt, *Von Elefanten und Menschen*, 256.

Figure 3. Elephant wellness at Zoo Zürich. Courtesy of Zoo Zürich, picture by Jean-Luc Grossmann

feels safe, comfortable, and at ease.[67] Commenting on this legacy, however, Chrulew argues that "the contemporary biopolitics of zoological care, revolutionised by Hediger and since developed in all manner of enrichments and interventions, may have reduced the incidence of stereotypy and other effects of captivity; but it has a long way to go to truly heal the wounds of the 'sickly beasts' procured and produced by zoos."[68]

Chrulew's analysis centers on what we know: we know what these wounds are, and they are utterly accessible to our interpretive prostheses. While we do not disagree, the viral creep reminds us that elephants, like herpesviruses, can also be profoundly inscrutable. When elephants kill trainers, for example, it is often completely unexpected and happens to a trainer with a good relationship to an animal. Further, Rübel views stereotypic behaviors as the frustration of a specific need that can often be identified and resolved, not the automatic consequence of confinement. And where, to some, training looks stressful, he believes predictable training can help reduce stress on the animal. Similarly, in our conversation with Alex Greenwood, he argued, "we don't know if elephants are happy or not."[69]

As we have noted above, herpes reactivation is highly correlated with stress in all creatures. But even for trained, attentive professionals the stress of captivity, or what

67. Hediger, *Tierpsychologie im Zoo und im Zirkus*.

68. Chrulew, "Managing Love and Death at the Zoo," 153.

69. Greenwood, Skype interview by Celia Lowe and Ursula Münster, July 14, 2015.

makes an elephant a "sickly beast," is not an obvious thing. In elephants, herpes viremia can come when they experience what Rübel calls the "hard stress" of being moved. It also often comes at the time of weaning. Pregnancy can cause herpes viremia, leading to spontaneous abortion. These are some things we think we know, but we do not always know what the relevant conditions of stress will be for an elephant or which conditions will create an opportunity for a virus. This complex situation is not as intuitive as animal rights activists like the Friends of the Woodland Park Zoo Elephants want to make it out to be. To understand stress, we need to know more about elephants, about their particular and intersecting *Umwelten* and psychotopes, and about elephants both as a kind and as individuals with complex situated histories. But we also need to recognize that we cannot and will never know all there is to know about these beings who withdraw from the human gaze. At the same time, it is not only elephant ways of being that matter here: the viral creep emerges and takes form at the intersection of diverse *Umwelten*, diverse forms of human-virus-elephant life (alongside, of course, many others). This complex "ecology of selves"[70] is a definitively multispecies affair.

While finding the question of what makes an elephant happy important, Rübel does not want his keepers to fall in love with their elephants. The new ideal for elephant keepers at Kaeng Krachan is nonaffective labor through a system of "protected contact." The keeper killed by Komali at Zoo Zürich had been away from the herd for a while and had then tried to come back in and assert control in direct contact with the elephant. In the new system of protected contact, first introduced at the San Diego Wild Animal Park in 1989, humans and elephants never share the same space. This means that keepers must entice elephants to participate in their care and not force them through rank-order dominance or beatings. Elephants come up to the bars to have their feet examined or their ears checked, and they are able to walk away and refuse the care that is being offered. Elephant autonomy may also contribute to elephant well-being.

Rübel was profoundly affected by his first encounter with EEHV. He still remembers Lohimi's death from when he was a clinician at Zürich University and fears that Omysha might be killed by the virus when she is weaned; the most he can do is fortify her with gammaglobulin injections at the time. But he also hopes it is possible that, within the bubble of wellness at Kaeng Krachan, conditions for living will bring contentment and Omysha can survive to become a permanent part of the multigenerational herd of older female elephants. In Zoo Zürich's techno-nature-culture, organisms and architecture are "joined together to ground modest hopes,"[71] yet it seems unlikely that these relatively minor innovations in care will offer a complete solution for captive elephants and certainly not for the broader troubles of extinction or suffering in proximity to humans faced by their kin at large.

70. Kohn, *How Forests Think*.

71. Kirksey, *Emergent Ecologies*, 53.

As would be expected, all the elephants at Kaeng Krachan harbor latent herpes infections. Despite the nature-like innovations and the spa-like atmosphere, viral creep might yet disrupt this bubble of wellness. As recent scholars of care and technoscience indicate, "The ways in which we are enjoined to be happy are often normalizing strictures,"[72] in this case normalizing the confinement environment. And yet the Zürich collection of elephants also lives under artificial conditions where, as Greenwood observes, every animal is in constant close proximity to every other and where, when "one animal sneezes it sneezes on the entire food supply, like the hay pile." Here, mating is planned and not random, and you have an "artificial collection of viruses and elephants." In short, Greenwood told us: "A zoo is more like a commercial hog farm than you might think."[73] Despite its level of attention to the various elephant *Umwelten* and psychotopes, the Kaeng Krachan is still an enclosure with limited capacity to provide for all of the behavioral and affective dimensions of elephant lives. Around the world, as elephant lives become increasingly frayed and fractured, it is more and more clear how vital these broader contexts have been in enabling elephants to live with, evolve with, and in the past even thrive with their companion viruses.

Ending: When Viruses "Go Rogue"

In our research and writing collaboration we have attempted to acknowledge intense levels of suffering and destruction for people, elephants, and viruses, while holding onto narrow spaces of hope, in three human projects of care. This ethnography of the human-elephant-viral mix among different settings of the Anthropocene explores our contemporary world as a mix of nature, culture, design, and technology, and never purity. Our collaborative natural-cultural ethnography aims to take "our powers of observations," as Anna Tsing puts it, "back to the world to see what promises and terrors surround us."[74]

In our story, there is no wild that exists outside the Anthropocene, Capitalocene, Plantationocene, or Chthulucene[75] to which elephants might joyfully return. The zoo, the "wild," and the sanctuary are each, in different ways and to different extents, contemporary forms of human-designed care. Despite their differences, these three sites share one feature: none can guarantee elephant futures and flourishing. Zoos attempt to alleviate social isolation, boredom, and stress while keeping the existence of the species in view and striving to suppress the virus. The "wild" provides fleeting resources for genetic diversity, behavioral comfort, and species care but no longer is a "refugia"[76] that might replenish elephant populations or where elephants might return to lead normal lives. The wild can no longer protect elephants from similarly damaged yet overarmed

72. Murphy, "Unsettling Care," 721.
73. Greenwood interview.
74. Tsing, "Feral Biologies," transcribed notes.
75. Haraway, "Anthropocene, Capitalocene, Plantationocene, Chthulucene."
76. Tsing, "Feral Biologies."

humans who threaten and terrorize them. And elephant sanctuaries, while offering an ease of living conditions for former circus and zoo animals to live out their remaining days, contribute little to elephant-viral symbiosis or to the future of the Asian elephant as a species. Each designed setting attends to its own limited perspective on elephant and viral being, leaving some vital processes, spaces, and bodies unexamined and uncared for.

Elephants and viruses also bring into view interconnected worldings. "World making," as Deborah Bird Rose reminds us, "depends on uncertainty. The way of nature is the way of the new."[77] EEHV is a deeply ancient elephant companion that has persisted together with elephants over millennia, though something has now changed. In the viral creep, herpes has turned on elephants in a way that may soon prove to be suicidal, since the virus cannot live without its host. We do not know how the herpesvirus engaged the elephant a century ago and more, other than to observe that it did not decimate elephant young. As Greenwood notes, "When viruses go rogue, something has gotten out of balance."[78] We do not know these viruses, so we presume they are negative, he told us, but in humans the herpesvirus is a regulator of immunity. He similarly believes that EEHV is at least benign "in nature" and possibly even helpful. Nevertheless, in the contemporary human-elephant-virus assemblage, the virus has become a killer and a threat to species survival. We cannot rely on the positivist realism of reductionist explanations or on what Haraway calls methodological individualism to understand this.[79] The story of the virus and the elephant shows us that speculative imagination—modes of imaging what cannot be known but is nonetheless very real and consequential—is always involved when we make sense of the world around us.

Human solutions to the viral creep are limited in part because our access to the entities involved is also limited. We act on scientific and linguistic representations, without acknowledging the limitations of these techniques. But elephants and viruses escape human access in either science or language. Symptoms are likewise representations and enactments; the herpesvirus represents itself to the body of elephants as viremia in mild to acute expressions. But then the herpesvirus evades representation-as-symptom and withdraws. We still do not know where latent EEHV resides in the elephant body—maybe it is the heart, maybe the lung or nerve endings. And elephants are similarly withdrawn. We can guess and imagine what makes them happy and whether it is possible for them to live meaningful lives deprived of their complex social and cultural relationships and in close proximity to humans. But we do not know exactly what causes them stress, how stress is experienced and manifests in elephants' bodies, or if stress alone is the reason for this new fragility in elephant populations. It is hard to enact an ethic of care for entities whose needs are so opaque. Human care for

77. Rose, *Wild Dog Dreaming*, 50.

78. Greenwood interview.

79. Haraway, "Anthropocene, Capitalocene, Plantationocene, Chthulucene."

elephants and their viruses will never be enough. Thus the story we tell of the viral creep helps us to understand the limitations of diverse human orchestrations. It offers a way to unravel the open-ended stories of lively entanglement and world making in settings where human management and care have only limited power to secure the future of valued life forms on our damaged planet.

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Landscape and Inscription

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Abstract This essay discusses the changing notions of landscape and nature at work in the video installation *Mountain Pine Beetle* and explores some of the forces that eventuated in the devastated landscapes of the Rocky Mountain West brought on by the infestation of the mountain pine beetle beginning in the early 2000s—an infestation caused, in no small part, by what some scientists have called a perfect storm of circumstances created by global warming. For this project, the landscape becomes a site of inscription of forces that operate both above and below human scales of perception and interaction with the landscape—forces that are at once geological, economic, and geopolitical.

Keywords landscape, climate change, symbiosis, Rocky Mountains, pine beetle

Over the past couple of years, we have been working on a suite of video installation projects based on different landscapes. The first in the series is set in the Central Flyway Migration Corridor of the southeast Texas coast on the Gulf of Mexico, near Houston, where we live, which in turn sits in the middle of one of the largest and most concentrated oil and petrochemical refining and shipping complexes in the world, which runs from the Port of Houston and the Houston Ship Channel to Galveston Bay and from there to the Gulf of Mexico. The second is set in and around Big Bend National Park in west Texas, on the Mexican border—a UNESCO biosphere reserve that is the size of the state of Rhode Island and the most remote place in the lower forty-eight states, sitting at the "big bend" of the Rio Grande. Big Bend is a dramatic landscape of animal and human migration, not only home to 430 species of birds and more than 50 endangered, threatened, and otherwise listed species but also a hot zone for human movement across the US-Mexico border—a perennially explosive political issue in the United States, particularly in states such as Texas and Arizona. The third in the series, the one we focus on here, *Mountain Pine Beetle*, is set in the radically altered mountain forests of Colorado after the mountain pine beetle infestation that began about twenty years ago, reaching devastating proportions in the mid- to late 2000s.

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All of these pieces are interested in the movement and migration of human and animal populations across particular landscapes and particularly in the forces that drive them, some of which (like transportation networks) are visible and tangible, and some of which (like climate change and international circuits of energy production and distribution) are located nowhere in an immediately tangible sense but, for all that, are no less real. Our aim here is not to produce documentary art—on the model of, say, the Center for Land Use Interpretation—but rather to gesture toward how these landscapes and our experiences of them are in a fundamental way postnatural in the sense evoked by our colleague Timothy Morton. Morton argues that the world (and we need to hear the Heideggerian resonances of that term) has in fact *already* ended, that in fact it ceased to exist with the invention of the steam engine by James Watt in 1784. From that point forward, the Anthropocene was launched and climate was radically denaturalized (and for that very reason ecologized) by humans who had become a geological force inseparable from the nature they were in the process of befouling.[1] Our interest is less in the details of Morton's claim (dating this phenomenon, for example, to the invention of the steam engine) than in the sense we share with him that such concepts as nature are no longer adequate to a truly ecological thinking in this more complex sense in which human action and its impacts on the natural world are implicated in the scalar and temporal complexities of the Anthropocene and global warming. Morton characterizes these as "hyperobjects" that "are massively distributed in time and space relative to humans" and thus in a fundamental sense defy thought—certainly representational thought.[2] To shift the conversation in this way is to realize that any environment is fundamentally a virtual space—virtual in the sense not of less real but of *more* real, more multidimensional, in a way that is not domesticated or exhausted simply by human ways of knowing, seeing, and experiencing a landscape. This brings us back, of course, to the small, lowly pine beetle and its short life cycle, on the one hand, and the massive pine forests and mountain ranges, moored in geological time scales, on the other.

Mountain Pine Beetle focuses on the radically changed landscape of the Front Range and Gore Range in Colorado since the early 2000s due to a historically unprecedented infestation of small insects about five millimeters long, sometimes also called the Rocky Mountain bark beetle. When we lived there for a couple of months during the summer of 2013, in the Winter Park area, what caught our attention—and would capture anyone's attention at first sight—was the immense devastation of the pine forests in places like Fraser River Valley and Rocky Mountain National Park. In many places, as much as 80 percent of the pine forest is either dead or dying. The current infestation began in the mid-1990s in the lodgepole pine forests of British Columbia, and the first signs of Colorado's current infestation were seen in 1996 in and around Rocky Mountain

1. Morton, *Hyperobjects*, 4, 7.
2. Ibid., 1.

National Park.[3] But the infestation really took off in 2002, the same year that high winds in British Columbia allowed the pine beetle to migrate to the Alberta Plateau, well beyond its normal range.[4] As of May 2013, the pine beetle was devastating forests in all nineteen western states and Canada, decimating approximately 88 million acres of timber at a kill rate of 70 to 90 percent. The infestation has now slowed, simply because so many of the prime host trees in Colorado are either dead or dying.[5]

The way this process works is fascinating: the pine beetle lodges in its preferred host (typically ponderosa or lodgepole pine, though it does attack other species) and lays its eggs in late summer or early fall. The larvae winter over in "galleries" under the bark and start to mature the following spring; by July most of the pupae have turned into adults. Adults feed under the bark during the summer, and where the feeding chambers meet, the beetles emerge from the tree through an exit hole, where they can attack surrounding trees. Once infested, the trees try to defend themselves by using their pitch to push out the attacking beetles—hence the oozing pitch tubes found on infested trees. The beetles, however, have a powerful partner—a blue stain fungus, *Grosmannia clavigera*, which in fact is a symbiont of the beetle. The fungus travels from tree to tree in a special structure built into the beetle's head, and it attacks the tree by producing a thread-like mass that takes over the tree's phloem and colonizes its sapwood, thus blocking the ability of the tree to send out pitch to the pitch tubes, at the same time disrupting the nutrient-conducting columns of the tree.[6] Between the blue fungus's effect on the tree's circulation and the feeding of the beetles, the tree dies.

But the beetle has another, even more powerful ally that is important to our project: global warming. When we ask why this scale of infestation did not happen a long time ago (given that the mountain pine beetle is indigenous to Colorado), we find that the epidemic has been made possible by what a US Forest Service document calls a perfect storm of three primary factors. First, large stands of target species trees of a sufficient diameter (six or more inches), aging and growing in dense stands, allow the beetle to exit and move easily from one tree to the next. Second, a prolonged and chronic drought in Colorado began in the late 1990s and became severe in 2000, which stressed the trees and made them more susceptible to attack. Third, warmer than normal temperatures during the winter over the past fifteen years in Colorado have both greatly decreased beetle mortality rates and increased their reproduction.[7] In fact, in one high-elevation study, these warmer temperatures enabled the beetles to complete their

3. US National Forest Service, "Frequently Asked Questions about Mountain Pine Beetles in Colorado," www.fs.fed.us/rmrs/docs/bark-beetle/faq.pdf (accessed November 18, 2015).

4. Ibid.

5. Sims et al., "Complementarity in the Provision of Ecosystem Services."

6. Rice, Thormann, and Langor, "Mountain Pine Beetle Associated Blue Stain Fungi."

7. US National Forest Service, "Frequently Asked Questions"; Union of Concerned Scientists, "Rocky Mountains, Colorado, USA," *Climate Hot Map: Global Warming Effects around the World*, 2011, www.climatehotmap.org/global-warming-locations/rocky-mountains-co-usa.html (accessed November 18, 2015).

generational cycle in one year instead of two.[8] This, in turn, has only accelerated the devastation, and one result is not just that there are downed trees everywhere but that there is *lumber* everywhere. In fact, when we were in the Fraser River Valley, so many trees had been hauled to the sawmills and processed that there was a glut of lumber, and many of the mills were idle, even in the peak of summer—there was simply too much wood to deal with, all of it with the telltale blue ring of the fungus in evidence.

Still, as earlier experience with the epidemic in Canada had shown,[9] only a very small fraction of the dead trees can be cleared. When you travel around these areas of Colorado, you see how the scale of devastation far outpaces the availability of manpower and machinery—it would literally take an army decades to clean up the deadfall. As such, clearing and hauling away the dead trees is mainly strategic and infrastructural, focusing on proximity to roads, power lines, public use areas, and the like. What this means, of course, is that millions and millions of dead, dry pine trees litter the mountain landscape all over Colorado. In the bigger picture of which we were speaking earlier, this is less a matter of aesthetics (though it is also that) than of the complexities of the carbon cycle. Indeed, as a white paper on the pine beetle and climate change by the Union of Concerned Scientists puts it,

> A healthy forest normally stores significant amounts of carbon. By killing off millions of acres of trees, which then decay or provide fuel for wildfires, the mountain pine beetle has instead turned lodgepole pine forests into a source of carbon emitted into the already overloaded atmosphere. The pine beetle epidemic shows how warming temperatures can lead to a problem that, in turn, causes temperatures to rise even further. Such a feedback loop serves to amplify global warming. The added carbon in the atmosphere warms mountain temperatures even more, allowing the beetles to continue to multiply and destroy more trees, which give off more carbon. The feedback loop continues until the preferred host trees are gone.[10]

In these vast ruined landscapes, where millions of dead pines litter the ground, it is as if time is trying to decide what it wants to become: "the slow smokeless burning of decay," to use Robert Frost's words from his poem "The Wood-Pile" (an important intertext for the poem that is part of our *Mountain Pine Beetle* installation and film), or the fast release of carbon through wildfires into the atmosphere, thus accelerating the global warming that partially caused the forest's demise in the first place, a classic positive feedback loop responsible for the fact that the thirty largest fires on record in Colorado have all occurred since 1996, coincident with the pine beetle infestation.[11]

8. Union of Concerned Scientists, "Rocky Mountains."
9. National Forest Service, "Frequently Asked Questions."
10. Union of Concerned Scientists, "Rocky Mountains."
11. Resnick, "A 125 Square Mile Wild Fire in Colorado."

What we want to emphasize, though, is this: while it is true that the dramatic character of the mountain forest landscape and its devastation is what initially caught our attention—aesthetically, emotionally, viscerally, it was like nothing we had ever seen—as we dug deeper into the conditions and factors behind what we were seeing, that landscape became a site of inscription, a set of traces to be deciphered rather than something that could be known immediately and all at once, even as we experienced it like a blow to the face. This is true in a rather obvious way, of course: as the pines go down by the millions, they become traces of retention of an evolutionary past suddenly ill-fitted to new environmental conditions and traces of protention for a landscape that will look very different in twenty years, as other trees (especially the aspens) come in to take their place. But it is also true in another way more interesting to us: the trees become a cipher of sorts for factors and causes that indelibly left their mark there but were not limited to and did not begin and end with that plot of land before us: the use of fossil fuels, its effects on climate change, and its links to the chainsaws and heavy equipment that took the trees down; the transportation networks that hauled the trees away as they became lumber (and that allowed us to see much of what we saw); and the national borders between Canada and the United States that were in a fundamental sense effaced by these larger ecological forces, such as the winds that brought the beetles from Alberta to Colorado, in the same way that they are increasingly effaced by the economic forces at work in developments such as the Keystone XL pipeline that already, in an important sense, links the tar sands of northern Alberta to refineries in southern Texas, where we live.

In that sense, the fallen pines of the Front Range are traces of something both there and not there, the graphic materialization and registration of factors and forces at scales both above and beneath the domesticating world of the human who looks at nature and composes a landscape. For us, this asymmetry and asynchronicity of scales in both time and space are captured in the difference between the lowly mountain pine beetle, at a mere five millimeters long, and the vastness of the landscapes—entire mountain ranges, in fact—altered by its presence under quite ecologically and historically specific conditions. In the end, then, an emotional and affective response to landscape becomes the point of entry for a more complex and multivalent engagement of the question of ecology and environment—for what we would call a posthumanist (though not *anti*human) response to ecology.[12] This means that the emotional and affective charge we experience in the face of these landscapes—the almost visceral response one has to the palpable presence of death and devastation—does not go away. Indeed, it is fundamental to the poetic text that is central to the installation. Rather, that affective response, which takes place at our own human scale, by means of our own human orientation and physiology, gets mobilized as part of a much bigger picture.

12. For a more developed discussion of this distinction, see Wolfe, *What Is Posthumanism?*

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To view materials from the *Mountain Pine Beetle* instillation, please visit www.environmentalhumanities.org/archives/landscape.

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