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Land & Animal & Nonanimal

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intercalations 2

The *intercalations: paginated exhibition* series is an experimental foray exploring the structure of the book as a potential curatorial space. As the reader-as-exhibition-viewer moves through the book-as-exhibition, she discovers that the erratic intercalations of the Anthropocene invite new forms of literacy, visuality, inquiry, and speculation that are, in the words of Clarice Lispector, less promiscuous than they are kaleidoscopic.

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intercalations:
paginated exhibition series

Land & Animal & Nonanimal is an ensemble which contends that the meaning of the Anthropocene is less a geological re-formation than it is transformation of both land and animal; once exposed to some of the parameters defining this transition, the reader-as-exhibition-viewer may begin to discern erratic rhythms generated by the creatures of nonconformity that inhabit, with their violence, struggles, and love the vast, machinic reality called Earth.

Land & Animal & Nonanimal

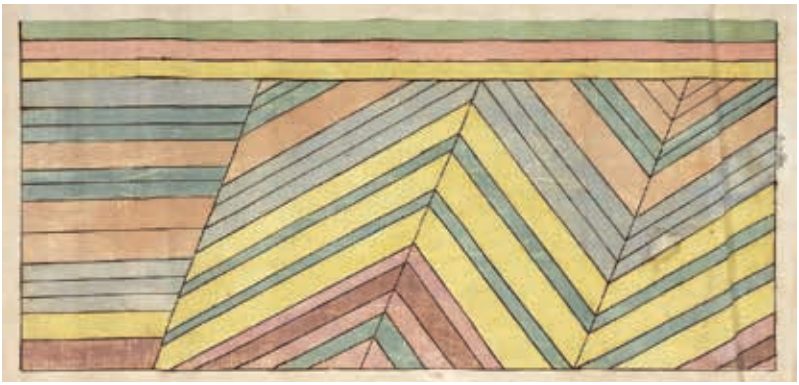
co-edited by
Anna-Sophie Springer
& Etienne Turpin

in association with
Kirsten Einfeldt & Daniela Wolf

intercalations 2

Preface

by Kirsten Einfeldt
& Daniela Wolf



Orra White Hitchcock, Plate 27, "Strata near Valenciennes," 1828–40,
pen and ink drawing on linen, (1 of 61). Courtesy of Amherst College Digital Collections.

Below a surface of three horizontal, uninterrupted layers, six types of sedimentation are seen moving their way up and down in a zigzag and pushing against a nearly horizontal section of differently composed layers situated on the left side of the image. While the two segments are still separated by a thin black line, it seems like a mere matter of time before the erratic layers on the right side of the image infiltrate the more consistent horizontal layers on the left. Born in Amherst, Massachusetts, Orra White Hitchcock (1796–1863) was one of the earliest female scientific illustrators in America. Working with and for her husband Edward, a geology professor, she created hundreds of illustrations of both botanical specimens and geological formations, such as Plate 27, "Strata near Valenciennes." Seen today, Hitchcock's sectional views of soil and rock strata in earthy tones evoke the evenly patterned artworks of twentieth-century artists Anni and Josef Albers.

In the vocabulary of geology, the proper term for one type of rock being pushed in-between other stratified segments is an "intercalation." With reference to its Latin etymology, the word literally means something like "being inserted between an existing 'proclamation'"—or, something that has been understood as official, and of great importance, is changed because of a new layer or element having entered the reified sequence. In contrast to hard rock, the stuff of narrative is softer and more malleable

to begin with. Nevertheless, in a novel, the work of weaving one story into another shares the eponymous, albeit literary term, "intercalation." In the wake of the Anthropocene hypothesis—which, at least in part, contends that anthropogenic sedimentations are transforming previous geological compositions in literally fundamental ways—the intercalating of existing "stories" and "official proclamations" with transformative and erratic new layers seems of particular urgency.

The series is continued with this volume, *Land & Animal & Nonanimal*, which turns the reader-as-exhibition-viewer's attention from the built space of cultural repositories to the postnatural landscapes of planet Earth. In his interview about urban soils of the Anthropocene, landscape architect Seth Denizen considers a history of land-use practices that is also reflected in artist Robert Zhao Renhui's photographs of Singapore as a scenario of continuous development. Inspired by a recent visit to the environment of Wendover in the Utah desert, Richard Pell and Lauren Allen of Pittsburgh's Center for PostNatural History make a case for a postnatural imprint upon the geologic aspects inherent in the concept of the Anthropocene. By encountering "the last snail," environmental philosopher Thom van Dooren considers the meaning of hope and care in the context of species extinction. And, while curator Natasha Ginwala has invited the artists Bianca Baldi, Arvo Leo, Axel Staschnoy, and Karthik Pandian and Andros Zins-Browne to create visual contributions on cosmological and ancestral human-animal scenarios, in his two-part essay, the sound artist and researcher Mitchell Akiyama examines how early phonograms of simian voices have complicated long-standing philosophies of consciousness and nineteenth-century evolutionary theories.

Inspired by Orra White Hitchcock's dynamic line drawings and a polysemic concept that sits comfortably, if at times erratically, in both earth science and the humanities, the *intercalations: paginated exhibition* series seeks to engage with entangled relationships and habitual distinctions in order to reimagine traditional fields of knowledge within the unstable context of the Anthropocene. When explored as *intercalations*, the presumably dialectical categories of nature and culture, human and nonhuman, subject and object, fact and fiction become transitional, layered narratives with porous, permeable, and shifting boundaries.

The Last Snail: Loss, Hope, and Care for the Future

by Thom van Dooren

In a single room, tucked away on the main Honolulu campus of the University of Hawai'i, a group of dedicated people have set up an "ark"—a place of last refuge—for some of the islands' many highly endangered tree snails.[1] The ark is not a particularly fancy affair: a small space comprised of about six "environmental chambers" that look quite a lot like old refrigerators. These units allow staff to control daily temperature and light and "rain" cycles to provide ideal conditions for their slimy inhabitants. Inside each unit are a whole lot of small terrariums—like the kind you might keep a pet fish or rat in—these ones, however, are home to a variety of local snails, and have been filled with 'ohia and the other local vegetation that they would ordinarily live amongst.

On a warm January afternoon in 2013 I was lucky enough to get a tour of this facility from its founder, Professor Mike Hadfield. Amongst the many things that I learned chatting with Mike that afternoon was the fact that these snails don't actually eat the leaves that they live amongst. Rather, they eat an invisible layer of molds and algae that they scrape off the top of the leaves. Consequently, in order to ensure that their

1 This short chapter is adapted from a larger discussion of conservation in Hawai'i, to be published as Thom van Dooren, "Banking the Forest: Loss, Hope and Care in Hawaiian Conservation," in *Defrost: New Perspectives on Temperature, Time, and Survival*, edited by Joanna Radin and Emma Kowal (forthcoming).

charges have a good, balanced diet, Mike and his team have developed a method of culturing one of these molds on agar in petri dishes to produce little "cakes" that can be used to supplement the fresh vegetation.

Fig. 01. An environmental chamber; photo courtesy of the author.

In addition to the daily maintenance of the facility, every two weeks each of the terrariums is taken out, its inhabitants carefully counted, and the whole unit disinfected. All in all, keeping snails alive and thriving in a captive ark like this one is hard work, requiring dedicated daily care and an ongoing curiosity about how to make their conditions, and indeed their lives, better. Donna Haraway, the mutual friend who put me in contact with Mike, has written elsewhere about the careful practices that underlie work in this snail program.[2] For Haraway, this work is an exemplar of the kind of attentiveness practiced by good biologists—in the field or the lab—that

2 Donna Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008).

enables them to simultaneously care for the well-being of their "critters" and generate reliable data about the world. Here, we see that care, far from being antithetical to research, might in fact enable new forms of responsiveness—perhaps even "politeness"[3]—that broaden our sense of what matters to others and consequently enrich our understandings. This is a possibility for people involved in the maintenance of—in the care for and with—"collections" of all kinds, from galleries and museums to snail arks.

My specific interest in this short paper, however, lies in the way in which these caring practices might enable hopes for the future. Through the support for fleshy snail bodies that this ark provides, what kinds of possibilities for the future does it hold open?

Before turning to these more complex questions, it is necessary to start with a basic one: why go to all this trouble to keep snails in captivity? The answer is an all too familiar one. As with most captive breeding programs, this one is guided by a committed effort to hold species now at the edge of extinction in the world a little longer. In little over a thousand years these snails have gone from having no significant predators at all, into an environment with numerous overlapping threats. First came the rats—introduced by Polynesian peoples, but then supplemented with additional species by later European explorers and settlers. Rats can eat a huge number of snails when they put their minds to it, and they have done just this in Hawai'i. In addition to these key predators, over the years Hawaii's endemic tree snails have also had to cope with massive losses of native forest habitat and the

3 Vinciane Despret, "Sheep Do Have Opinions," in *Making Things Public: Atmospheres of Democracy*, ed. Bruno Latour and Peter Weibel (Cambridge, MA: MIT Press, 2006).

introduction of other significant predators, like Jackson's chameleons and a species of larger, carnivorous, snail.

While some of Hawaii's snails now hang on in this small ark, they are a tiny fraction of the islands' original diversity, with an estimated seventy-five percent of the more than 700 named species already having been lost.[4] Of the forty-three species in the particular genus of snails on O'ahu that Mike's work focuses on (*Achatinella*), only ten remain; all are federally listed as endangered.

Fig. 02. Mike showed me a Hawaiian tree snail shell collection. Most of these species are now extinct; photo courtesy of the author.

Many other groups of plants and animals in Hawai'i are in a similar state. Of the 113 bird species known to have lived exclusively on the Hawaiian islands just prior to human arrival, almost two-thirds are now extinct. Of the forty-two species

4 R. H. Cowie, N. L. Evenhuis, and C. C. Christensen, *Catalog of the Native Land and Freshwater Molluscs of the Hawaiian Islands* (Leiden: Backhuys Publishers, 1995).

that remain, thirty-one are federally listed under the *Endangered Species Act*.[5] Roughly a third of Hawaii's 900–1,000 endemic plant species are similarly listed, and as many as 100 are already thought to be extinct.[6] With these statistics in mind, it is not hard to see why Hawai'i is now considered to be one of the "extinction capitals" of the world.

While conservation in general is often poorly funded, Hawai'i really is in a league of its own in the USA. Despite having a huge proportion of the country's federally listed endangered species, the state receives a tiny percentage of the relevant funding. Without the political or economic clout to change this situation, Hawaii's vanishing species remain largely invisible.[7] And so, slowly, silently, a whole range of endemic species—including many that are yet to be documented—are slipping away in Hawai'i.

In this dire context, Mike explained this particular project as "a last-ditch effort to 'save snails' that would certainly have been devoured by alien predators … in the immediate future."[8] Although underwritten by intense processes of loss, this snail ark represents an important site for the production and maintenance of hope: it contains within it the possibility that at some time in the future, after the wreckage has cleared, at least some future might be possible for these species.

5 D. L. J. Leonard, "Recovery Expenditures for Birds Listed Under the US Endangered Species Act: The Disparity Between Mainland and Hawaiian Taxa," *Biological Conservation* 141 (2008): 2054–61.

6 J. Delay, M. Merlin, J. Juvik, L. Perry, and M. Castillo, *Rare and Unusual Plants: Island of Hawaii* (Lyon Arboretum Special Report).

7 See Leonard, "Recovery Expenditures for Birds"; and M. Restani and J. M. Marzluff, "Funding Extinction? Biological Needs and Political Realities in the Allocation of Resources to Endangered Species Recovery," *BioScience* 52, no. 2 (2000): 169–77.

8 All references to Mike Hadfield refer to our conversation during my visit in January 2012 or to a personal email correspondence with him in February 2014.

More specifically, I view this project as an example of what Eben Kirksey has called "modest forms of biocultural hope."[9] Kirksey is here writing with and against Jacques Derrida, and in particular the emptiness, or indeterminacy, of Derrida's notion of the "to come," of a messianicity without messianism.[10] Here, Derrida emphasizes a relationship of radical openness towards the future that is not locked down to any particular vision or project. Grounded in the notion of the event, the unexpected, that ruptures temporal continuities in the name of something wholly new, Derrida sees a primary responsibility in remaining open to the unpredictable, the incalculable.[11]

In contrast, Kirksey emphasizes the need for more *grounded* hopeful projects, engaged in practical and concrete acts of care for the ongoing biological and cultural richness of our world. These are not utopian visions that hope to set everything to rights in one fell swoop, but modest efforts to make a

9 S. Eben Kirksey, Nick Shapiro, and Maria Brodine, "Hope in Blasted Landscapes," *Social Science Information* 52, no. 2 (2013): 228–56.

10 Jacques Derrida and Maurizio Ferraris, *A Taste for the Secret* (Cambridge: Polity Press, 2001).

11 I am not sure that Derrida's approach is as empty of content as it first appears. His argument is centrally occupied with bringing about a better future. In this context, the "to come" takes the form of what Paul Patton has called a promise: "it is a means by which an imagined future can intervene in or act upon the present. Just as a promise in relation to some future state of affairs has consequences for one's actions in the present, so the appeal to justice or to a democracy to come will have consequences in the present." Paul Patton, "Politics," in *Understanding Derrida*, ed. Jon Roffe and Jack Reynolds (London: Continuum, 2004). Derrida's broader body of work gives many indications of the kinds of projects—including democracy, justice, and hospitality—that might animate and guide our actions in the present (albeit in similarly difficult and indeterminate ways). The fact that justice, for example, will never "arrive" in the present—that perfect justice is *impossible*—is precisely what gives it, and will continue to give it, the capacity to motivate *better* futures. See Derrida and Ferraris, *A Taste for the Secret*; and Chantal Mouffe and Ernesto Laclau, "Hope, Passion, Politics," in *Hope: New Philosophies for Change*, ed. Mary Zournazi (Annandale, NSW: Pluto Press, 2002), 128.

difference in often creative and inclusive ways that draw others into an opening—rather than recruiting them into a fixed vision of how things might be. Although the future remains fundamentally unknown and unknowable, Kirksey calls for modest projects that respond where they can to the challenges we can already see around us in an effort to build a better future (however partial and uncertain our vision of it may be).[12]

At the snail ark this hope takes the form of the daily acts of care that sustain living beings, and through them the future of their species. The maintenance of environmental chambers, the cleaning of terrariums, and the careful counting of individuals help to ensure accurate mortality records that enable the early detection of any potential problems.[13] Beyond this life support, staff and students are also engaged in larger efforts to better understand the causes of snail decline in the islands' forests, and ultimately to get them back out into the world. This is an intensely grounded and practical form of hope: working to imagine and craft better futures.

But if we slow down with these snails for a moment, if we slow down with their complex situation, we might be compelled to think a little more deeply about the forms of hope produced and sustained here. In what sense have these snail extinctions really been delayed in this ark? What kinds of futures, what kinds of hopes, should we really entertain on behalf of these species?

Amongst the many endangered snails that I saw that day, one in particular stood out: *Achatinella apexfulva,* a single snail in a terrarium all on its own. On its own because this tiny being

12 On a related theme, see David Wood, "On Being Haunted by the Future," *Research in Phenomenology* 36, no. 1 (2006): 274–98.

13 Haraway, *When Species Meet,* 91–2.

is now thought to be all that is left of its species. Despite over a decade of searching in the wild, scientists have been unable to locate any more. Hope mingles with loss in palpable ways at a time like this. We are compelled to hope and care, and yet we must also acknowledge the hopelessness of the situation.

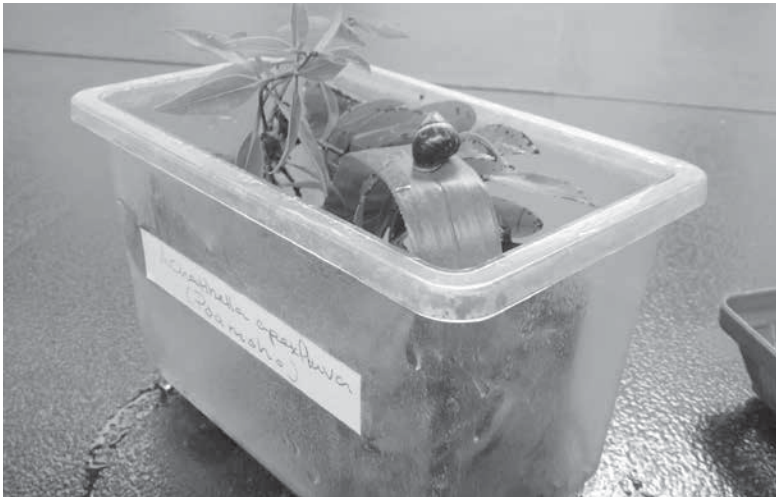


Fig. 03. The last snail: *Achatinella apexfulva*; photo courtesy of the author.

This snail offers a tragic example of the "non possibility" of at least some of the lives "banked" in facilities like this one. When this snail dies, a whole evolutionary lineage will pass from the world, and yet at the same time nothing much will really change. This species is already amongst what some biologists call the "living dead": it is a species whose population has become so small that extinction in the near future is now an inevitability.[14] Alongside this obvious example, many of the

14 Genese Marie Sodikoff, "The Time of Living Dead Species: Extinction Debt and Futurity in Madagascar," in *Debt: Ethics, the Environment, and the Economy*, ed. Peter Y.

other snail populations in the ark are also in dire trouble. In Hadfield's words, "after functioning very well for more than fifteen years, something changed a few years ago, and most of the lab-snail populations have gone into severe decline."[15] Inbreeding within small isolated populations seems to be at least partly to blame. Wherever possible staff are now working to introduce new snails into these populations to increase "genetic vigor." But for some of the species in the ark there are now no—or very few—other survivors to draw on. For at least some of these species, there will be no release. The "ark" is in reality something more like a living tomb.

In fact, all of Hawaii's endangered tree snails find themselves in a pretty bad situation. Restoring habitat for these species will be an incredibly difficult task, if it is possible at all. Their diverse introduced predators—rats, snails, chameleons—are very difficult to control in a forest environment. Even introduced ants have been known to kill snails. In relatively small spaces, conservationists have worked to establish habitat for release. With assistance and funding from the US Army, they have set up high-tech barriers incorporating electric fences, video surveillance and a range of other devices to both exclude predators and monitor the barrier. It is then a matter of eradicating all predators inside the fenced area along with ongoing vigilance to ensure that they don't reestablish themselves.[16] This is an approach that can obviously only be applied in relatively small areas. It is also an approach with a questionable chance of *long-term* success. For now, however, it may see these snails through a little longer.

Paik and Merry Wiesner-Hanks (Bloomington, IN: Indiana University Press, 2013).

15 Hadfield, personal correspondence.

16 Ibid.

In the tiny bodies of these gastropods we see that in at least some cases, living "collections" like this ark are not quite what they seem. Rather than preventing extinction, what has actually been delayed—with respect to at least some of these species—is simply the *recognition* of extinction, the recognition that something significant has already *been* lost. Single individuals or declining populations stand in for this thing called a species, keeping it off the official listings of the departed. This way, when that moment of recognition does finally arrive, extinction has been so long coming that no one can really be surprised. After so long in a refrigerator, even the long drawn out ripples of loss and change that constitute an extinction[17] will have largely settled into new patterns of life (and death). This, I think, is a key part of the danger of hope, of working to imagine a better future: if it is a future that cannot come, if it is a future that has already been lost, then hoping for it is no longer helpful.

Hope is often associated with the affirmation of life, the refusal to give up, and consequently the absence of hope is associated with despair. As Mary Zournazi puts it: "Without hope what is left is death—the death of spirit, the death of life—where there is no longer any sense of regeneration and renewal."[18] But sometimes affirming life is not what is needed. Instead, hope for ongoing life becomes a form of denial that allows us to go on without having to come to terms with our reality or with the vital need for change. In this way, these hopeful conservation projects enable the laundering of what

17 Thom van Dooren, *Flight Ways: Life and Loss at the Edge of Extinction* (New York: Columbia University Press, 2014).

18 Mary Zournazi, introduction to *Hope: New Philosophies for Change*, 16.

some biologists call our "extinction debt"[19]—rendering invisible all those extinctions that are now inevitable as a result of our past actions, extinctions that are already unraveling the world in various ways. In so doing, these kinds of biodiversity banking projects, whatever their intentions, can play an important role in undermining our imaginative and moral capacity to *perceive* the pressing crisis of the current mass extinction event.

Beyond delaying the recognition of extinction, however, these banks also have the potential to delay much-needed conservation action. In some cases they might have the opposite effect, providing strong incentives to deal with larger conservation issues to create the habitat necessary for a population's release. But, these collections can equally be an excuse to delay that action further—resting in the comfort that we have a secure "backup." In short, banked lives can be mobilized in either rhetorical direction. There is a worrying analogy to be drawn here with debates about ecological restoration and the way in which the spin and quasi-possibility of "putting things back later" has been captured by mining companies and others interested in the continuation of business as usual. If species can be collected, held in captivity and put back later—or rather if the perception can be created that they can be—then new possibilities open up for exploitative practices in fragile places. As Chantal Mouffe reminds us, "hope can be something that is played in many dangerous ways."[20]

This surely is not the intention of the many committed individuals who dedicate so much of their lives to the snail ark and other biodiversity banking initiatives, but in dark times the lure of hope as a form of denial or distraction can be very strong.

19 Sodikoff, "The Time of Living Dead Species."
20 Mouffe and Laclau, "Hope, Passion, Politics," 126.

In this context, the ongoing call in the environmental movement to focus on hope and hopeful narratives becomes somewhat worrying. Increasingly we are told that "good news stories" instead of "doom and gloom" are what is needed to compel people to appropriate action.[21] There is a strange similarity, although far from an equivalence, between Derrida's appeal for a radical openness towards the future, a hopeful invocation of the "to come," and the vague way in which environmentalists now often urge one another to focus on the positive. In this context, what is hoped *for*, often seems less important than the act of being hopeful, of encouraging others into a particular state of being towards the future. But vague and general "hope" is not always helpful. Instead, what is needed is a critical lens on, and more attention paid to, what it is that we are specifically hoping for and working *towards*. As Ghassan Hage has argued, "we need to look at what kind of hope a society encourages rather than simply whether it gives people hope or not."[22] What should we be hoping *for* in these times of incredible loss, and are we able to hope responsibly? Which is to say, can our hopes be translated into meaningful action and taken up in a way that recognizes the myriad losses and exposes the dangers that lie buried in the things we hope might yet come to pass?

I see this kind of hope as a practice of "care for the future." Care must be understood here as something far more than abstract well-wishing. As María Puig de la Bellacasa has

21 Stewart Brand, *The Dawn of De-extinction: Are You Ready?* TED Talks, 2013, www.ted.com/talks/stewart_brand_the_dawn_of_de_extinction_are_you_ready; Futerra, *Branding Biodiversity: The New Nature Message*, www.futerra.co.uk/downloads/Branding_Biodiversity.pdf; and Elin Kelsey and Clayton Hanmer, *Not Your Typical Book About the Environment* (Toronto: Owlkids, 2010).

22 Ghassan Hage, "On the Side of Life: Joy and the Capacity of Being," in *Hope: New Philosophies for Change,* 152.

noted, a thick notion of care requires that it be understood as simultaneously "a vital affective state, an ethical obligation and a practical labour."[23] To care for another, to care for a possible world, is to become emotionally and ethically entangled and consequently to get involved in whatever practical ways that we can. But, as Haraway notes, caring deeply also "means becoming subject to the unsettling obligation of curiosity, which requires knowing more at the end of the day than at the beginning."[24] Knowing more, in this sense, is about being drawn into a deep contextual and critical knowledge about the object of our care: *what* am I really caring for, *why*, and at *what cost* to whom?

The grounded and responsible hope that we need today, hope for a world still rich in biocultural diversities of all kinds, requires this kind of care for the future. It requires a grounded and practical care, but also one that is committed to a critical engagement with the means and consequences of its own production.

Ultimately, I don't think this means we should abandon our banking projects. Importantly, some of them will "work"—in the sense of holding on to species and even getting them back out in the world in meaningful ways. Rather, the point is that our banking practices need to be re-imagined and reworked to make more visible their own limitations and concerns, *to make visible all those things that they cannot quite hold on to and all those that they cannot hope to ever restore*. I am not sure what such a "bank" would look like. Within its walls, however, holding on to individuals like the last of *Achatinella*

23 María Puig de la Bellacasa, "Nothing Comes without Its World: Thinking with Care," *The Sociological Review* 60, no. 2 (2000): 197.

24 Haraway, *When Species Meet,* 36.

apexfulva for as long as we can—provided that they are living flourishing lives—might simply be understood as an effort to cultivate some semblance of responsibility for another whose world we (collectively) have destroyed.

While in times like these we certainly need all of the conservation efforts that we can muster, it remains vital that we pay careful attention to the means by which particular approaches generate and sustain their visions for the future. For at least some species, the time for hopefulness about a return to the wider world has passed. It is time for us to acknowledge, to take responsibility, and care for other kinds of futures.

Part 1: Speaking of Animals

by Mitchell Akiyama

> [Circa] 1000 BC The author(s) of the *Book of Genesis* reported a conversation between Eve and the serpent.
>
> — William Hillix & Duane Rumbaugh, *Animal Bodies, Human Minds: Ape, Dolphin, and Parrot Language Skills*

It is Adam who is tasked with naming the animals, presented by the Lord with his own menagerie, so that he might not be lonesome. The Lord is curious; He has no special inclination to call any creature by any particular name. Let Us see what Adam comes up with. Ibis, crocodile, marmoset, dung beetle, pterodactyl, lion, porpoise, tick, etc. But, having given a name to each of those creatures that creeps upon the earth, having made them knowable to himself and to Himself, Adam is still lonely. And so the Lord makes for Adam a counterpart, the second of a species that we can surely surmise is itself yet to be named, as it is not the prerogative of the namer to give himself a name as well. And this counterpart, a female not dissimilar to the man from whose sleeping body she is created, despite her duplicate origin, is certainly privileged in her own right, for she is the one to whom the Serpent speaks. It is Eve, woman, who is the first and the last human to hear the animal, to fully understand its speech. Or, perhaps this serpent is also the first and the last animal endowed with the subtle gift of speech. In

Fig. 01. Hugo van der Goes, *The Fall of Man and the Lamentation*, c. 1477; courtesy of Google Art Project works in Kunsthistorisches Museum Vienna; image public domain.

this singular encounter, as we all know, the serpent convinces the female progenitor of the upstart human race to eat of the fruit of a forbidden tree, a fruit which opens her and her counterpart's eyes to the unsightliness of their naked genitals.

In those first days, humans and animals alike were babbling and bare. But never again. At least not outside of stories. Language and clothing become, enduringly, two of the measures by which the animal and the human are distinguished. Standing naked and embarrassed, caught in his cat's gaze, the philosopher Jacques Derrida, in his own inimitable way, recapitulates the Fall.[1] He wonders why he is ashamed, and before whom or what this shame is manifest. The cat doesn't know the philosopher is naked, does he? Does the cat know that *it* is also naked? We might say, as many others have said, that there is no such thing as nudity without the possibility of the shame that compels one to cover up, to hide one's genitals from the gaze of another, human or animal. Yet, surely there's more to the seemingly unbridgeable gulf been human and animal than an embarrassed philosopher considering whether or not to hide his dangling cock from his pet. It is the cat's inscrutable gaze that makes any hope of communion impossible, because not only can the cat never be naked, it also can never speak. Or, can it? Its purrs and meows might, to another cat, signify something, but could these sounds ever be intelligible to human ears? As Ludwig Wittgenstein famously wrote, "If a lion could talk, we could not understand him."[2] The animal, it is said, can only react; it cannot respond.[3] The

1 Jacques Derrida, *The Animal That Therefore I Am*, trans. David Wills (New York: Fordham Press, 2008).
2 Ludwig Wittgenstein, *Philosophical Investigations* (Oxford: Basil Blackwell, 1958), 225.
3 Derrida, *The Animal That Therefore I Am*, 108.

animal's barks, hisses, pants, roars, or screeches are allegedly involuntary and unconscious reactions to external stimuli. And so Derrida, while skeptical of his philosophical forebears—Descartes, Heidegger, Levinas, etc.—who assume that the animal does not possess language, is still caught in his cat's gaze, unable to hear a response about whether it makes a difference, or not, if he slips into some briefs.

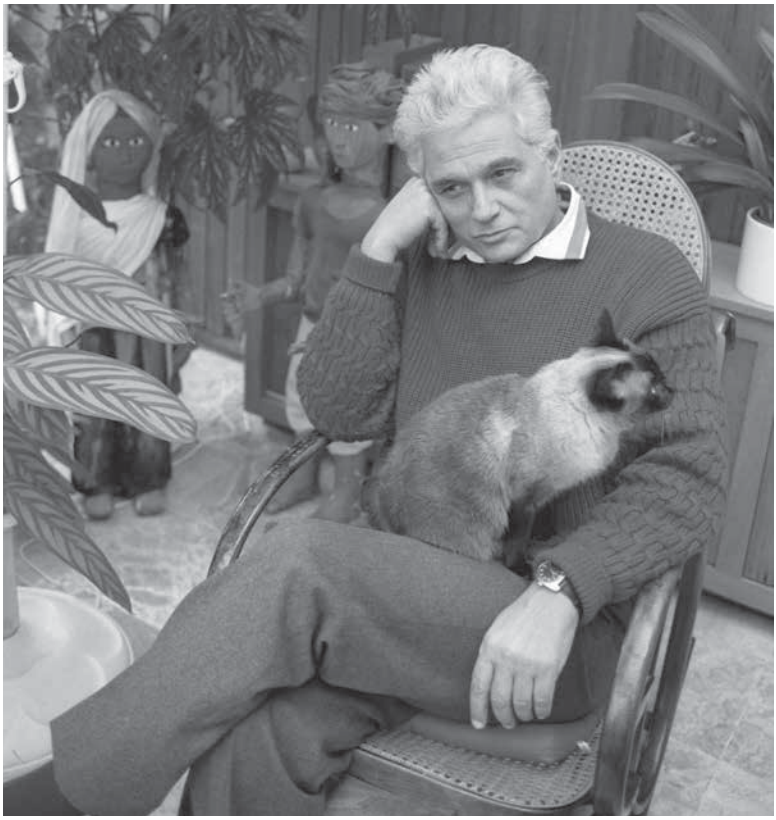


Fig. 02. Jacques Derrida and his cat, Logos. Photo by Sophie Bassouls/Sygma; image courtesy of Corbis.

In 1890, at a zoo in Washington D.C., a self-proclaimed "Simian Linguist" named Richard Lynch Garner (1848–1920), conducted an experiment that would prove his longstanding hunch that animals do, indeed, have language. Armed with the latest in consumer technology—an Edison cylinder phonograph—he separated two monkeys (one male, one female), longtime roommates, and goaded one into chatter. He recorded the first and then played its outburst to the second. "The machine was then placed near the cage containing the male," writes Garner, "and the record repeated to him and his conduct closely studied. He gave evident signs of recognising the sounds, and at once began a search for the mysterious monkey doing the talking."[4] As far as Garner was concerned, the search for the missing monkey provoked by the recording ended the experiment, and thereby confirmed what his master, Charles Darwin, staunchly believed: that language is not the sovereign possession of humankind, and that, instead, the ability to communicate is distributed throughout the animal kingdom, albeit with differing degrees of complexity and sophistication.

For Darwin, these were differences merely of degree, not of kind. Darwin's claim in *The Descent of Man* (1871), that all the higher faculties possessed by people are there in other animals (although yet unrealized), unseated the millennia-old, Biblical assumption that humans stood alone in nature thanks to some unique, privileged state of communicative being. To be sure, this line of thinking was already present in *The Origin of Species* (1859), in which Darwin honed the tools he would later use to radically displace humankind's centrality in God's creation. It was a canny tactic to focus, as he did, on

4 Richard L. Garner, *The Speech of Monkeys* (London: William Heinemann, 1892), 5.

focus—that is, on the development of a sensitivity to light across species, tracing this capacity from a rudimentary ability to distinguish between light and dark toward more sophisticated ways of *seeing*. The "perfected" eye, proposed Darwin, contained within it eons of simpler solutions to the task of converting light into sensation.[5] In *The Descent of Man* (1871), Darwin set himself to dismantling an even larger icon: the belief that the human species was sovereign, exceptional, and fundamentally different from other creatures. He posited that the distinction between humans and other animals—both physiological and mental—was only comprised of gradations, differences in degree. While he supposed the mental faculties of a lamprey, an ape, and a human differed in sophistication, Darwin argued that the intervals among them fell along a continuum, itself the product of evolutionary forces. Language, one of the definitive capacities traditionally understood as singularly human, was a similarly relative and contingent phenomenon. Language should be thought of as a *tendency*, a latent and virtual capacity nested within all creatures, waiting for its moment of articulation.[6] Human vocalization was but one form of communication among many, a capacity commensurate with the physiology of the species. Language, be it the semiotic dance of honeybees, the luxuriating songs of birds, the pheromonal signaling of ants, or the transfer of molecular compounds between cells, was an "ongoing exploration of and experimentation with the forms of bodily activity that living things are capable of undertaking."[7]

5 Charles Darwin, *The Origin of Species* (Edison: Castle Books, 2004), 223-28.
6 Elizabeth Grosz, *Becoming Undone: Darwinian Reflections on Life, Politics, and Art* (Durham: Duke University Press, 2011), 19.
7 Ibid., 22.

Richard Garner, while profoundly influenced by Darwin, offered his theory of language as a means to further the science of evolution. He felt that Darwin had admirably addressed the fluidity of filiation between species, although he faulted his predecessor for a lack of engagement with language.[8] Garner argued that speech, like anatomical structure, differed among species by degree. Excluding other forms of communication, Garner's discussion focused solely on vocal expression; significantly, he decoupled speech from signification by contending that its symbolic content lay beyond the basic will to communicate. "Speech is not an invention," wrote Garner, "and therefore is not symbolic in its radical nature. True, that much that is symbolic has been added to it, and its bounds have been widened as men have risen in the scale of civil life, until our higher types of modern speech have departed so far from the natural modes of speech and first forms of expression, that we can rarely trace a single word to its ultimate source."[9] Speech, in this form, is a potentiality, an inchoate stirring that, through use and refinement, evolved to become the complex, neosymbolic species of language that Garner held to be unique to human beings.

Speech had long been one of the significant boundaries demarcating the line between the human and the animal. Among these other critical divisions were the stages of development through which humankind allegedly had passed, thereby setting itself apart from the animal world. The ability to design and utilize tools was one such frontier; the emergence *Homo habilis* two million years ago was thought to mark a unique stage in the development of humankind, a moment in

8 Garner, *The Speech of Monkeys*, 154.
9 Ibid., 171–72.

which the species began to mutate away from the pack of primates to which it had once belonged. But tool-making, as Jane Goodall observed in the 1960s, is not a distinctly human trait. Chimpanzees would strip leaves from stalks of grass in order to "fish" for termites. When Goodall wrote to her colleague, Richard Leakey, describing what she had seen, his telegrammed response read: "Now we must redefine *tool*, redefine *Man*, or accept chimpanzees as humans."[10] Leakey's reply speaks to the contortions that philosophers and scientists have performed for well over two thousand years in their efforts to separate the human from the animal. The Italian philosopher Giorgio Agamben traces these divisions and definitions back to Aristotle's definition of life in *De anima*. According to Agamben, Aristotle failed to articulate what life *is*; rather, he circled around being, casting aside those entities that lack the vital, nutritive force inherent in something that can be said to be living.[11] Aristotle defined the human by what is proper to it as a distinct species, but also by decisively clearing away what is not. What Agamben calls the "anthropological machine" has, for much of Western history, posited *Homo sapiens* as a placeholder for human traits. "The anthropological machine of humanism," he writes, "is an ironic apparatus that verifies the absence of a nature proper to *Homo*, holding him suspended between a celestial and a terrestrial nature, between animal and human—and, thus, his being always less and more than himself."[12]

The story of the creation of the human certainly remains incomplete without attending to how Descartes, in his

10 Jane Goodall, *Through a Window: My Thirty Years with the Chimpanzees of Gombe* (New York: Mariner Books, 2000).

11 Giorgio Agamben, *The Open: Man and Animal* (Stanford: Standford University Press, 2004), 14–5.

12 Ibid., 29.

Fig. 03. "Richard L. Garner beim Sprachunterricht mit einem Affen" (Richard L. Garner teaching language to a monkey), circa 1900. Image from the book Karl Krall, *Denkende Tiere*, (Leipzig: Engelmann, 1912), 231.

infamous declaration that animals are little more than automata, reduced nonhumans to biomachines, creatures capable of locomotion, but lacking in "cogito"—the capacity for reason. By virtue of the human ability to recognize being through reason, he believed, we humans were able to discern our humanity. To support his argument, Descartes proposed a thought experiment: imagine an artfully constructed, mechanical ape—a contraption indistinguishable from the living animal. It could be made to react to stimuli in such a way as to convince an observer of an organic, fleshly, authentic life. A humanoid automaton, however, could never fool a human

interrogator, according to his speculative experiment. A human would be expected to *respond* creatively, in ways that would announce the subject's awareness of herself as human; an animal or an automaton could do no more than *react*. This distinction, which Derrida teases out of Descartes's writing on animals, is one that carries through to virtually all that follows in the Western philosophical tradition: animals lack the ability to respond, to recognize the quality of a question, and then answer back. While Descartes understood that humans also lack a perfect ability to rationally apprehend the world in its totality (a person might be in a perennial deception owing to a malevolent demon), this lack should be incommensurable with the faculties that other animals are missing; we both lack, but we lack differently.[13] This incommensurable form of lacking was, for Descartes, a difference in kind that did not fully vanish with an acceptance of the Darwinian argument that a particular capacity—such as the ability to respond—was variable, historical, and biologically contingent. Derrida, like Agamben, recognizes in this line of thought a suspension of judgment in the definition of the human. In order to determine what is properly human, Descartes had to detach the human subject from any quality that could be said to be proper to life, whether it be animal, human, or both. "The presence to itself of the present of thinking," writes Derrida, meditating on Descartes, "the presence that presents itself to itself in the present, that is what excludes everything detachable constituted by life, the living body, animal life."[14] The "cogito" that constituted Descartes'

13 Derrida, *The Animal That Therefore I Am*, 81–2. See also Stephen Walker, *Animal Thought* (London: Routledge, 1983), 8–9.

14 Derrida, *The Animal That Therefore I Am*, 72.

assurance of his own existence, and of his humanity, was also what separates his human being from a lesser, animal state.

Agamben notes a similar suspension at play in the taxonomy of Linnaeus, who similarly disavowed all characteristics other than self-recognition in his definition of *Homo sapiens*. For Linnaeus, there was no simple means within natural science to distinguish between humans and apes. Paraphrasing Linnaeus's maxim, Agamben writes, "man has no specific identity other than the *ability* to recognize himself. Yet, to define the human not through any *nota characteristica*, but rather through his self-knowledge, means that man is the being which recognizes itself as such, that *man is the animal that must recognize itself as human to be human*."[15] Self-recognition presupposes a particular cognitive ability: one cannot recognize oneself as recognizing oneself without language, at least according to Garner's argument. Indeed, his phonographic experiments, while ostensibly undertaken with the goal of proving that monkeys speak, were an inevitable extension of the argument in favor of primates' ability to think. Garner's proposition was a direct affront to the Victorian anthropological machine: the discipline that would come to be known as comparative psychology. In 1892, the year in which Garner published his best-known work, *The Speech of Monkeys*, the British zoologist C. Lloyd Morgan formalized a theory of animal mind. Morgan's "canon" posited that one should not impute the functioning of a "higher" faculty to an animal if a given, seemingly intelligent behavior could be explained by a "lower" attribute. A dog might learn how to open a gate, for example, but Morgan's canon dictated that this skill could be proven through observation to

15 Agamben, *The Open: Man and Animal*, 26.

be merely a conditioned response—or learning through trial and error—rather than the manifestation of a more sophisticated faculty such as intuition, insight, or ingenuity. Positioned in opposition to the Darwinian thesis that intelligence was manifest as a matter of degree across species, Morgan's canon equated reason with language: without words there was no thought, and vice versa. Garner, however, saw a direct link between cognition and language, positing the very opposite: that speech evolved in direct relation to brain development.

Garner was attempting to bridge the gulf between human and animal that many of his contemporaries had reaffirmed through the invention of a non-speaking human-animal ancestor. Ernst Haeckel, an influential naturalist and a promoter of Darwin in the German-speaking world, upon learning of the discovery of a set of bone fragments morphologically similar between a simian ancestor and a human descendent, declared it to be the missing link "in the evolutionary chain of the primates."[16] This proto-human, alternately dubbed *Pithecanthropus erectus* and *Homo alalus*, represented a stage through which the primate passed on the way to becoming human, a stage whose significant feature was silence. The creation of the human at the end of the nineteenth century necessitated a dual move: the denial of language to the creatures that preceded the human, and the assumption that language emerged in a primate that could no longer be called a primate. Haeckel and his followers were caught in a paradox: language is a historically contingent production that could only ever have manifested in the human; however, it is not a trait that was always already inherent in the species' progenitors.

16 Quoted in ibid., 34.

Because of this paradoxical condition of emergence, they had to invent a figure that could reconcile this contradiction. The human could only come into being against the background of a non-human entity for whom language was lacking.

Crouched over his phonograph, Garner believed that he was uncovering a relation between humans and apes that revolved around the intellectual capacity of speech. While Garner would never have deigned to describe this cognitive affinity as anything other than a rudimentary version of a much more sophisticated human capacity, he was nevertheless suggesting that the lines between human and animal were far more entangled than had previously been supposed. This was an era in which ideas about human communication were beginning to shift with the emergence of electrical transmission and storage media. In fact, the very idea of "communication" is a product of nineteenth-century anxieties regarding the barriers standing in the way of two (human) minds ever truly meeting, impasses both created and potentially bridged by communications media.[17] Although language had been one of the measures of the human since Aristotle, in conjunction with the rise of media technologies and the erosion of humankind's special place among creation, it became a contested line that decided the humanness of animals and the animality of humans.

In the late nineteenth century, these already blurred lines were beginning to form a zone of renegotiation. "The classification of genera and species," wrote Garner, "is in a great degree arbitrary; but much less so than are these abstract characters of life and mind. There is nowhere a line at which emotion stops and thought begins; there is nowhere a line at which

17 John Durham Peters, *Speaking into the Air: A History of the Idea of Communication* (Chicago: University of Chicago Press, 1999), 6.

thought stops and expression begins; there is nowhere a line at which expression stops and speech begins."[18] Despite such remarks, the anthropological machine was still working within Garner, helping him draw lines to protect humanity, even as he disavowed the existence of such divisions. His romantic pronouncements about the fluidity of capacities and the general continuity between creatures notwithstanding, Garner went on to contend: "If man has risen from the low plane of brutehood which the ape now occupies, has scaled the barriers which now separate him from apes, and has climbed to the divine heights of mental and moral manhood, the ape deserves no praise for this."[19] Garner was expressing his agnosticism about the debate as to whether the human was a perfect iteration of the ape (one that had left its lower cousin behind) or whether the ape was a fallen, debased human. Regardless of whether the separation came about through progression or degradation, what is important to note is Garner's assumption that, no matter whether they are attributable to God or to some other vitalistic force, human capacities outstrip other creatures' abilities so thoroughly as to be categorical. "I cannot regard the matter as proven beyond appeal," wrote Garner, "that man has come from any antecedent type that was not man, nor yet do I deny that such may be the case; but I do deny that the broad chasm which separates man from other primates cannot be crossed on the bridge of speech."[20]

18 Garner, *The Speech of Monkeys*, 191–92.
19 Ibid., 149–50.
20 Ibid., 150–1.

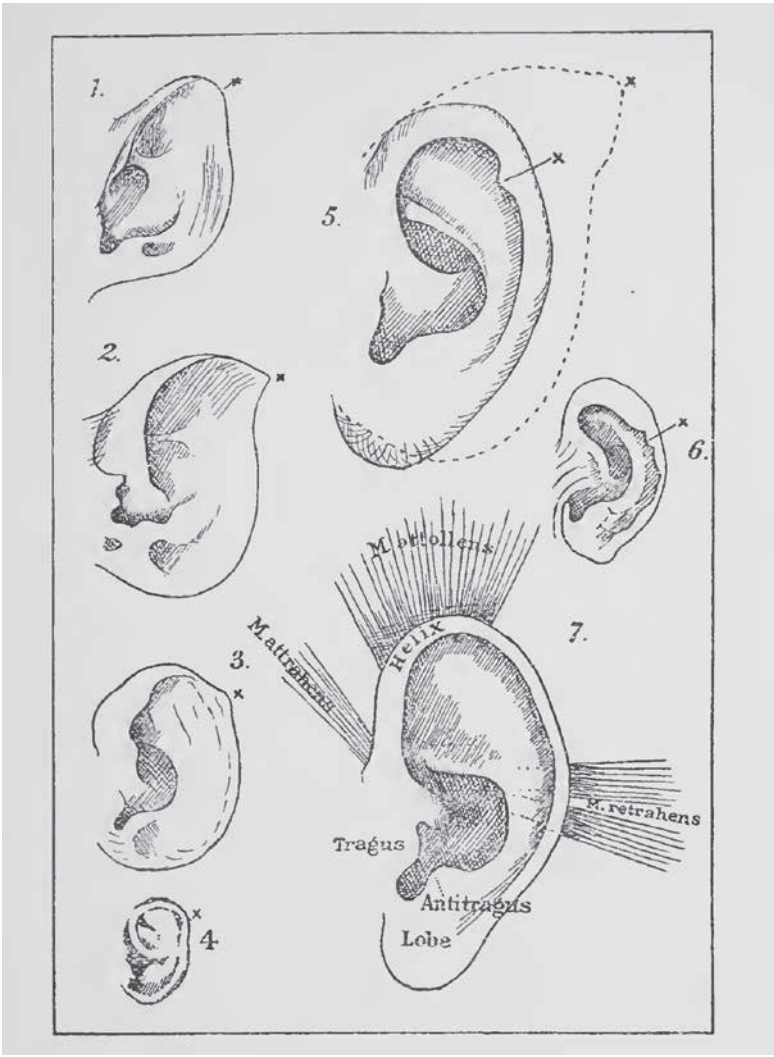


Fig. 04. "*Outlines of the left ear of– – –*," anatomical sketches from Ernst Haeckel, *The Last Link: Our Present Knowledge of the Descent of Man* (London: Adam and Charles Black, 1898), 15.

→ "Part 2" continues on page 113

Traces of the Animal: Neomylodon, the Cow, De Brazza's Monkey, and Actor Camels

by Natasha Ginwala

with artist contributions by Arvo Leo, Axel Straschnoy, Bianca Baldi, Karthik Pandian and Andros Zins-Browne

> The animal scrutinizes him across a narrow abyss of non-comprehension.
>
> — John Berger, "Why Look at Animals?", 1980

> The comparison I have just drawn between myself and Kafka's ape might be taken as such a lighthearted remark, meant to set you at ease, meant to say I am just an ordinary person, neither a god nor a beast.
>
> — J. M. Coetzee, *The Lives of Animals: The Tanner Lectures on Human Values,* 1997

The four artist contributions forming the paginated series *Traces of the Animal* were developed in collaboration with five artists; each configures the animal as a symbolic agent across civilizational, crypto-zoological, urban, and choreographic dimensions. Whereas each set of two spreads takes a different point of departure and conceptual approach as a curatorial sequence, together they articulate variegated provocations towards themes such as the forbidden desires associated with a "becoming animal," contemporary urgencies around species extinction, cultural memory, and the "beast-as-knowledge."[1]

1 Erica Fudge, *Animal* (London: Reaktion Books, 2002), 8.

The animal can be seen as an entity located somewhere between society, our particular sense of self, and the conditions of an external, more-than-human world. As a cosmographic guide and terrestrial force of recognition, the animal steadily escapes the quest of anthropogenic mastery over nonhuman life. It is particularly in this liminal role of the animal vis-à-vis the human—that is, by way of the animal's capacity to challenge our very structures of understanding and knowledge—which the artistic contributions presented throughout the following sequence aim to explore.

I

Ever since the first paleontological finds of the NEOMYLODON in the nineteenth century, its mythology and dispersed representations persisted in staging this fantastic animal's unresolved relation to humankind. A subspecies of giant sloth, the Mylodon, this mammal posed a challenge to the Darwinian thesis of evolution when it unexpectedly "returned" about 10,000 years after it once used to inhabit Patagonia. Charting the narrative through a crypto-zoological lens, Axel Straschnoy ties together the dynamics of extinction with the voracity of the expeditionary impulse.

In Staschnoy's multi-part project, *Neomylodon Listai Ameghino* (2014–ongoing), a cave site in Southern Patagonia emerges as a zone of manufactured origins. Bones, fur, and animal droppings perform as field notes towards a lineage, which spans the Northern and Southern hemispheres. The Neomylodon is treated as both a kind of intertextual skin and as "unfinished business," such that the literal task of piecing together the creature engages deep histories of early science, expedition-making, and the forensic evidence of an organic trail connecting several natural history museums.

II

THE COW is both a miniaturized and monumental subject; a daily trespasser in urban life, yet also the essential symbol of a bucolic cosmology. With his film, publication, and exhibition project, *This Is the Cow* (2010–ongoing), developed during his journeys through India, Arvo Leo explores this animal as both cinematic tableau and fleshy architecture. She sits at the busiest

intersections disavowing angrily blinking traffic lights; sometimes she acts as a drifting tour guide to secret alleys of the city. Her body is a healing device. When decorated and worshipped, she is figured as an oracular being.

In 1999, four surgeons extricated 4,000 plastic bags and an assortment of objects from the belly of a cow. This operation proves that the animal, more than merely a being-in-the-world, is also literally capable of swallowing up the world—as an embodied act of "worlding." Leo's project gestures toward the cow as an assemblage of material culture. Departing from the sign hung around the cow's neck in García Márquez's renowned novel *One Hundred Years of Solitude*, the artist invited ninety-nine collaborators, including children, travellers, sign painters, a screenwriter, a Nepalese tailor, nurses, and others to conceive print-based works that plot the cow as embodying a plenitude of meaning.

III

Bianca Baldi's project *Zero Latitude* (2014–ongoing) posits an anatomy of colonial desire through an odd pair of protagonists, the Italo-French explorer Pierre Savorgnan de Brazza (1852–1905) and an Old World monkey that lives on as his namesake. Set amidst the dual backdrop of the Congo River and the tropical jungle, the Equator reveals a transverse staging of the explorer and his portable contraptions, such as, in this particular case, the so-called *Louis Vuitton Explorator* (a customized field bed) and the monkey (*Cercopithecus neglectus*) as modern allegories.

Through the aesthetic choices of her contribution, Baldi activates body language as a narrative device in both spatial and semiotic terms. An enigmatic charge of human-ape "connect" unleashes a web of hostility and kinship. Where wildlife is tamed and trained to perform as a form of "conjoined" habitat, the rawness of animality meets virtuoso poses. Surface readings of DE BRAZZA'S MONKEY produce conjectural maps of a civilizational span in disarray. Figuring as a "future promise" of conquest, companion species, and ideological apparatus, the monkey recurs as an entanglement of decadent imaginations—mimetically travelling from lives past to present.

Baldi created her contribution to this paginated series by compiling visual material from her research archive, in collaboration with the Lisbon-based graphic designer Marco Balesteros. Conceived as maps, the layouts also form a part of the online publication *Zero-Latitude.net*.

IV

The camel in motion has the tendency to make some riders feel "seasick."

Set amidst the cinematic ruins of Atlas Studios in Ouarzazate, a desert township in Morocco, Karthik Pandian and Andros Zins-Browne's film *Atlas/Inserts* (2014) engages a flock of ACTOR CAMELS to re-present Merce Cunningham and Charles Atlas's dance-film *Channels/Inserts* (1982). Dressed in custom-designed Liberty print costumes embroidered with American pennies and nickels, the camels' bodies appear charged with dis/continuity as they echo a set of choreographic operatives: chance methods, improvisation, and a temperamental sociality that refuses total domestication.

As they pace restlessly, chew slowly, gallop, and congregate before the lens, one begins to perceive the camels as "bodies in alliance."[2] Evoking the protest formations from the public squares and pavements across the Arab world and beyond, this choreographic realm as human-animal encounter opens up "a space of appearance" for political forms of life. Contrary to Eadweard Muybridge's depiction of camel motion in his electro-photographic study the *Animal Locomotion* series (1872–85), which registered the beast as an object and measure of study of the Western imagination, *Atlas/Inserts* reanimates the camel as a figuration of queered endurance and physical alterity.

Consisting of two spreads each, the artist contributions on the following pages appear in this order:

Axel Straschnoy, *Neomylodon Listai Ameghino*
Arvo Leo, *This Is the Cow*
Bianca Baldi, *Zero Latitude*
Karthik Pandian & Andros Zins-Browne, *Atlas/Inserts*

All images courtesy of the artists.

2 Judith Butler, "Bodies in Alliance and the Politics of the Street," *eipcp*, September 2011, www.eipcp.net/transversal/1011/butler/en.

In 1895, Herman Eberhardt — a German sailor who had settled in the area of Last Hope in Chilean Patagonia — found a strange piece of hide inside a cave on his property. Eberhardt was sure it did not belong to any animal he had ever seen. However, the hide was fresh, indicating that the animal had died quite recently, and Patagonia was still unknown territory at the time. Eberhardt hung it outside his house where it was noticed a year later by Nils Otto Nordenskjöld, the famous Swedish explorer, who was then reconnoitring the area. Impressed by the hide, Nordenskjöld requested Eberhardt to show him the location where it was found. After doing some of his own digging he uncovered two small hide fragments and some nails which he took back to Sweden.

A year later, Francisco P. Moreno —Director of the Museum of La Plata — visited the region. He was also struck by the hide

Fig. 4. — *Morceau de cuir de Mylodo encore garni de poil et armé d'oss dermiques (galerie de Paléontologie Muséum de Paris).*

someone traveling back from Patagonia showed the famous palaeontologist Florentino Ameghino some small round bones, like coffee berries, asking what animal they could have belonged to. Ameghino realised immediately that they belonged to a Mylodon - a one-tonne, three-metre-long ground sloth that was discovered by Charles Darwin in 1832. However, the Mylodon was believed to have been extinct for

couldn't help but remember the story told to him by Ramón Lista, then governor of the territory of Santa Cruz. Lista had ran into the strange animal and shot at it. However, it seemed to be immune to bullets and had quickly run back into the brushwood. This would probably be the case with a mylodon, the ossicles under the skin providing a sort of armature. According to Lista the animal looked like a Pangolin in every way except for the fact that it was covered by reddish grey hair.

Patagonian Indians told the story of a mysterious quadruped who inhabited the territory inside Santa Cruz, living in burrows carved into the ground and only coming out at night. A terrifying creature, it was armed with long nails and it was imposible to kill as bullets and arrows just bounced off its skin.

Ameghino quickly realised that he was in front of a previously undiscovered species, related to the Mylodon but smaller and still alive in the depths of Patagonia. He released the pamphlet "Première Notice sur le Neomylodon Listai, un Representant vivant des anciens Edentés Gravigrades fossiles de l'Argentina" in

Fig. 9. — Représentation native du Su [illegible] Succasath, d'après le P. André Thevet (1558).

In 1900 after Professor Ray Lankester, director of the British Museum of Natural History, expressed, in a meeting of the London Zoological Society, that "it is quite possible – I don't want to say more than that – that he [the Mylodon] still exists in some of the mountainous regions of Patagonia" Arthur Pearson, owner of the Daily Express,

acclaimed hunter Hesketh Hesketh-Prichard to go to Patagonia and find a live specimen. Hesketh-Prichard came back empty handed but, as Ray Lankester mentioned in his *Extinct Animals* the Mylodon Cave is so remote that Hesketh-Prichard was not able to get to it. Furthermore, Prichard stated that "A large portion of this country is forested, and it would be

FIG. 123.—View, looking outwards, from the mouth of the cavern on the fiord of the Ultima Speranza in Southern Patagonia, in which have been found the skin and hair and the bones with cartilage, blood and tendon and the dung of the Mylodon and other animals, proving its co-existence with man and its survival until a period estimated variously at fifty or a thousand years ago.

presumptuous to say that in some hidden valley far beyond the present ken of man some prehistoric animal may not still exist. Patagonia is, however, not only vast, but so full of natural difficulties that I believe the exhaustive penetration of its recesses will be the work not of one man or of one part of men, but the result of the slow progress of human advance into these regions."

FRESH REMAINS OF MYLODON

During then Parisian Academy of Sciences meeting on 14 January 1901 a note sent by André Tournouer was read: "One night, having established my camp next to a river in the interior of the province, I saw the head of an animal, the size of a puma, come out of the currents. I shot at it. The animal resubmerged and never came up again. It's head was dark brown, the eyes surrounded by

FIG. 124.—Photograph of a piece of the skin of the Mylodon (also called *Grypotherium darwini*) showing the coarse greenish-coloured hair. From a specimen found in the [illegible] Patagonia.

light yellow hair. The eyes extended towards the ears which had no auricle. When I described the animal to my Indian guide, he had no doubt that it was Hymché, Ameghino's Neomylodon. The next day, as we continued our way, my guide showed me footprints that looked like they had been made by a big feline. But he stated that they had been made by the Hymché."

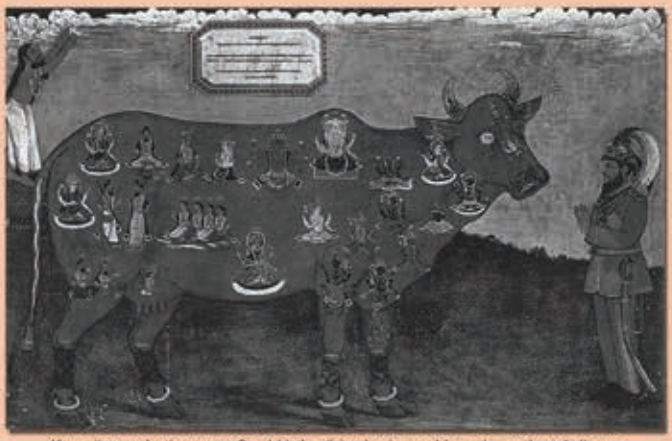
09. Close-up of cow ruminating (nostrils, mouth, whiskers). Human enters edge of frame-right and pets the cow's head. Cow stops ruminating. Man exits frame. Cow resumes ruminating.

man on bicycle holding bag with goldfish inside

"SIR, COULD I PLEASE HAVE A CHAI TEA WITHOUT MILK?"
"I'M SORRY, WE DON'T HAVE MILK. WOULD YOU LIKE IT WITHOUT CREAM?"

120. Mirror light illuminating a glass of chai tea, moves over to empty glasses, old books, and down to buckets with dirty water, the ground, someone's shoe.

52. Fence in foreground, road in midground, wet fields in background. Cow enters frame-right and walks left, scooters drive by, cow looks at camera, gazes meet, cow exits frame-left.



Kamadhenu, also known as Surabhi, the divine bovine-goddess, the mother of all cows.

Cow dung coconuts

THE COW THEN WALKS BY STIRRING UP A SMALL CLOUD OF DUST BEHIND IT. ONCE THE DUST HAS SETTLED YOU COLLECT IT AND SPRINKLE IT UPON YOUR BODY.

Made by Ayush Saha in Calcutta, West Bengal 56cm x 76cm

SHE HAS A BOUQUET OF ORANGE FLOWERS IN HER STOMACH

Self portrait as the Cow who swallowed a Knife

Udaipur, 2010

59. Medium shot of boy inspecting poo on foot. Begins to lose his balance, arms flailing.

72. A CAR MAKES A LEFT TURN AND CHANGES INTO A COW

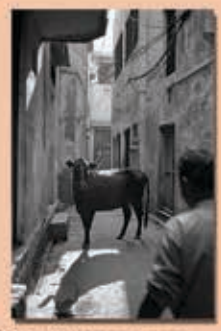
130. Shot of men doing push-ups, walking, running, palace and sky in background, fade out.

Three swimming sisters, who lived at home near the opera.

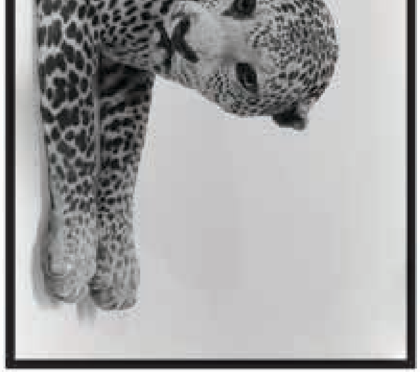
Sacred Cows on the esplanade of the Maharanas Palace in Mewar, Udaipur, 1927 – Roger Dumas.

06. Shot panning right, street scene, cow's upper half in foreground, colorful clothes draped on fence in midground, busy street in background. At the end of the shot we catch a glimpse of what appears to be a female tourist.

A COW URINATES
ACROSS THE STREET
FROM A SHOP
THAT SELLS
COW URINE
EYE DROPS



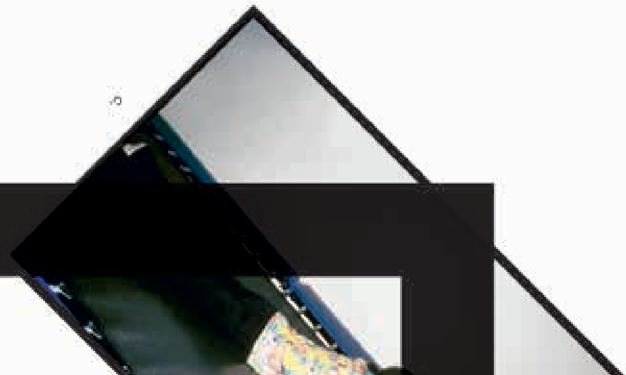
On September 14th, 1999 four veterinarian surgeons removed 4,000 plastic bags from the stomach of a cow during a four-hour operation. The cow over three years had swallowed the polyethylene bags and an assortment of other foreign objects including a coil of metal wire, some coconut shells, a screw, a piece of sari, and a napkin. After a successful operation they weighed the waste and found that the plastic bags alone weighed 45 kilograms.



a.

b.

c.



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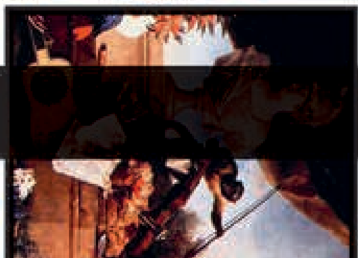

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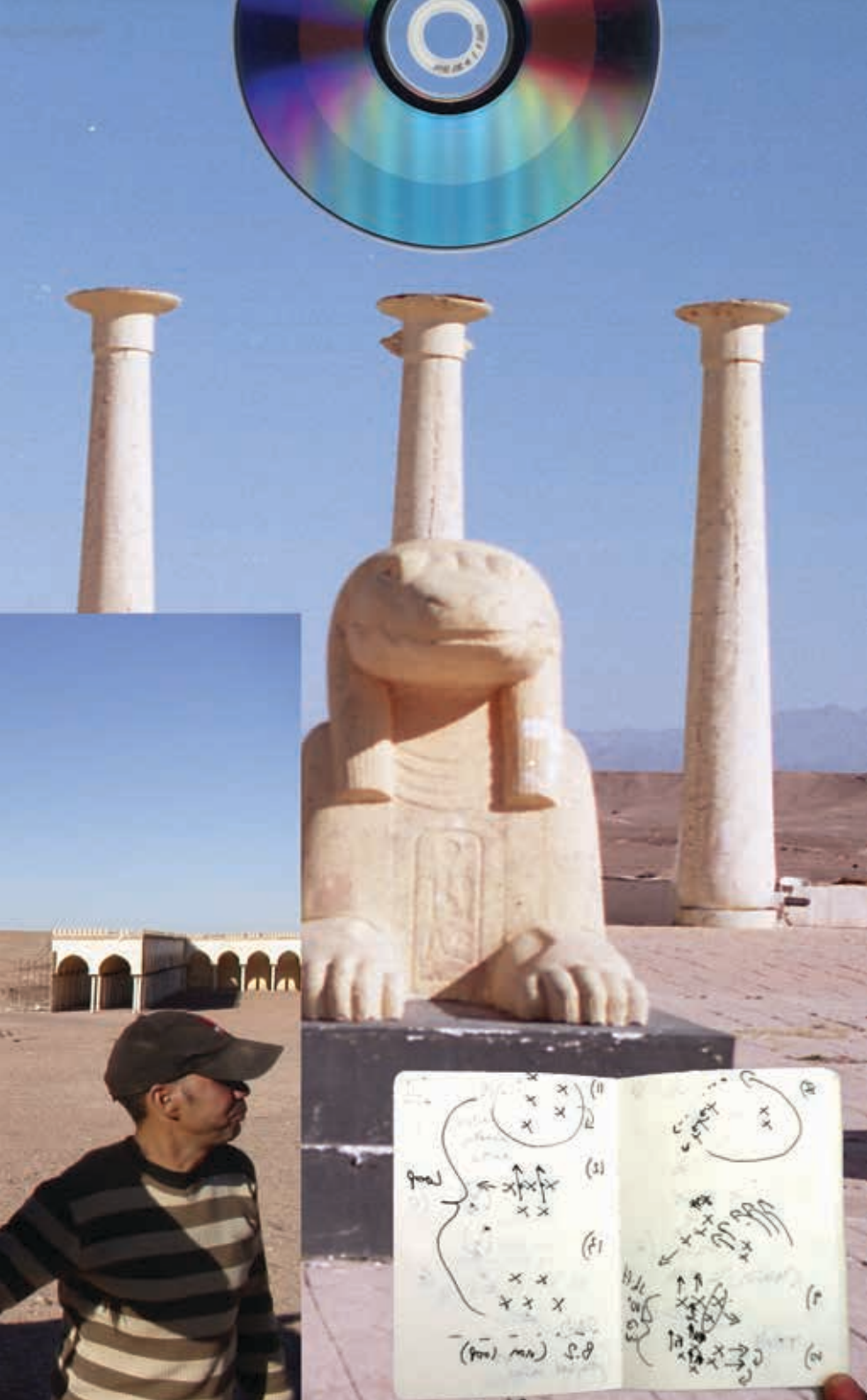
I CAME TO VISIT PYRAMIDS ..
LEAVE ME ALONE ...




ATLAS
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"EGYPT IS THE EMPTY CENTER"
ATLAS GREEK


CHARLES ATLAS
CHANNELS / INSERTS, 1981
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COURTESY VILMA GOLD, LONDON

The Stratophysics of Urban Soil Production

Seth Denizen (S D) in conversation with Etienne Turpin (E T)

The apparently sudden desire of the geological sciences to amend the timeline of Earth's history to incorporate an epoch defined by human action has opened a conceptual territory that has appeared as a kind of terminal moraine of ideas about the nonhuman world. In the search to describe this ground more clearly, and inspired by speculative geological projects, we sat down to talk about the soil underfoot, its history, historiography, and increasingly urbanized mixtures. The question of how to understand, measure, and otherwise characterize anthropogenic changes within nonhuman systems is an increasingly challenging enterprise. From the biosphere to the cryosphere, and through literally every domain on the planet, the consequences of human impact are felt; yet, how to develop any scientific approach to accounting for these changes commensurate with their consequences remains a task common to aesthetic and scientific practice. In this interview, we discuss a speculative project completed by Denizen to redesign the world's system of soil taxonomy; the project was recently exhibited at the 2014 International Architecture Biennale in Rotterdam.[1]

E T

Your recent project, *The Eighth Approximation,* was completed at the University of Virginia as part of your Master of Landscape Architecture research. Can you explain where this research came from and why it is the "eighth" in a series?

S D

The *Eighth Approximation* is what I imagine to be the unwritten update to the *Seventh Approximation*, which was a system of classifying soils published by the United States Department of Agriculture (USDA) in 1960. When it was published, it was a radical, new approach to soil taxonomy that came from twenty years of work published as "approximations." Now it has become the dominant methodology for classifying soils around the world.

E T

When did the USDA begin approximating soil with their new taxonomy? Was this following the dust bowl in the US?[2]

S D

There's a helpful timeline of taxonomic systems posted on the *Eighth Approximation* site.[3] The *Seventh Approximation* wasn't released until 1960, decades after the "dirty thirties," but yes, it certainly came out of a major reassessment of soil taxonomy that began after the dust bowl. The history of USDA soil classifications goes back

further than that, though. Basically, you have Milton Whitney in 1909, George Nelson Coffey in 1912, and Curtis F. Marbut in 1927 all putting together schemes for soil classification, and they all took different approaches. Significantly, Marbut read Russian, and he was reading the publications of the Dokuchaev School, named after Vasily Dokuchaev, a Russian geologist who is credited with founding the discipline of soil science in the 1860s and 1870s. Dokuchaev basically begins the entire discipline of soil science by describing soil as a body, in the biological sense of a whole—a body with organs.

Agricultural Imperatives

E T

Even in the Italian geologist Antonio Stoppani's 1873 argument for the "Anthropozoica," among his comprehensive accounts of human activity on earth, he remains convinced of the pure virtues of "mother earth," who opens herself, or *is opened* by man, to receive the gifts of agriculture.[4] What is it that gives rise to these more speculative concerns about soil in Dokuchaev's work?

S D

Agriculture. It was a moment at which the science of growing food was important, and becoming increasingly important. If you start to look at soil from the point of view of agriculture, you realize quite quickly that some soils are better than others, and when you apply the knowledge and disciplinary training of a geologist in the 1860s to this problem, you realize that soils don't just appear *ex nihilo*. There is a process of things living and dying in the soil, and the formation of layered strata over time, which are important for fertility. So Dokuchaev's idea of soil as a kind of body is an understanding with an important consequence: all of the complex differentiations, and all the distributions of matter in the soil, and all the irreconcilable differences that appear in the soil profile, in the layers that appear over time, can be understood as one thing—all of this is soil—and it is one thing because it is found in other places, it is repeatable, and thus the "soil body" can become the basis for a taxonomic classification.

E T

So, is there also, in addition to this geological line, a biological line that enters the discourse, where the microbiology of the soil puts life to work and begins to capitalize on this realization? A biological line that wants to tap a kind of internal vitality to maximize and standardize, not just inert stuff, but as a body to be worked on?

S D

Yes, soil begins to be seen as a "standing reserve."[5]

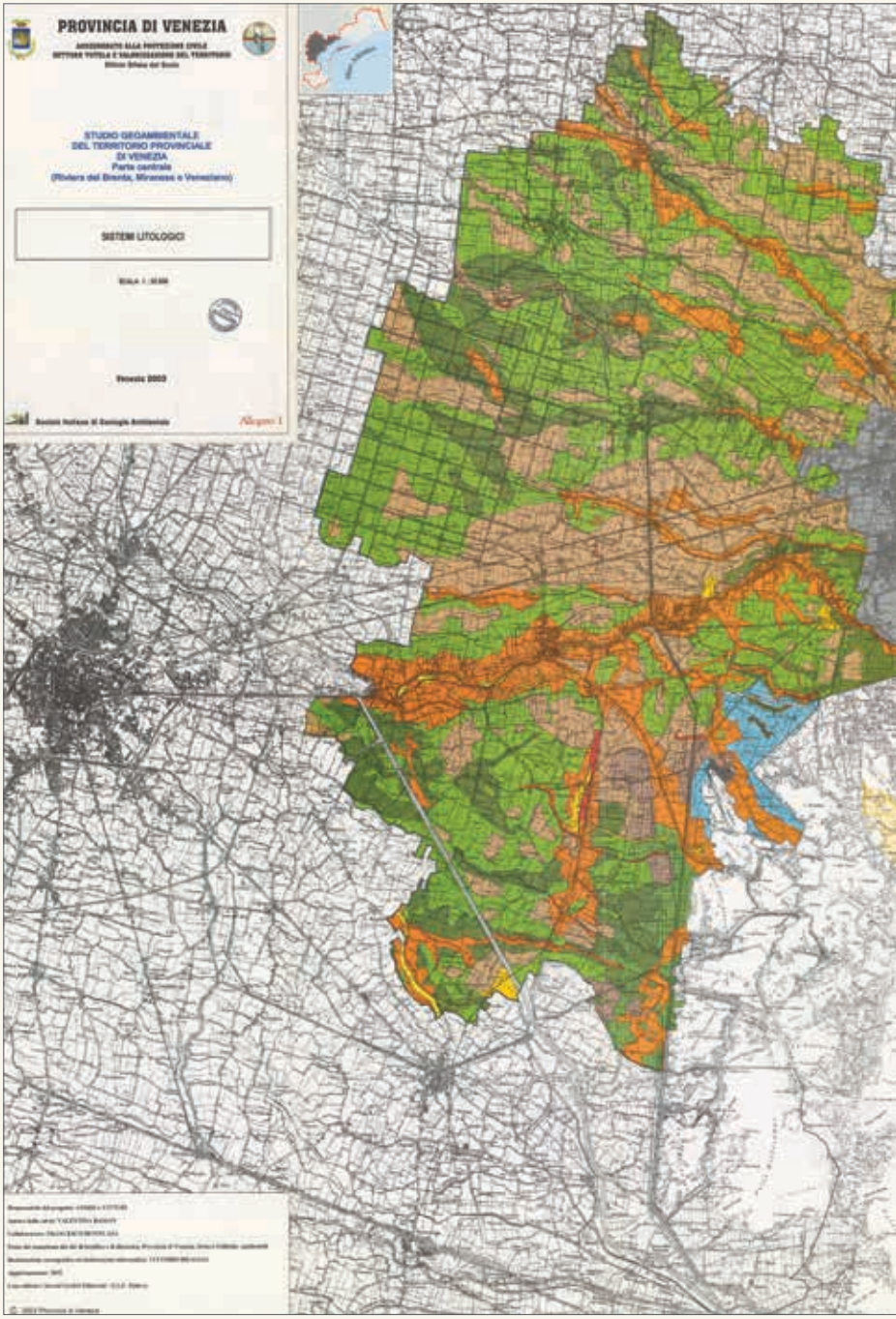
E T

How does this compare to the previous systems of soil classification? Your research develops a comparison to these previous systems as a means to show some of the limits and the ways in which your project attempts to overcome them. Can you start by explaining the history of these other systems of soil classification?

Early Soil Classifications

S D

Previous systems of soil classification can be differentiated into three groups: genetic taxonomies, morphological taxonomies, and a mix of both. Dokuchaev, as a geologist, created a taxonomy of soils that is genetic; that is, when you ask, "what is a soil?" the answer is


PROVINCIA DI VENEZIA
STUDIO GEOAMBIENTALE
DEL TERRITORIO PROVINCIALE
DI VENEZIA
Parte centrale
(Riviera del Brenta, Miranese e Veneziano)
SISTEMI LITOLOGICI
Veneto 2003
Allegato 1

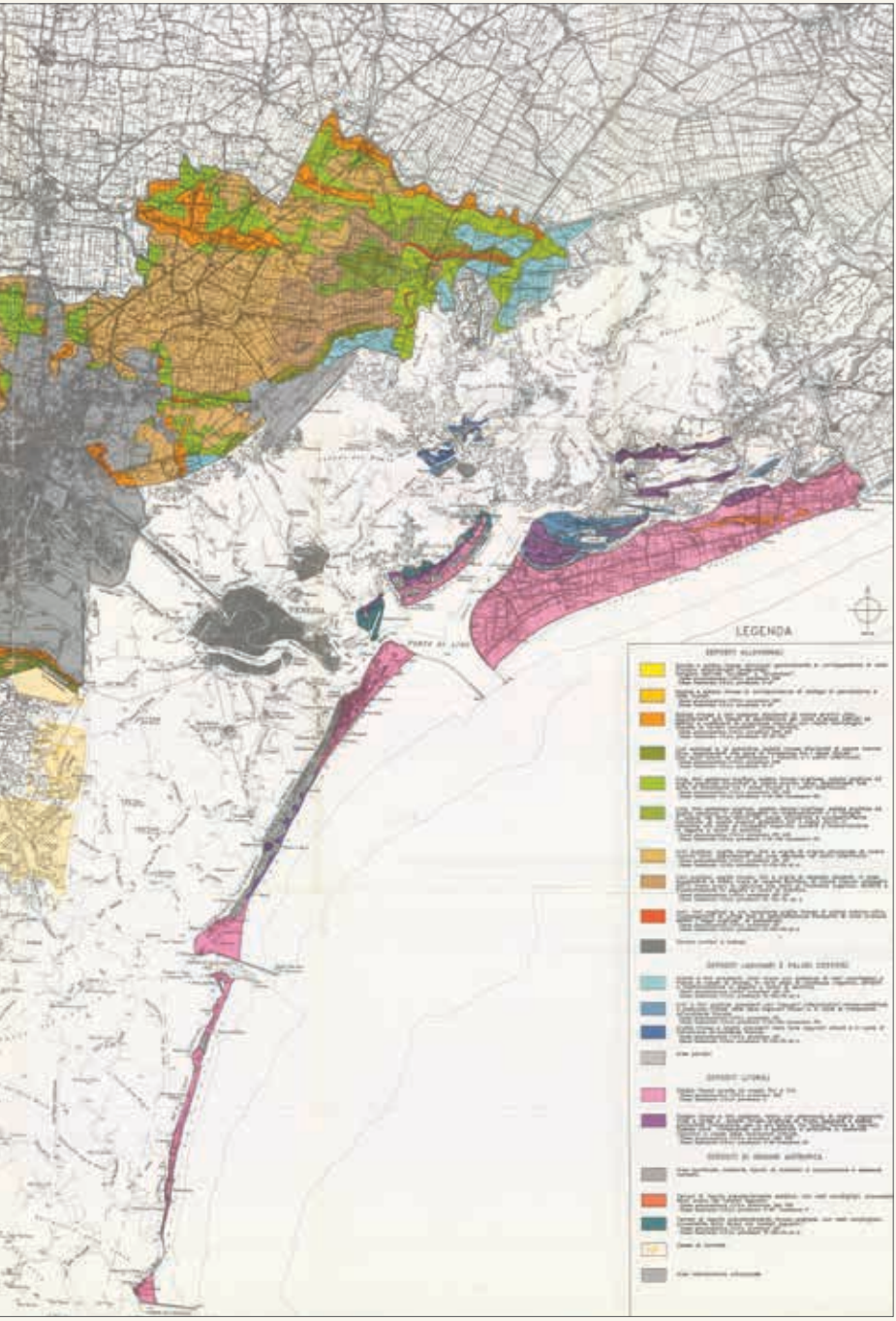


Fig. 01. Soil Survey of Venice revealing former river courses and depicting its urban soils as a void. Venezia 2003, Societa Italiana di Geologia Ambientale. Scale = 1:50,000.

always, "where did it come from?" This requires that you know where a soil came from in order to classify it; you have to know your geology. So while Dokuchaev understands soil as a living thing, and not just the residue of rocks, his taxonomy of this body is still based on the observation that certain rocks produce certain soils. It's a phylogenetic move, in the same way that what makes dolphins distinct from fish is not their ecology, it's that they used to be a kind of deer or cow. The system is actually pretty convincing. If you look at a geological map the boundaries between surface formations will often be the same boundaries separating soil types. In Virginia, where I was doing this research, the state is creased by these Triassic basins that map to the soil survey perfectly. The problem with this is that you end up with a taxonomy in which every soil classification becomes an argument about geology, or geological history, and this leads to any number of differences of opinion on how to classify a soil.

E T

The origins that the soil expresses are not necessarily agreed upon?

S D

Exactly, because geology is in a state of constant revision. Geohistory is constantly being revised. This seemed like a big problem for geologists and soil scientists, at least in the US, until the dust bowl. After the dust bowl, people quickly realized that this was not a problem for geologists and soil scientists, this was a problem for everyone! The major, fundamental misunderstanding about soil in the dust bowl was the role played by the living things in a soil that are required to keep the soil in place. There is a critical threshold after which the soil becomes extremely fine and particulate, and at that moment it is carried away by the wind with relatively little force. So, from that point on, research on soil focused on how soil forms clumps, called "peds" or "clods," and there are multiple important scales to consider when you want to prevent soil from becoming a microscopic clay particle that can be blown across the country.

E T

By the end of the dust bowl, the loss of topsoil had reached nearly a billion tons.[6] It was just blown away—and it wouldn't be easy to replace! So the goal of soil science becomes how to deter, urgently, the processes that allowed this to happen.

S D

Exactly, because an inch of topsoil can take 500 years to form, so the soil that is lost is not easily replaced. It is a catastrophic moment, and, in fact, we are still in that moment. There are some pretty dark statistics about topsoil loss worldwide. You can see from Google Earth just what kind of topsoil loss we are talking about. Take Panama, for example. If you look at high-quality satellite images, you can see the topsoil literally shooting into the ocean, but you can see this in a lot of places. This is due to land-use practices, and the lack of understanding of how to keep a soil in place, which can be a complicated problem, especially with changing climates.

E T

When it finally ended in 1939, the drought in the United States was brutal enough to generate concerns about how to prevent that level of damage from happening again, but is there really a concern about the practices, or the causes of it? I can't really speculate on this, but, presumably, the extensive use of fertilizers and pesticides, as well as

HISTORICAL DEVELOPMENT OF SOIL TAXONOMIC SYSTEMS

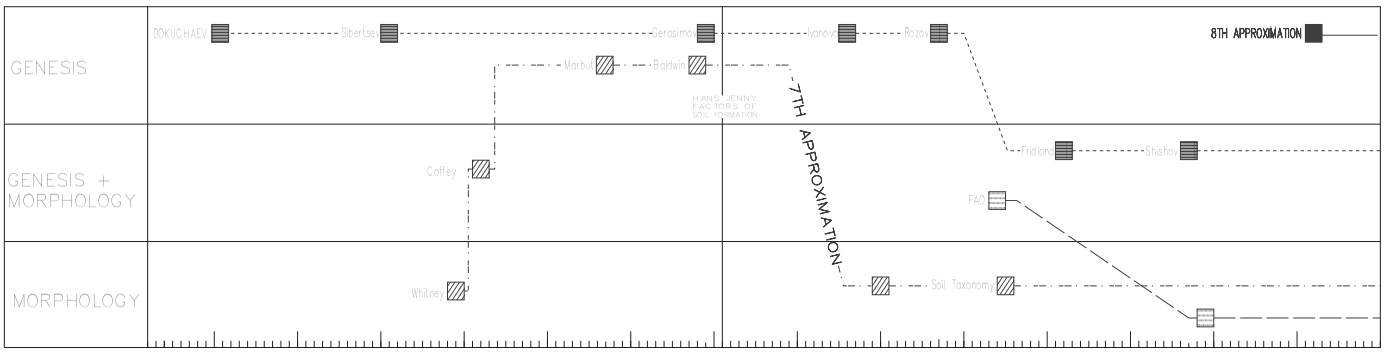


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Fig. 02. The historical development of three major soil taxonomies classified according to their emphasis on genetic or morphological diagnostic criteria. The general trend has been towards morphological criteria, and away from historical or genetic factors; drawing courtesy of S. Denizen.

industrial crop production, suggest that we do know why it happened, in part at least, but we continue to aggravate the soil nonetheless. We just add greater compensatory techniques of management and control, don't we?

Technical Responses for Continuous Growth

S D

It is not a total mystery why this was happening in the 1930s. If you look at some of the documentation I have put together from the Library of Congress, you can see some of the things the USDA was doing to educate farmers about soil. After the dust bowl they mounted a massive outreach effort to disseminate information about how to prevent top soil erosion. Publications like *Soil and Shelter* contain striking images that argue for the use of new techniques, for example, the planting of wind rows of trees to help fight erosion. The USDA also introduced techniques like plowing on the contour, so, instead of just plowing a grid on a field, farmers were taught to follow the topographic contour with their tractors, so when water hits the top of the hillside on your land, it doesn't just shoot down the rows of planting, but is slowed by successive terraces of crop rows. This was another important aspect of the USDA educational campaigns.

E T

The development of the McCormick Reaper in the late nineteenth century had an incredible influence, even though it remained a horse-drawn technology. But the tractor introduces an important, unprecedented new feedback; that is, the ability to collect more crops on a given farm allows us to attempt to grow more as well. The technological demand for increasing yield is also about the increased capacity for harvesting. So, while the response to the dust bowl is the USDA's implementation of these educational means, new means to reduce erosion were also competing with technological advances.

S D

But this also meant that agriculture is now a question of national security. It always was, to an extent, but after the dust bowl there was a whole new emphasis that went all the way from the farm to the academy.

E T

This is why John Gerrard and Michael Morris talk about the fight to secure nitrogen reserves in South America so that Britain and America can ensure that they can grow more food. The question of national security is also a question of the attendant chemical resources that go into these practices.[7]

S D

Yes, absolutely. Floyd Bennett Field in New York City is a good example. When New York was a horse-powered city, all of its dead horses were sent to the horse-rendering factories there to be boiled for the production of nitrogen fertilizer for agriculture. This was necessary because the only source of nitrogen at that time was from organic matter. So, the kind of economies that developed around these rural concerns were also very urban because of the need to consolidate organic waste for the production of fertilizer. We should add here as well that the immensity of the change made possible by the Haber-Bosch process is usually quite understated.[8] You have to realize that for the last billion years there has been a tendency for nitrogen to become an inert, atmospheric, biologically unavailable gas through the metabolic processes that defined life on earth. The technology

to produce the reverse reaction was only held by bacteria. Only bacteria had the Haber-Bosch process.

E T

Which is quite significant in light of the biologist E.O. Wilson's comment that human beings, in the Anthropocene, have reached a rate of biological reproduction that is more bacterial than primate. It is precisely the fixing of nitrogen through the Haber-Bosch process that begins the asymptotic ascendency of the so-called "great acceleration" following WWII.[9]

S D

This is a much better way of clarifying what Wilson meant. We are not talking about the division of cells here; we are talking about a reorganization of the world's resources to support an extremely energetically costly reproduction model, which is a whole other thing.

Redefining Soils

E T

So, we have these precarious but somewhat stable processes that allow us to increase production. We have faith in these processes to continue to produce for us, but what does this do in terms of taxonomies of soil?

S D

The question we have to begin with is: "how are soils formed?" With the dust bowl, what we have is soil blowing away, but what is really happening? We can say that soil is ceasing to be soil, soil is dying and becoming rock, particulate rock, and blowing away. There is a famous soil scientist named Hans Jenny who created an equation based on Dokuchaev's five factors of soil formation, which were: climate, organisms, relief, parent material (i.e. rocks), and time. This was, and still is, the best description of what a soil is, although it has one key problem for soil science: it is unquantifiable. Jenny didn't think so, though, and he actually tried to make each of these processes a mathematical function of each other, using a lot of very strange conversion factors and arbitrary multipliers; you would get a number that was supposed to mean something very precise about soil formation, and this was far too arbitrary. Interestingly, it was Jenny who was responsible for introducing the vocabulary of "approximations" into soil taxonomy. He was still giving a genetic account that tried to show what formed a soil but instead the USDA tried to rethink the taxonomy altogether. Rather than asking how a soil was formed, or, like Dokuchaev, where it came from, they started to describe soils in terms of pure morphology. At this point, it did not matter where the soil came from, or what happened to it in geological time for the purposes of taxonomy. Instead, the USDA boasted, after the release of their *Seventh Approximation*, that they could parachute a USDA soil scientist blindfolded into any region in the world. Armed only with a pick-ax and rudimentary tools, that scientist would be able to accurately classify the soil they stood on according to this new taxonomy. This was possible because history was no longer the primary taxonomic criterium.

Instead, morphology—meaning the size, shape, and chemistry of the soil—became the most important criterion for classification. Here the chemistry of a soil came to mean the chemistry relevant to plant growth. But, if you are wondering about history you have to realize that the USDA is just approaching this from the other side. Once you have the morphological description, they believe you will be able to see in

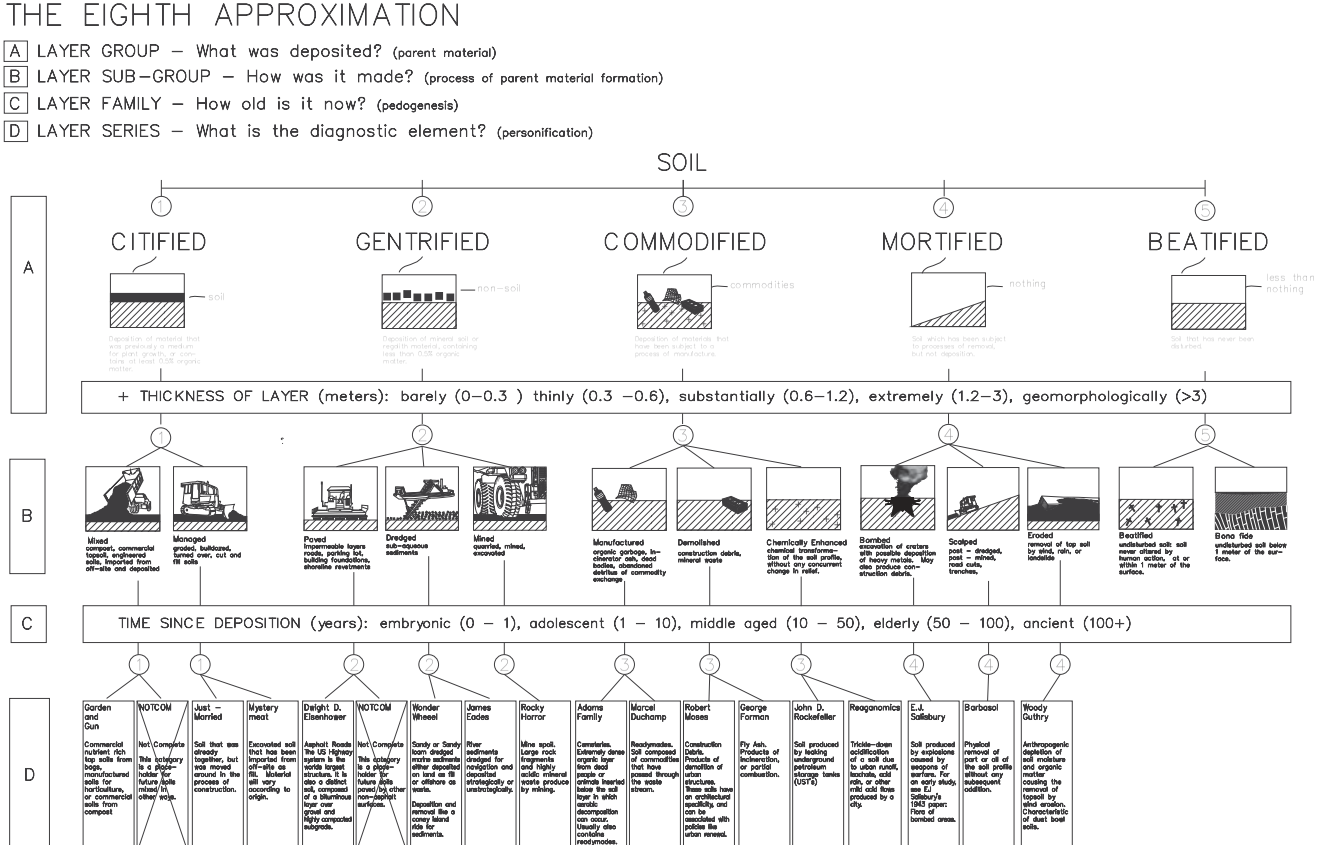


Fig. 03. Speculative soil taxonomy for describing urban soils according to their historical processes of formation. At the series level, descriptions are specific to New York City; drawing courtesy of S. Denizen.

that description the historical reality. History and genesis are not given up completely—trends and patterns in soil classification certainly require genetic explanations, so they haven't stopped thinking about the genetic factors of soil formation—but the only taxonomic features that are diagnostic in the *Seventh Approximation* are morphological.

Towards An Anthropogenic Approximation

E T

So, given that there is still an explanatory value that leads to the genetic, what is the role of the *Eight Approximation?* Was the *Seventh Approximation* just an epistemological trade-off that favored the morphological? How does your project act as a corrective to this?

S D

The problem with purely morphological soil taxonomies is that they are very bad at describing urban areas, or places with a strong set of historical forces acting on the soil. This means that the *Seventh Approximation* largely describes a world without humans. There are no human-made soils in the *Seventh Approximation*. The one exception is that there was a category that could be added to any of the soil groups to describe the impact of agriculture on the soil. Things like if your plow is a foot and a half deep, you will get a hard, compacted soil pan a foot and a half deep, etc. It was a description that could be appended to any soil classification. So human impacts were banished from the *Seventh Approximation*, and only introduced as a set of contingencies that natural soil was subjected to. This institutionalized certain well-known ideologies about what is natural, but it did so for reasons that had more to do with the requirements of a morphological approach to taxonomy.

Essentially, to identify a soil that has a very complex morphology—it's got seven distinct layers down to bedrock—and take all the difference and distinction that has taken hundreds or thousands of years and collapse it into a single taxonomic category … well, how can you do that? Because you can say that the same things happened to each layer, as they all experienced the same chemical history. Basically, this USDA taxonomy has a tremendous utility when we are talking about undisturbed, or relatively undisturbed, soils because you have hundreds or thousands of years of history intact to solidify your taxonomic system—a thousand years of climate, a thousand years of time, and a thousand years of organisms have acted uniformly on a soil body. This consistency gives your taxonomy its categories, so there aren't as many soil categories as soil samples. The system becomes much less useful when this consistency disappears, and this is the condition you find in the city. When you look at USDA soil surveys of urban areas you find these very strange dark holes in the maps, drawn along very sharp boundaries which correspond to city limits.

These black holes the shape of cities really surprised me. Going through these soil surveys, you are looking at an immense project, to survey every soil in the continental US, that has taken much of the last century to complete, and you realize that every single city on the USDA survey is just a void. So, my project began with the question, while looking at these maps, of what is in there? Surely, the soil doesn't stop; surely there is soil there where the city begins. This is especially apparent when looking at, for example, the soil survey of Venice. In Venice, you see this incredible, immaculate system of rivers that produced the Venetian lagoon, and every time they flood they deposit very

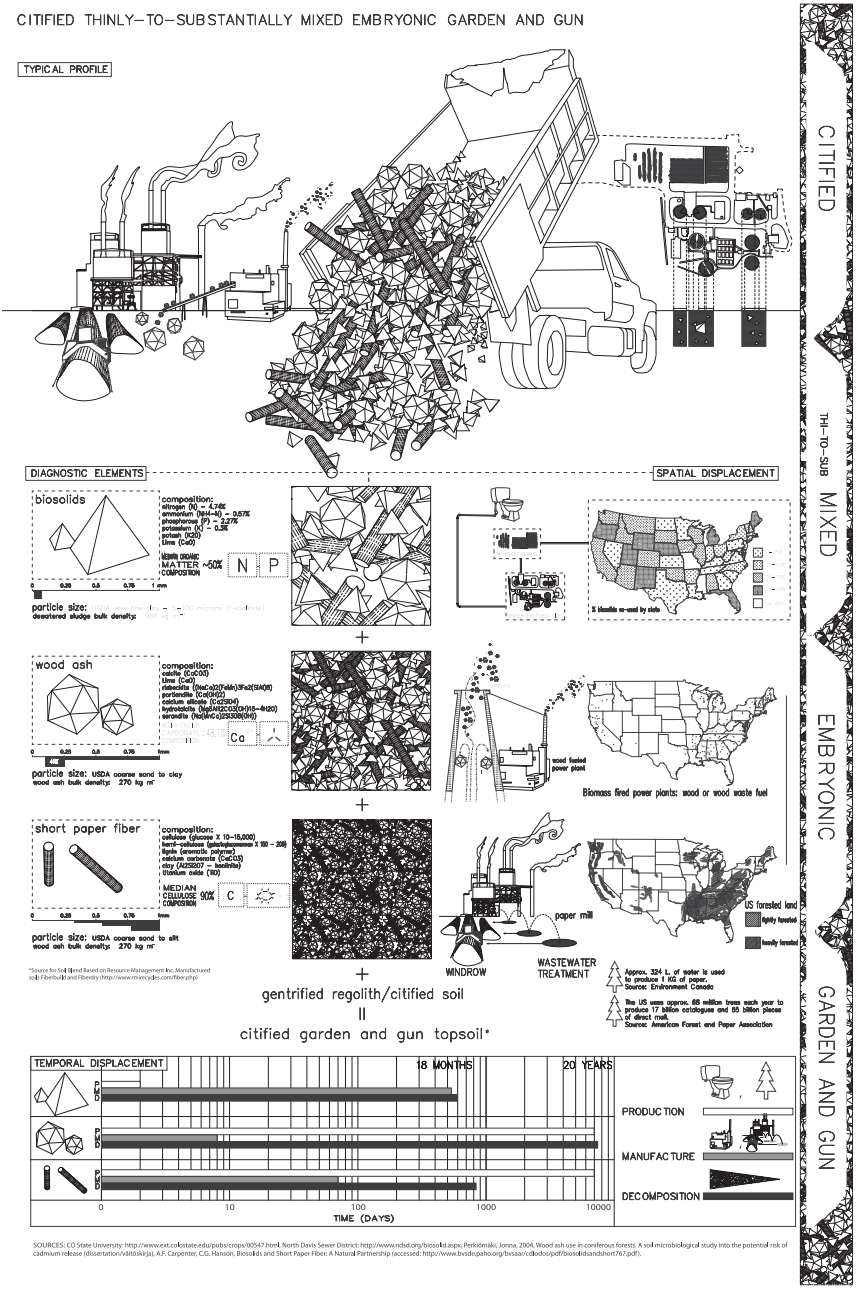


Fig. 04. Citified Thinly-to-Substantially Mixed Embryonic Garden and Gun Soil, usually consisting of commercial, nutrient-rich topsoils from bags, manufactured soils for horticulture, or commercial soils from compost; drawing courtesy of S. Denizen.

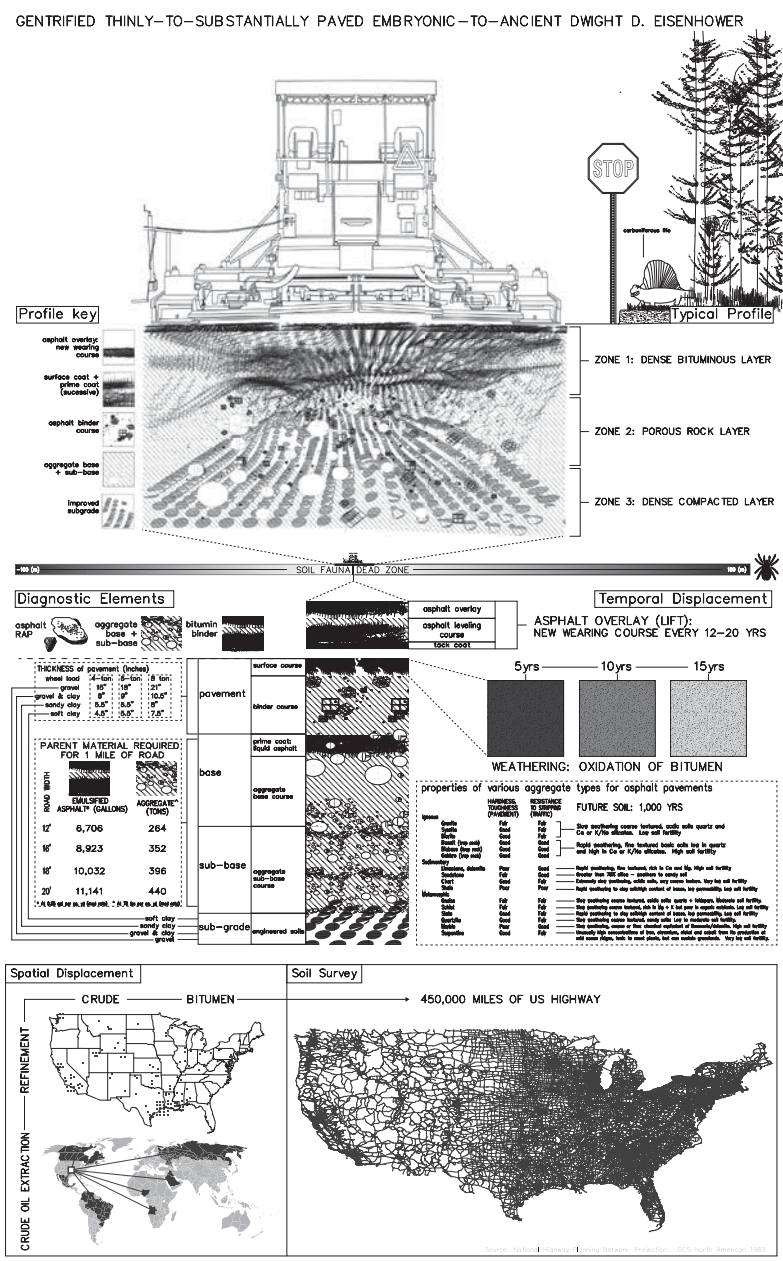
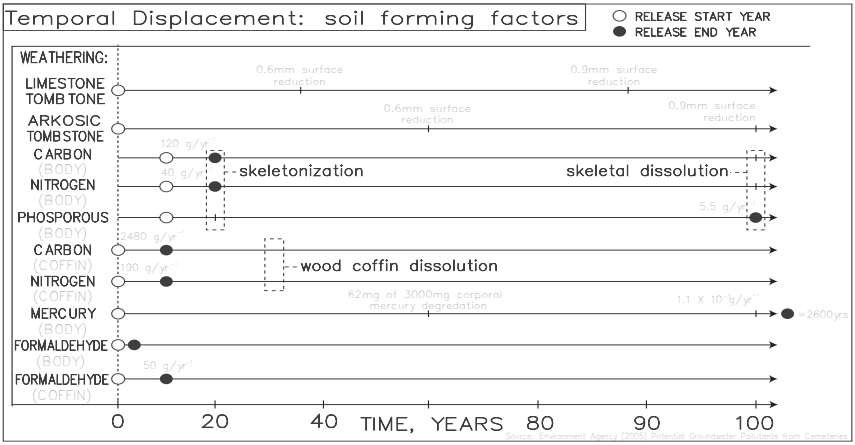
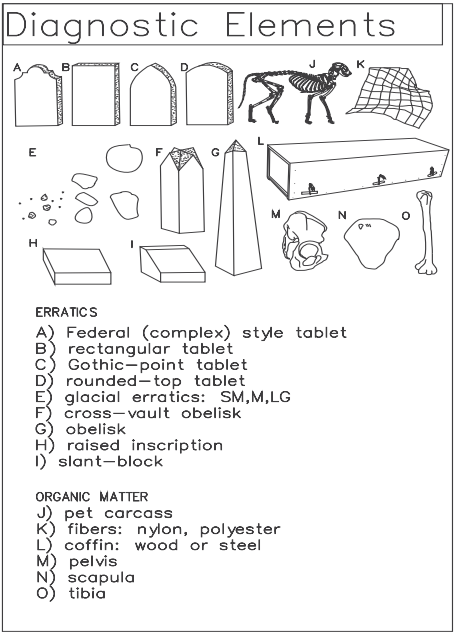


Fig. 05. Gentrified Thinly-to-Substantially Paved Embryonic-to-Ancient Dwight D. Eisenhower soils, usually consisting of asphalt roads and compacted subgrade; drawing courtesy of S. Denizen.





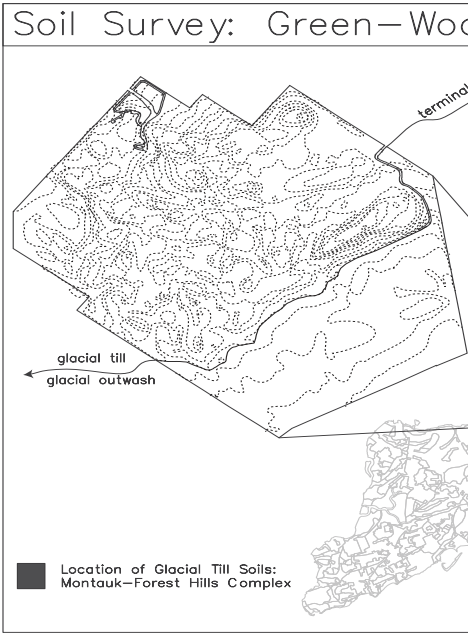
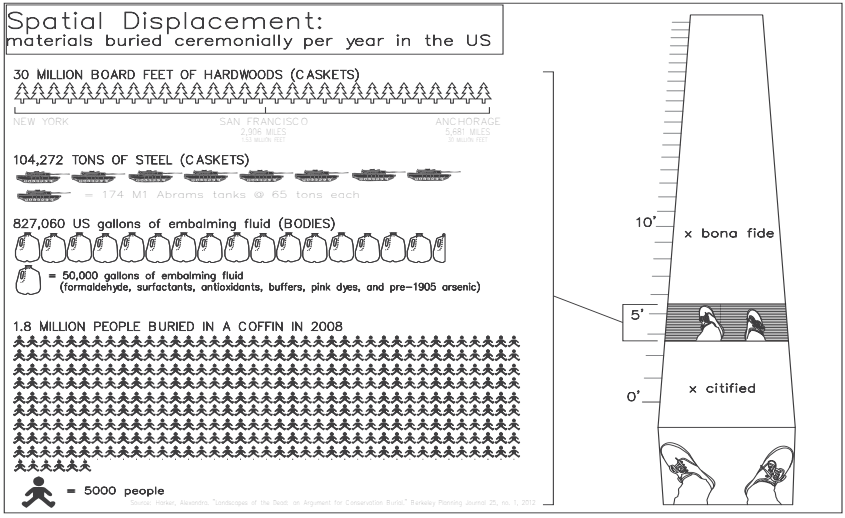


Fig. 06. Commodified Thinly Manufactured Adolescent-to-Ancient Adams Family soil, usually consisting of an extremely dense layer of organic matter from dead people or animals inserted in the soil profile below the depth at which aerobic respiration can take place; drawing courtesy of S. Denizen.


Spatial Displacement:
materials buried ceremonially per year in the US
30 MILLION BOARD FEET OF HARDWOODS (CASKETS)
NEW YORK
SAN FRANCISCO
2,906 MILES
2.3 MILLION FEET
ANCHORAGE
5,681 MILES
20 MILLION FEET
104,272 TONS OF STEEL (CASKETS)
= 174 M1 Abrams tanks @ 65 tons each
827,060 US gallons of embalming fluid (BODIES)
= 50,000 gallons of embalming fluid
(formaldehyde, surfactants, antioxidants, buffers, pink dyes, and pre-1905 arsenic)
1.8 MILLION PEOPLE BURIED IN A COFFIN IN 2008
= 5000 people
10'
x bona fide
5'
0'
x citified


od Cemetery
moraine

particular sediments depending on the very particular geological origins of the rivers, and so you have this beautiful soil survey of fingered, sprawling difference, with soil from all over the Veneto and all over the Italian Alps, and then you see that there is a black hole where all the rivers enter the lagoon as if history ends at the periphery of the urban settlement of Venice. In Venice, there has been a millennium's work forcibly redirecting the rivers that enter the lagoon, so on the survey there are also soils that exist from deposition where there is no longer a river, and you can see where they were. But, what we have on the soil map is a void, an absence … nothing. The question my research asks is simple: what's there?

E T

Are these voids there because soil science has always been marshaled toward building new farms or developing farmland, and the imperial expansion of agriculture into the hinterland? This also begs the question of what soil science is ultimately responsible for, or what it could contribute to other than an expansionist agricultural project.

S D

The black hole in the map is not just because of an emphasis on agriculture; it is also because the taxonomic system simply doesn't work there. It doesn't work there because the soil has been turned over, among other things, and this destroys the system of horizons that gives consistency to this form of classification. Really, a lot of things happen to the soil of cities: things are added, burned, dumped, and leaked, which affect the development of soils in ways that are not always well-understood. We can specify the effect in terms of pollution, in specific ways, but in terms of the kind of soil that roads or cemeteries make, it can be hard to tell, and it's often very site-specific. And if we don't know what soil it makes, we don't know how to classify it. So, it is a point at which the USDA taxonomy becomes less useful for classifying soil because it solely operates on morphological properties, and the force behind a morphological classification of soils is the consistency of morphology through time. Here, in the city, we have a total breakdown of this consistency, at the scales of time that it takes for soils to form, and so it becomes very difficult to classify a soil morphologically. What you end up with instead are engineering taxonomies that specify if a soil is good, or not good, for a specific function, a subway, a road, etc. So, we don't know what it is, we don't know what it will be, it's just classified in terms of certain properties related to use. Soil as standing reserve, once again.

Soil in the Future of the Anthropocene

E T

The absence of temporal consistency is quite interesting for soil science, not least because it repeats, in a way, Stoppani's argument in the *Corso di Geologia,* which was basically that although humans have been around for a relatively small amount of time, geologically speaking at least, their impact is not negligible for natural science.[10] The question of adapting a morphological system to account for an intensive moment that challenges the previous historical consistency is quite important in the longer history of the Anthropocene. How do you work with that in your project?

S D

It means that the repetition that gives force to a taxonomy of soils in the city is not the consistency of a geography,

like a delta or prairie, but rather the consistency of the urban forces that act on soil through time, like bulldozers. So the urban condition calls for a return to genetic classification in order to understand the relationship between the city and the soil that it makes. For me, the moment at which you disconnect, in a taxonomy, the relationship between the history of a soil and its morphology, you cease to be able to see these in their real relationship. In the *Eighth Approximation*, I am arguing that urban soils call for a return to genetic taxonomies. My thesis was the project to build this taxonomy and see what it would look like.

The system starts with a series of questions. The first question, the highest taxonomic level, is: what was deposited? This is to assert that in a city all urban soils are the result of a process of deposition. So, in the highest level, we answer the question of the mode of deposition responsible for the material. There are five groups. The first group is the *Citified* soils, or soils that are the result of the deposition of a medium previously available for plant growth; basically stuff which we would commonly recognize as soil, and maybe use in our gardens. The second group is *Gentrified* soils, or soils that are the result of the deposition of mineral soil or regolith, which basically has no organic matter, or what we think of as non-soil, like mined rock or asphalt. The third group is *Commodified* soils, which are the result of the deposition of materials previously subject to a process of manufacture, and this is a category in and of itself because we have to understand the cycle of commodities inherent in the mode of deposition, which means we have to see the cycle of our economy as producing materials that, as waste, are incorporated into the soil of our cities, like garbage, dead bodies, incinerator ash, construction debris, etc. The fourth group is the *Mortified* soils, or soils in which the mode of deposition is removal. This happens when the side of a mountain is scalped, leaving whatever is geologically underneath the soil naked. And finally the *Beatified* soils, which are those soils that are pronounced to be undisturbed. Those are the categories at the highest level, and then beneath that, for example, in the *Commodified* category, we have manufactured soils, distinguished from cemeteries, which include the deposition of human bodies usually placed below the zone in the profile where aerobic decomposition is possible, accompanied by an assortment of heavy metals in the form of coffins and tooth fillings. Also, here are the *Chemically Enhanced* soils, which are entirely intact in their structure, just polluted in some chemical way. So, the first three levels of the taxonomy are identifying the mode of deposition, the thickness of the deposited layer, and the material that was deposited. Finally, at the fourth level you ask, what is the diagnostic element of this soil?

Here, at the fourth level, I have used names that might mean something in the diagnosis, for instance, the paved soil in the *Gentrified* group is called *Dwight D. Eisenhower*, because Eisenhower created the system that produces these soils, in 1956, with the implementation of the Federal Highway Act. It is a way of personifying the soil, which has a certain character. But, at this level, of course, the taxonomy could never be complete because it is connected to the processes of the city, as the city is continually making itself. So at this level the identity would be quite local.

Again, for example, I have a *Robert Moses* soil in New York City, where this soil is connected to the practices of urbanism implemented by Robert Moses, but in relation to very particular materials connected to their historical and geological past that is quite local.

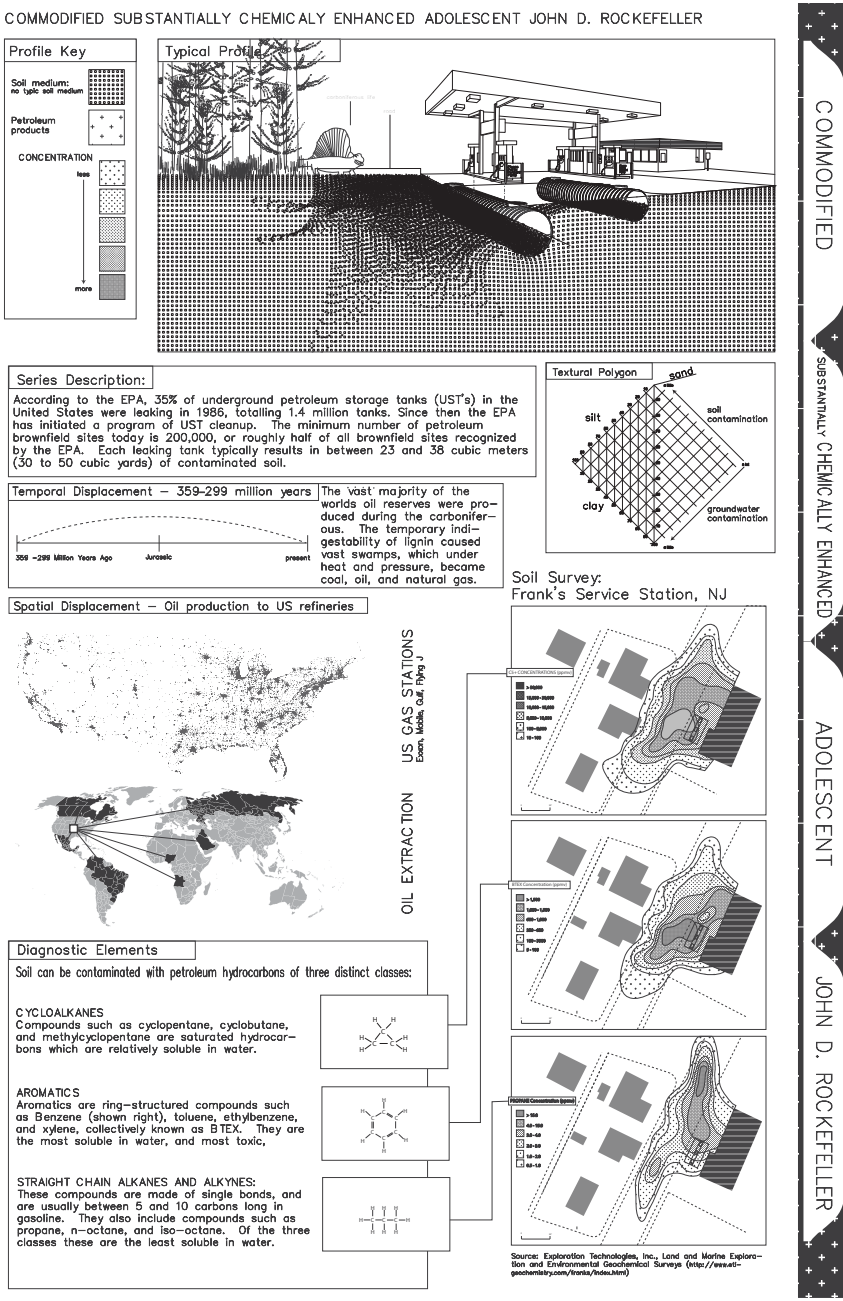


Fig. 07. Commodified Substantially Chemically Enhanced Adolescent John D. Rockefeller soils, usually consisting of soil produced by leaking underground petroleum storage tanks (USTs); drawing courtesy of S. Denizen.

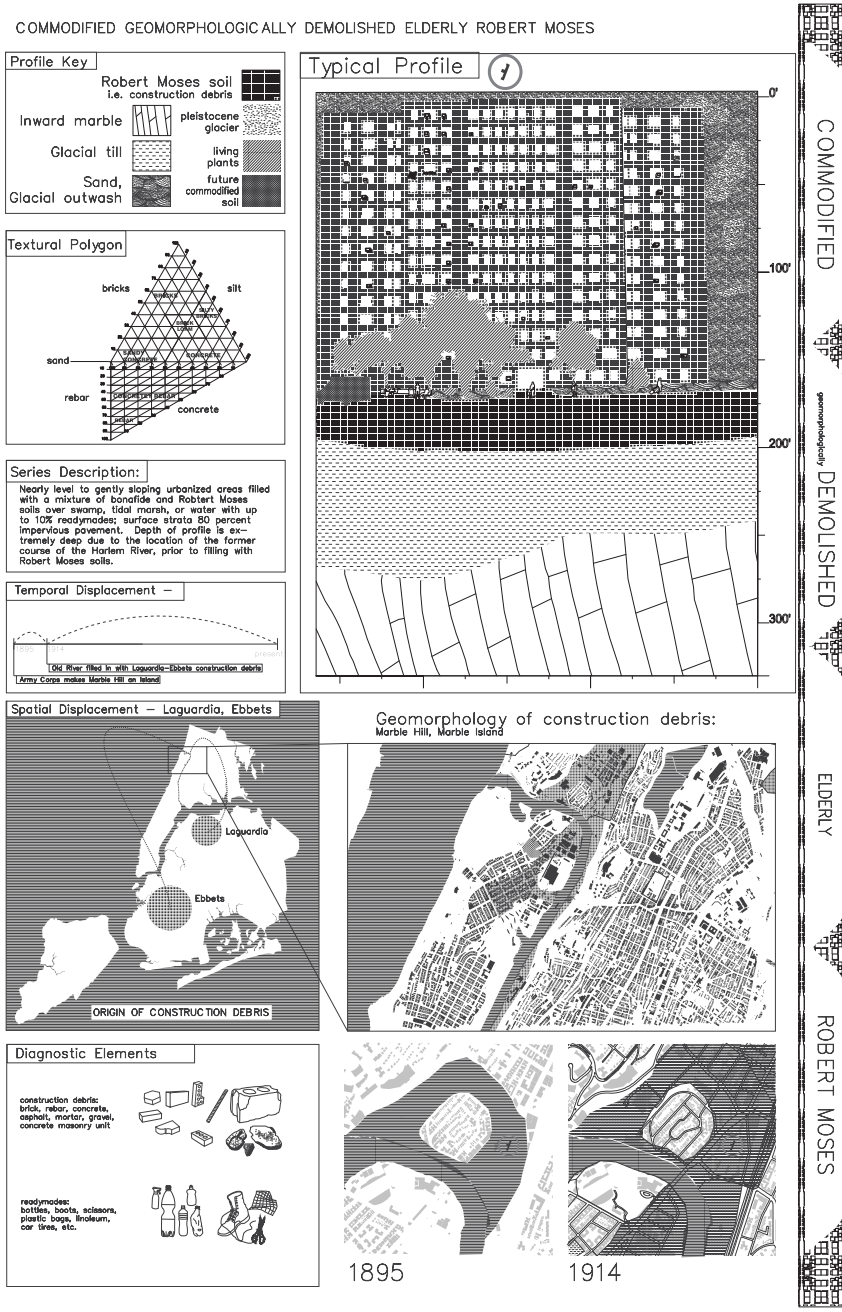


Fig. 08. Commodified Geomorphologically Demolished Elderly Robert Moses soils, usually consisting of construction debris or products of the demolition of urban structures in New York City; drawing courtesy of S. Denizen.

E T

I'd like to ask about the *Chemically Enhanced* designation because it brings up another point we should address. What about the role of drift, or the ways in which the circulation of materials that have been accumulated and disposed create aberrant forms of deposition? Is this addressed in the *Eighth Approximation*?

S D

The important thing to realize about the *Eighth Approximation*, is that it really privileges the section, or profile, rather than the soil map. The organizing principle of the taxonomy is deposition, so immediately, there is a reference to a process of layering, and layers are not the same thing as horizons. This is the condition you find in riverbeds, where so much material is being constantly deposited that the soil is essentially just this history of deposition, until the process stops, and processes of weathering and leeching begin to transform that layered order. This is the condition, I think, we find in the city. It's an urban riverbed of bodies, buildings, and garbage.

E T

Can you speculate on the role of the *Eighth Approximation* for research today? If, in a previous epoch, the USDA and soil science was directed toward agricultural expansion, efficiency, and consistency, in a similar way to how the USGS (US Geological Survey) played a role in the development of mineral extraction, what does your research try to do in the context of urban soil that makes it different from the engineering profile of soils?

S D

In some ways, the *Eighth Approximation* is still a totally Aristotelian project. Whereas engineering taxonomies like the Unified Soil Classification System ask the practical question "what can a body do," my taxonomy is still asking the old ontological question "what is soil?" I think this is a good strategic question in the context of urban soil, because in some ways the city is already classifying soil in an Aristotelian manner when it decides that it doesn't have any soil, or the soil that it has is "not-soil." When I am talking about soils that are formed by construction debris and fly ash, it's difficult to get a soil scientist to actually even consider this as a soil, because in a classical USDA mode, it's just a hole in the map.

E T

There is also an important strato-physical limit of the USDA soil science research, that is, they only concern themselves with the soil to a depth that typical plant life, or, perhaps, consumable plant life, requires for growth and maturation prior to its harvest. It is a kind of "root-down analysis," but then, the USGS doesn't concern itself with these layers either, so there is a missing aspect of soil analysis for cities, which is actually where cities really are, given the role of the subterranean infrastructures that constitute such large parts of contemporary urbanism.

S D

I would also say that plants do grow in these things. You only have to spend a few days in New York to realize that there is all kinds of strange plants growing out of this stuff! The people whose problem that really becomes, and this is one of the most interesting things that is happening right now, is the National Park Service (NPS). The NPS inherited Floyd Bennett Field in New York City as part of the Gateway National Recreation Area, which is made of dredged sediments, fly ash, WWII ammunition magazines, construction debris, and all

of the eighteenth century's dead horses still discernible as layers in the soil profile. The NPS doesn't have the luxury of saying that this isn't soil because they want to have a nice, pretty park where things grow, and so they need to understand this soil as part of the project of cultivating the park. They are in the position of trying to do the kind of work that the *Eighth Approximation* does, which is to make classifications of these soils. Whereas my taxonomy is trying to create a structure which explicitly links processes of urbanization to soil formation, their taxonomies are more specific and local, and remain morphological in their descriptions.

So, the NPS, working with the USDA, will have things like the *Freshkills* series, which is described as containing over forty percent fly ash. Why not call it a fly ash soil and then start building a more systematic knowledge of how fly ash soils work that could be applied to other parts of the city? I asked a USDA soil scientist responsible for the recent soil survey of New York City where the name *Freshkills* came from and why it was connected to fly ash, and he said that he didn't know, but that it was related to the place where that soil was first found. There is also a *Big Apple* series and a *LaGuardia* series, which is vaguely related to the LaGuardia area of New York, but creating these series based on locations in New York isn't very helpful because it doesn't connect the soil to the process of its formation, like bombs or burned garbage. This whole practice of place names is nostalgic for a time when it mattered where a soil was from.

E T

I know you haven't been in Hong Kong that long, but are you interested in developing your research in new directions in China as well?

S D

Land reclamation in Hong Kong is enormous. I am still trying to understand a lot of it myself. I was walking in the middle of the city the other day, really, in the middle of Hong Kong, and I happened upon a historical marker that designated the former coastline. And I looked around—I couldn't see water anywhere, not in any direction! There was no water in sight, and I would have had to walk longer than I was willing to walk to find it. So, in Hong Kong, you have massive land reclamation composed of both marine and terrestrial sediments, where thousands or even millions of years could separate the geological origins of what is under my left foot and under my right foot, and it is all completely paved over. So, it is a tip of the iceberg indication, what I've been looking at, but the diversity is going to prove to be quite astounding because it is all anthropogenic soils that have really disparate material and economic histories.

A New Image of Soil

E T

When you mention the left foot and right foot discrepancy, it reminds me of the drawing convention you have developed, which always includes human feet; this seems both quite important and especially original, as one perspective in the drawing describes the process of deposition spatially, while the other perspective, as its mirror, describes the deposition process temporally. Can you explain the process of creating these kinds of representations that call attention to both spatial and temporal features of soil?

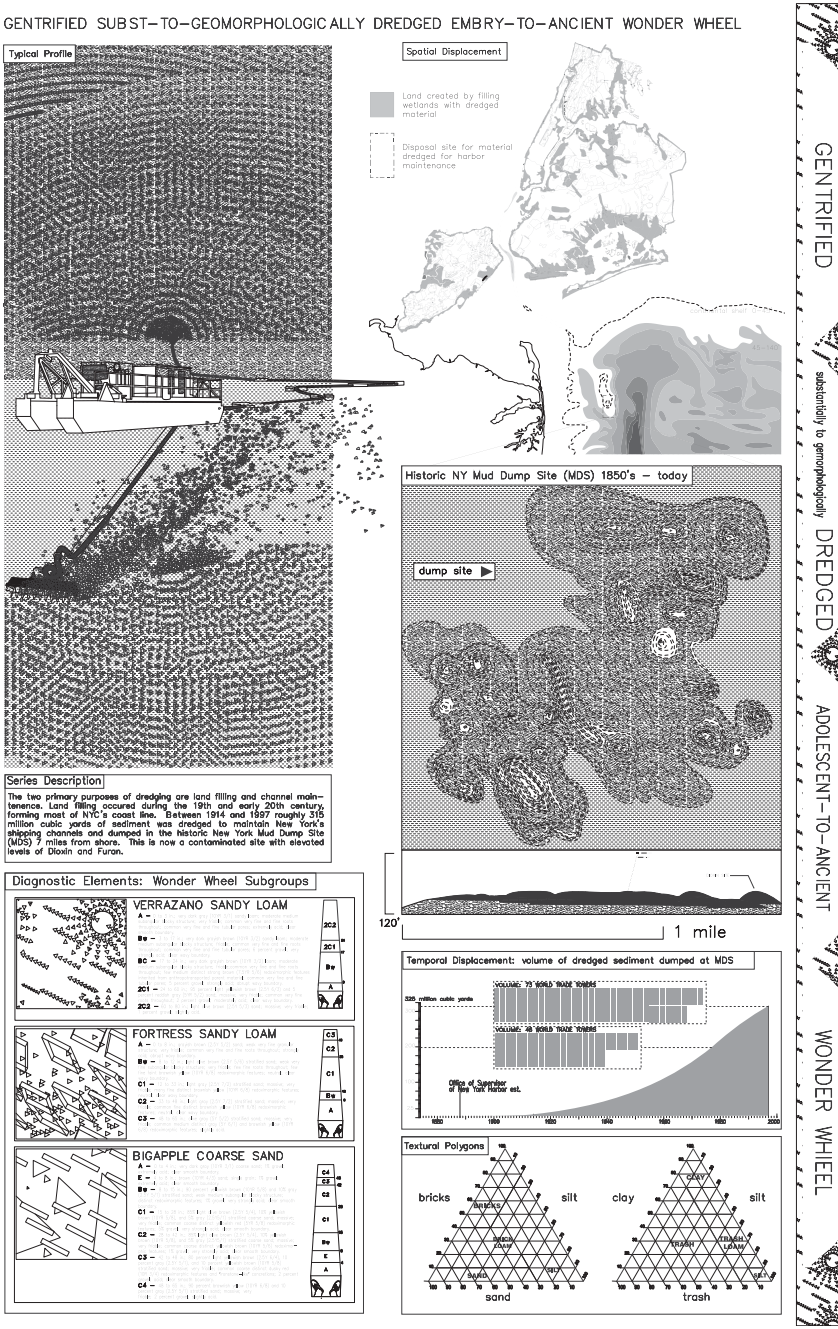


Fig. 09. Gentrified Substantially-to-Geomorphologically Dredged Embryonic-to-Ancient Wonder Wheel soils, usually consisting of dredged marine sediments either deposited on land as fill or offshore as waste. Deposition and removal like a Coney Island ride for sediments; drawing courtesy of S. Denizen.

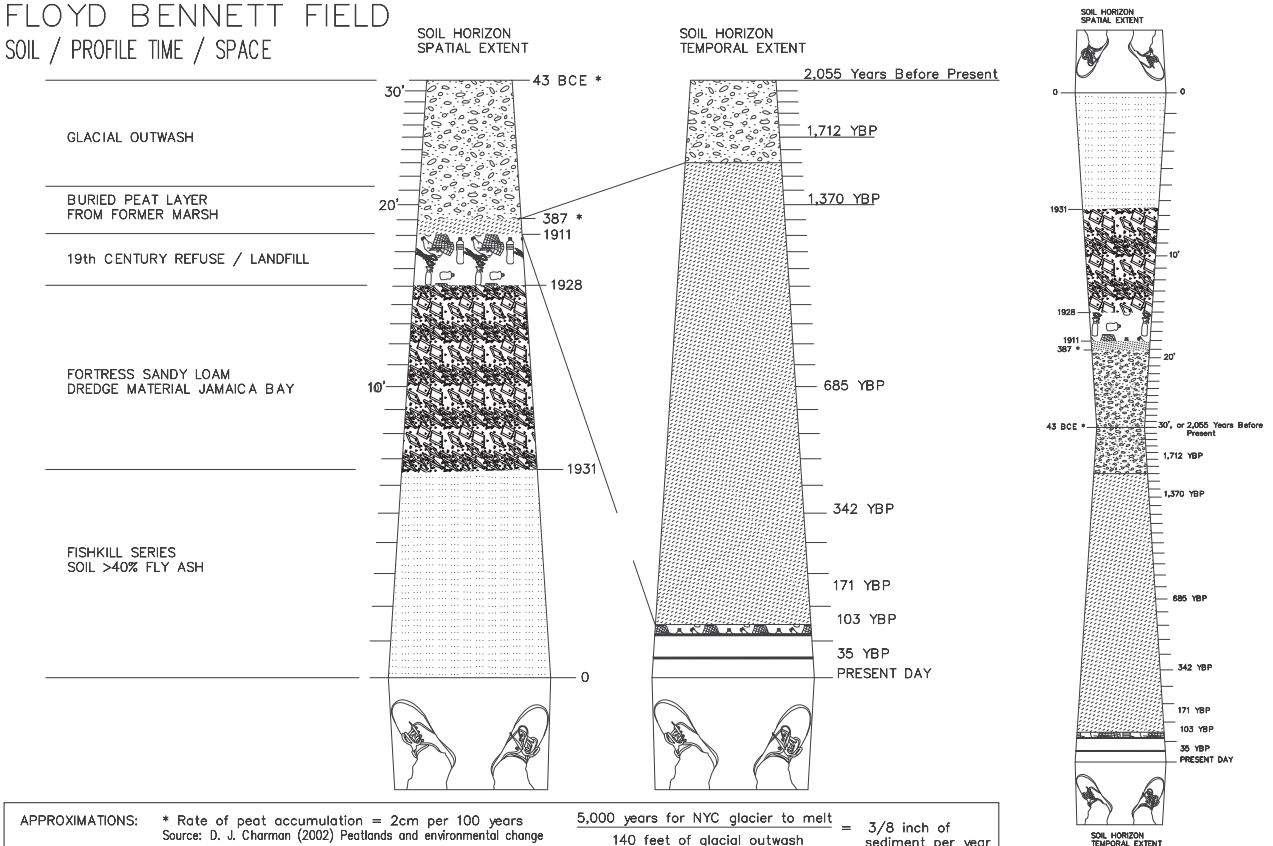


Fig. 10. Soil Profile of Floyd Bennett Field in New York City showing the spatial depth of each layer and the historical period in which it formed; drawing courtesy of S. Denizen.

S D

In part, it is a way of emphasizing the breakdown of taxonomic systems that are commonly used to describe these things. Soil formation happens within a particular space and, in the USDA taxonomy, soils are only classified down to six feet below grade. The reason for this is that six feet is the zone where the processes of weathering and soil formation create their most distinctive morphological features, their A, B, C horizons in the soil profile. So, what we start to understand is that embedded in the taxonomy of soils that we are using now is a particular spatial imagination of what soil is, and this has to do with the time that it takes for soil to form.

But, in the city, we have the interruption of these processes and the spaces they imply. So, the space of soils is dramatically more than six feet, and the time of soils has nothing to do with that space at all. These are two fundamental violations of the logic of the USDA's *Seventh Approximation*—space and time are really disconnected in the urban soil profile and this is precisely what the *Eighth Approximation* tries to begin to think about.

E T

My last question is about the specification of your work in the context of the Anthropocene. I am interested in the discourse about the "origin" of the Anthropocene because of the way this speculative conversation brings together questions of paleo-climatology, chemical signatures, oceanography, geochemistry, and all the various means by which the sciences contribute to an understanding of the Anthropocene to suggest diverse and interesting ways of reading, or of learning to read, the impact of human activity on the earth system. From the perspective of soil science research, what is your estimation of the Anthropocene?

S D

The Anthropocene arrives at the moment we understand that geology is not distinct from human production. It is the same thing that happens when we understand that we are changing the climate of the earth because we are producing a thing called carbon dioxide that has certain effects that create atmospheric conditions that we are going to have to live in. In soil science, it is very clear that we are producing our future conditions. It is at that moment that we can ask questions like, what kind of cities do we want to build? And, what kind of conditions do we want to live in? So, the moment the Anthropocene becomes relevant as a discourse is the moment at which we understand that we are creating fundamental geologic and biological conditions that we will be living with in both the very near and very distant future, and that the decisions we make have to be made in relation to these ethical and political futures of the city.

E T

So the real significance of the Anthropocene, for your work, is that before it can ever be read as a geological epoch it must first pass through its life as soil?

S D

There is absolutely nothing related to our human habitation on this planet that does not, at some point, pass through the soil because—and this is very important to understand—the soil is the filter through which all material production must pass.

1 An earlier version of this interview appeared as Seth Denizen and Etienne Turpin, "Stratophysical Approximations: On the Urban Soils of the Anthropocene," *Organs Everywhere* 4 (September 2012): 30–45.
2 For a description of the Dust Bowl of the 1930s, see en.wikipedia.org/wiki/Dust_Bowl.
3 See anthropocenesoil.wordpress.com.
4 Antonio Stoppani, "A New Force, A New Input, A New Element: Excerpts from the *Corso di Geologia*," (ed. Etienne Turpin and Valeria Federighi, trans. Valeria Federighi) in *Making the Geologic Now*, ed. Jamie Kruse and Liz Ellsworth (Brooklyn: Punctum Books, 2013), 34–40.
5 On standing reserve, see Martin Heidegger, "The Question Concerning Technology," in *The Question Concerning Technology and Other Essays,* ed. and trans. William Lovitt (New York and London: Garland Publishing, 1977), 3–35.
6 John Gerrard and Michael A. Morris, "Corn Bomb: A Short History of Nitrogen 1660–2008," *Collapse VII: Culinary Materialism* (July 2011): 85–118.
7 Ibid.
8 For a further discussion of the Haber-Bosch process, see ibid.
9 See Elizabeth Kolbert, *The Sixth Extinction: An Unnatural History* (New York: Henry Holt and Company, 2014).
10 Stoppani, "A New Force, A New Input, A New Element."

Preface to a Genealogy of the Postnatural

by Richard W. Pell & Lauren B. Allen

The Anthropocene and the Postnatural

The "Anthropocene" was first proposed as a new geological epoch defined by human-driven changes to the global atmospheric and geologic order. Since then it has been taken up within the natural sciences, social sciences, and humanities, used to describe large-scale changes to the environment and ecology through deforestation, extinction, atmospheric alterations, transformations of the landscape, and the propagation of invasive species. Presently, there is no consensus on precisely when the Anthropocene began, but some proposals include the dawn of agriculture, the first sedimentary evidence of human activity, the industrial revolution, the development of non-solar-based energy production, and the dawn of radioactive contamination. In this essay, we will walk through a brief history of the Anthropocene as illustrated by a tiny town in the western United States and introduce the concept of the "postnatural," a more specific biological interaction between humans and our environment, which we offer as a lens through which to examine the broader construct of the Anthropocene.

At first glance, Wendover, Utah may not be an obvious destination for the study of the Anthropocene, but the tiny,

remote desert town on the border between Utah and Nevada bears the marks of thousands of years of human endeavor. All around Wendover, materials are extracted from and injected into the earth in poetically equivalent proportions. Various surface-mining operations recover rocks, minerals, and salts from the ancient floor of the Great Salt Lake. A bit further down the highway, toxic and radioactive waste disposal companies operate reverse-mines, inserting unwanted materials from all over the country into the earth, while the Tooele Chemical Agent Disposal Facility incinerates the nation's chemical weapons stockpile, releasing particulate leftovers into the atmosphere.

The vast "emptiness" of the area attracts activities that benefit from remoteness. Wendover shares its southern border with the edge of the Utah Test and Training Range, part of an immense, closed military area that includes the Dugway Proving Ground, the United States' largest open-air chemical and biological weapons testing site. A few miles southwest of the military area, the remains of a crashed experimental aircraft litter the desert with tiny pieces of titanium.

Fig. 01. Dugway Proving Ground; photo courtesy of the Center for PostNatural History (CPNH), Pittsburgh.

The area also serves as a receiving site for sample return missions from outer space. In 2004, the Genesis mission collected solar particles from the sun and attempted to return them to Earth. However, the probe's parachutes failed to open, resulting in a rare geological event wherein a metal canister of solar dust was injected directly into the Earth's crust.

During World War II, the Wendover Airbase operated as a part of the Manhattan Project—the top-secret operation that developed the atomic bomb. Here, the crew of the Enola Gay bomber was trained for their flight to drop the first atomic bomb on a populated area. The active bombing range, to the south of the Wendover Airbase, is pockmarked with craters and the wreckage of non-nuclear demonstration models of the first atomic bombs. Radiation from these and subsequent atomic bomb tests at the Nevada Test Site are among the proposed geological reference points for the start of the Anthropocene.

While Wendover exhibits many of the common contemporary symptoms attributed to the Anthropocene, it is also the site of the first evidence of human intervention in biological systems in the Americas. In the debate over the specification of the "Anthropocene" currently spearheaded by scientists of the Royal Geographic Society, human-driven changes to the biology and genetics of living organisms are a less commonly discussed example of how we have altered our environment. The earliest evidence of domestication in the Americas, between 9,000 and 10,000 years ago, was found in Danger Cave, just outside Wendover: the bones of domesticated dogs were found buried alongside human remains.[1] The cave

1 Jennifer Leonard, et al., "Ancient DNA Evidence for Old World Origin of New World Dogs," *Science* 298, no. 5598 (2002): 1613–16.

Fig. 02. Danger Cave. Wendover, UT; photo courtesy of the CPNH.

contains evidence of consistent human occupation from the Paleolithic era, when it was in the desirable location near the banks of Lake Bonneville. Today, it is located hundreds of feet above the dry desert floor of the Bonneville Salt Flats. Steel bars designed to thwart attempts at rehabitation seal the cave from modern intruders.

The bones of domesticated dogs found in caves in Germany, Israel-Palestine, and Iraq dating back 12,000 to 14,000 years are referred to as some of the earliest physical

evidence of domestication, thousands of years before humans began practicing agriculture. Humans have selectively bred and domesticated a relatively tiny portion of the overall tree of life, starting with dogs and the subsequent development of agriculture, likely beginning with the selective breeding of maize. Such intentionally altered organisms have been widely propagated and now occupy essential roles in supporting and sustaining human culture all over the planet. They feed us, help do our work, comfort us, and are sacrificed for our benefit.

Generations of selective breeding, and more recently genetic engineering, have dramatically altered the morphology and behavior of these life forms. These purposeful changes to the living world are a contribution to the evidence for the Anthropocene epoch, paralleling the geological changes to the earth resulting from human activity that are more commonly referred to as signs of the Anthropocene.

When we speak of the "postnatural," we refer to anthropogenic interventions into evolution that are both *intentional* and *heritable*, regardless of their subsequent unintentional consequences. The postnatural therefore is not an epoch of Earth's geohistory, but a conceptually inclined adjective used to describe the purposeful and permanent modification of living species by humans through domestication, genetic engineering, and synthetic biology. The stages of this process will be outlined in detail in the following sections. The term arises in response to the conception of nature that is commonly presented by natural history museums. In contrast to this traditional image of nature, we will use specimens and documents from our collection at the Center for PostNatural History to elucidate what postnatural life is in the Anthropocene.

Stage One: Habitat Control

Postnatural changes begin when humans take responsibility for the habitat of another species. By cohabitating or building a fence to protect it from predators, humans modify the "natural" selection pressures on the organism, hence the term "artificial selection." This allows for physical traits and behaviors to emerge that would quickly be selected out in the wild. For example, animals bred in captivity are far more likely to express the stark white fur of albinism than their "natural" or wild counterparts.

In the early nineteenth century, rats were bred in captivity for a blood sport known as rat-baiting. The amusement was created during a time when large cities such as London and New York were becoming infested with rats to an unprecedented degree. In dark taverns, men would gather around a large wooden pen and bet on how long it would take for a dog to kill one hundred rats. Developed as an entrepreneurial rat abatement strategy, the sport proved so popular that it inadvertently created a cottage industry in rat breeding. Occasionally, an albino rat would be born and set aside as an oddity. In the wild, stark white fur against a dark ground makes an easy meal for a predator, but in the postnatural habitat of a rat breeder's care, the sheer novelty of an albino specimen could help save it from the dogs.

It wasn't long before the outwardly clean white rats had shed their cultural association with filth and the plague, and transformed into pets in the homes of Victorian women who rebranded them as "fancy rats." The popular nineteenth-century activity of "rat fanciers" fetishized the aesthetics of novel coat colors and patterns that emerged from the "mixing" of

black, brown, and albino rats. Later on, in 1900, the rediscovery of Mendelian genetics revolutionized the speed at which an organism could be changed through selective breeding.

Fig. 03. Albino rat from the collection of the Center for PostNatural History; courtesy of the CPNH.

Stage Two: Reproductive Control

Breeding dramatically accelerates postnatural change. By breeding plants and animals in captivity, humans play a curatorial role in the reproductive life of another species. Whether breeding cattle, decorative flowers, vegetables, or pets, humans can increase the potential for traits to stabilize in a population

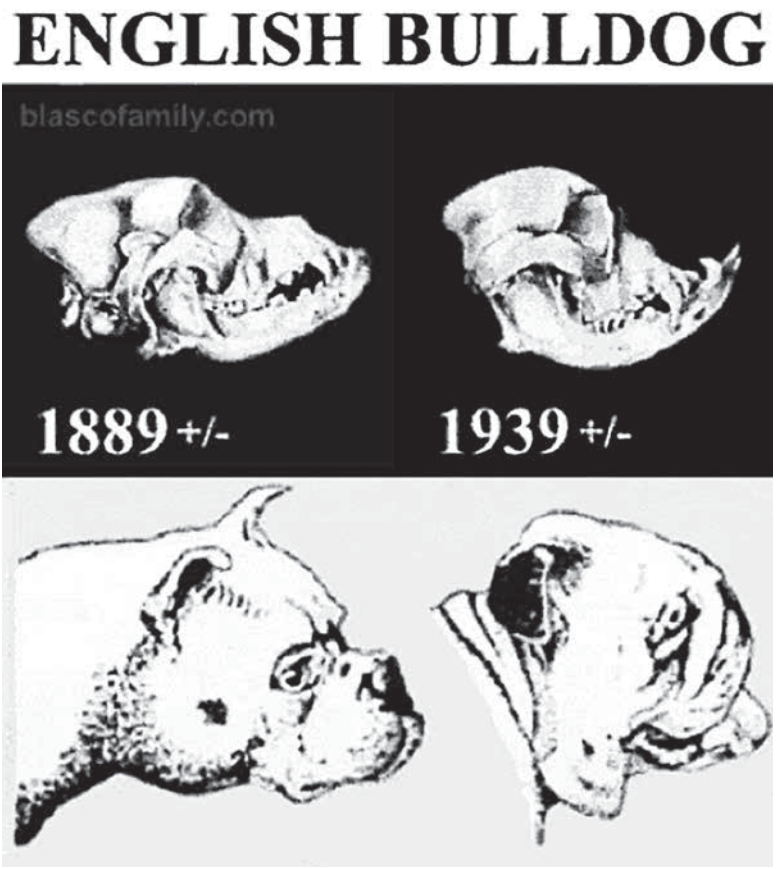


Fig. 04. Comparison of Bulldog standards across fifty years. Illustration from Blasco Family Bulldogs.

and thus accelerate the rate of change. Purebred dogs are an especially visible example of this phenomenon, possessing traits that were once subtle signifiers of a cherished breed one 100 years ago but that rapidly became cartoonish exaggerations of themselves. Eugenic concepts of racial purity still

persist among some dog breeders, who will cull or sterilize any dogs that do not exhibit all of the textbook traits that have been assigned to the "pure breed." In some cases, highly awarded inbred traits put the basic health of the animal at risk. For example, the skulls of English Bulldogs have grown to such an extent over the last hundred years that most females can only give birth through caesarian section.

Another example is the Cavalier King Charles spaniel, a popular pure breed in the UK, which is highly inbred and suffers a high instance of the disease *syringomyelia*—wherein the dog's brain is too large for its skull. Researchers traced the majority of Cavalier King Charles spaniels with this affliction to a single bitch born in 1956, and the two offspring from her single litter.[2]

Among laboratory organisms, the process of breeding has become an extraordinarily quantified and systematized practice. The most common breed of laboratory mouse in the world is the "C57 black 6," sold by Jackson Laboratories out of Bar Harbor, Maine. This mouse is used in genetics studies all over the world, including The European Conditional Mouse Mutagenesis Program, where for every gene in the mouse genome a variety of mouse is created that is missing that gene.[3] C57BL6 mice, as they are known, are all very closely related because they have been carefully inbred to be as genetically similar to one another as possible.

2 C. Rusbridge and S. P. Knowler, "Hereditary Aspects of Occipital Bone Hypoplasia and Syringomyelia (Chiari Type I Malformation) in Cavalier King Charles Spaniels," *The Veterinary Record* 153, no. 4 (2003): 107–12.

3 Roland H. Friedel et al., "EUCOMM—the European Conditional Mouse Mutagenesis Program," *Briefings in Functional Genomics & Proteomics* 6, no. 3 (2007): 180–85.

Fig. 05. C57BL6 mouse from the collection of the Center for PostNatural History; photo courtesy of the CPNH.

If we take any two members of the C57BL6 family from anywhere in the world and trace their ancestry back through their parents, grandparents, and great-grandparents, their two family trees will eventually converge. Specifically, they will converge on a black female mouse that was for sale in Miss Abbie Lathrop's pet shop in Granby, MA, in 1921.[4] This mouse was known as number 57; it was purchased by Jackson Laboratories' founder, Dr. C.C. Little, who contributed the "C" to its name. These mice have been subsequently bred and engineered to possess and embody human afflictions including cancer, baldness, obesity, depression, anxiety, Parkinson's disease, and more.

4 David P. Steensma, Robert A. Kyle, and Marc A. Shampo, "Abbie Lathrop, the 'Mouse Woman of Granby': Rodent Fancier and Accidental Genetics Pioneer," *Mayo Clinic Proceedings* 85, no. 11 (2010): 83.

The reason Little chose to purchase a mouse from a pet store, rather than catching one in the wild, is that the mice in Lathrop's shop were already quite distinct from their feral counterparts. The hobbyist breeders of "fancy mice" had already been selecting for traits that they found beautiful or interesting for generations; because of this, the mice exhibited obvious signs of human intervention such as unusual coat colors and patterns. Some of the breeds even exhibited strange behaviors, like shaking or "waltzing." These are traits that would easily get a mouse killed in the wild, but to Little these tendencies were evidence of underlying genetics. He sought to isolate these traits by breeding the mice to be virtually identical, allowing researchers all over the world to compare results using specimens that were as genetically standardized as possible. Little recognized that in order for biology to be compatible with the reproducibility required by the scientific method, the subject of study needed to be standardized. The mice and all subsequent model organisms thus needed to have predictable, repeatable, and interchangeable parts.

Standardization presents its own challenges. Genetically identical populations of crops or animals are monocultures, making each specimen equally susceptible to disease, even across a large population. Such loss of genetic diversity was a contributing factor to the catastrophic Irish potato famine: the initial founding population of potatoes brought to Ireland from Peru lacked the genetic diversity necessary to fight off disease. In fact, Michael Pollan argues that the monocultures created by industrialized agriculture have set the stage for potentially similar outcomes in the future.[5]

5 Michael Pollan, *The Botany of Desire: A Plant's-Eye View of the World* (New York: Random House, 2001).

Stage 3: Genetic Engineering

With the advent of genetic engineering in the late twentieth century, the rate of postnatural change underwent a dramatic increase. No longer limited to emergent mutations or constrained by the rules of breeding, scientists were able to directly manipulate organisms' DNA. One of the first techniques developed was the ability to turn an individual gene "on" or "off." Still a common practice, "knocking out" a gene is useful in beginning to understand what the function of an individual gene is. While the vast majority of single-gene changes do not manifest in a visibly altered organism, genes that influence

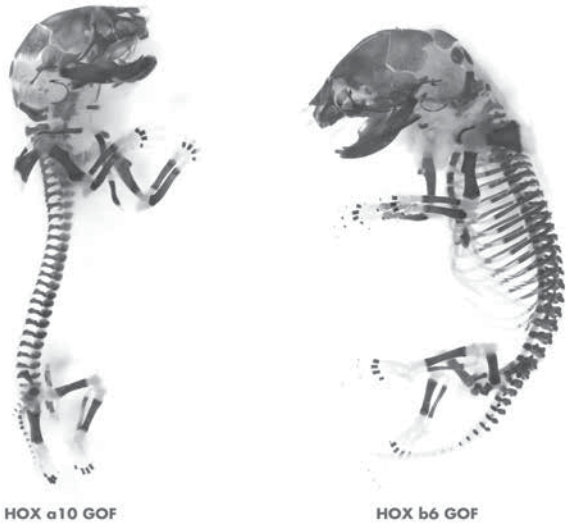


Fig. 06. On the left, a mouse embryo with the gene for rib creation knocked-out. On the right, a mouse embryo with the gene for rib creation over-expressed. These specimens have been "cleared and stained" in order to see through their skin and organs to the bones and cartilage, which have been stained. From the collection of the Center for PostNatural History; image courtesy of the CPNH.

Fig. 07. The Front Gallery of the Center for PostNatural History, featuring Freckles, one of the original Biosteel Goats; photo courtesy of the CPNH.

pattern formation in early body development can have a dramatic effect on the appearance of an organism. For example, in the lab of Dr. Moisés Mallo in Portugal, developmental pattern formation genes, known as HOX genes, were altered in embryonic mice, with wildly diverging results.

Genetic engineering also allows for the exchange of genes between disparate species, as well as the incorporation of entirely synthetic genes into an organism's genome. In the lab of Dr. Randy Lewis, a genetics researcher at Utah State University, dairy goats have been repurposed as living "biofactories" in pursuit of the large-scale production of spider silk. These so-called "Biosteel goats" have been given the genes that allow orb spiders to produce their incredibly strong silk fibers.

The silk is generated in the mammary glands of the female goats so that it can be extracted from their milk, the silk from which is filtered and extruded through a syringe before being spooled onto cylinders. The silk may then be woven into fabric for use as replacement tendons or bulletproof materials. While the goats were originally developed as a profit-making endeavor, the yields have thus far been inadequate for commercial production. Lewis has since expanded his research into spider silk by genetically modifying bacteria, alfalfa, and silk worms to produce the famously strong fibers.

Fig. 08. An American Chestnut Tree growing in the middle of the street in Cambridge, MA. From the collection of the Center for PostNatural History; photo origin unknown.

Stage Four: Release and Re-Wild

Most genetically modified organisms are confined to restricted containment facilities. To date, those that have intentionally been let out of the lab include industrialized crops and trees, fluorescent ornamental pet fish, disease-resistant plants, and experimental insects modified to mitigate human disease and crop predation. The trend is for many more genetically modified organisms to be raised in less captive environments. One of the first plants in line for this distinction is the Transgenic American Chestnut Tree.

Prior to the early twentieth century, in the Appalachian region of North America one in four trees was an American Chestnut. These iconic trees grew to mythic dimensions and provided useful nuts and wood. However, a shipment of wood cut from Asian Chestnut Trees in Japan arrived in the US around the turn of the century, carrying with it a fungus that American trees were not adapted to. It wasn't long before the fungal blight had killed off nearly every adult Chestnut Tree in America.

The American Chestnut Research and Restoration Project uses the techniques of genetic engineering in an attempt to produce saplings that are resistant to the fungal blight. In their lab at the SUNY Environmental Science and Forestry program in Syracuse, NY, Dr. Charles Maynard and Dr. William Powell are raising Chestnut Trees from cell cultures and attempting to pass them the genes they hope will allow them to resist the fungus. The slow life cycle of trees complicates genetic engineering methods that often rely on multiple attempts over many generations. Fearing that their research could be derailed by a negative public reaction attributed to the so-called "yuck

Fig. 09. American Chestnut Tree forest following the blight; photo courtesy of the Great Smoky Mountains National Park Library.

factor," the scientists were especially careful in choosing genes from more closely related plants rather than more distantly related animals. In the West, the mixing of "unlike" species has strong cultural associations, particularly with monsters and demons, and persists to this day in the popular rhetoric surrounding genetically modified organisms.

At the time of this publication, the habitat of the Transgenic American Chestnut Tree includes a number of marked and unmarked groves in strategic locations around New York State, including the New York Botanical Garden in the Bronx. The locations are often obscured to protect the costly research from sabotage and other dangers. The research is funded by an unusual consortium of ecological and commercial interests, including ArborGen, a company that uses breeding and transgenic technologies to produce trees primarily for the wood and paper industry.

Fig. 10. Transgenic American Chestnut Trees are propagated by cloning tissue culture in the laboratory, and marked with a yellow smiley-face sticker so as not to be confused with non-transgenic tree cultures; photo courtesy of the CPNH.

Permitted Habitats

Beyond the organisms themselves, the habitats that humans create for them also carry postnatural significance. What does a postnatural habitat look like? Traditionally, the habitat of an organism is defined by natural phenomena such as climate and ecology. In the case of postnatural organisms, habitats are defined by cultural circumstances. Whether defined by a fence line, cage, leash, home, isolated test site, concentrated animal feeding operation, or a negative air pressure laboratory, postnatural habitats are human cultural constructions. In particular, genetically modified organisms are tightly controlled by policy, regulations, and various international agreements. They are allowed to exist in certain countries and states and not in others.

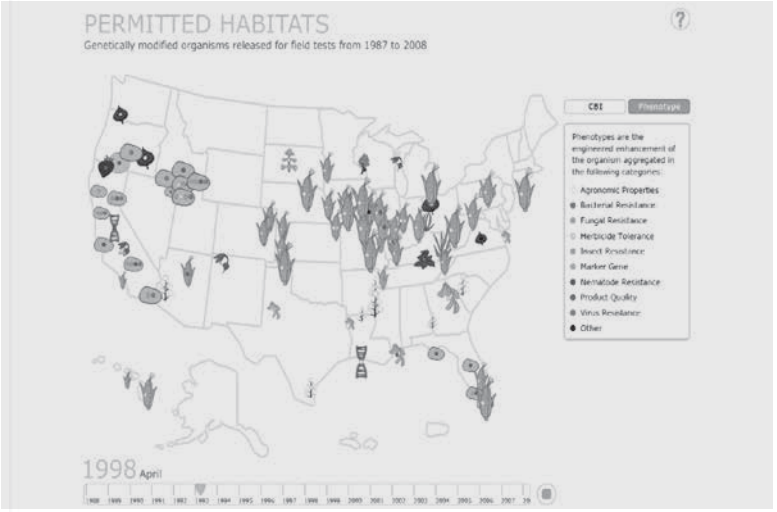


Fig. 11. One frame from the geographic visualization of permitted habitats between 1987–2006, created by Paolo Pedercini for the Center for PostNatural History. View the visualization at www.postnatural.org/permitted_habitats.html.

They are permitted to exist in certain kinds of containment facilities and not in others. In the United States, they require Federal permits in order to be transported across state lines.

When viewed from a postnatural perspective, a document like the US Animal and Plant Health Inspections Services (APHIS) database of Transgenic Release Permits becomes a unique catalog of migrations and habitats of genetically modified organisms that would otherwise be difficult to discern.[6] We call these documented areas "Permitted Habitats." A visualization of release permit data mapped geographically and over time shows the areas of the US most active in providing habitats for genetically modified fruits, vegetables, and grains. While

6 The database is available at www.isb.vt.edu/data.aspx.

classic American "corn belt" regions like Iowa and Missouri explode with activity, there are also some surprises. Puerto Rico and Hawai'i are, respectively, major sources of applications for genetically modified soybeans and corn. These islands are home to habitats for the production of upstream experimental "parent seed" varieties for a host of biotech companies attracted by the year-round growing season and relative isolation from cross-fertilizable crops and human intervention.

Many of the specific details—such as the origin of the transgenes with which crops have been enhanced—are closely guarded secrets obscured with the label "Confidential Business Information" in the APHIS database. Similarly, the test fields where they are permitted to be released are highly contained. Genetically engineered crops' habitats are defined by protective fencing and a lifeless buffer region surrounding the perimeter. The plants themselves are not permitted to leave the sites; similarly, unsanctioned humans are not permitted to enter.

Fig. 12. Monsanto test site in Kihei, HI; photo courtesy of the CPNH.

Some postnatural habitats are best understood when viewed from above. The Institute for Radiation Breeding Gamma Field in Ibaraki, Japan appears as a circular farm arranged in concentric rings around a central tower. The tower contains a retractable lead cylinder in order to expose an element of radioactive cobalt-60 to the surrounding vegetation, which increases the natural mutation rate in the plants, causing random changes in their DNA. Researchers periodically inspect the crops in search of new, desirable traits, such as adaptability to harsh soil conditions and novel colors or shapes.

Gamma fields have been built in many countries since the 1950s, when they were considered an important step toward developing popularly acceptable and peaceful uses of radioactivity. They have since been well received in developing nations, with facilities constructed in Bangladesh, Brazil, China, Costa Rica, Egypt, Ghana, India, Indonesia, Japan, Kenya, Nigeria, Pakistan, Peru, Sri Lanka, Sudan, Thailand, and Vietnam.[7] Gamma farms have been the origination point for a number of now common foods, such as the popular Rio Red grapefruit, Calrose 76 rice, and disease-resistant cocoa, among others.[8]

If Wendover, Utah provided a starting point for a geneaology of the postnatural, it might also hint at what the endpoint will look like. South of Wendover lies the Dugway Proving Ground, the nation's largest chemical and biological weapons testing facility. During the 1950s and 1960s, Dugway was home to elaborate military exercises involving the exposure of live pathogens to human and nonhuman test subjects.

7 William J. Broad, "Useful Mutants, Bred with Radiation," *The New York Times*, 28 August 2007.

8 B. S. Ahloowalia, M. Maluszynski, and K. Nichterlein, "Global Impact of Mutation-Derived Varieties," *Euphytica* 135, no. 2 (2004): 187–204.

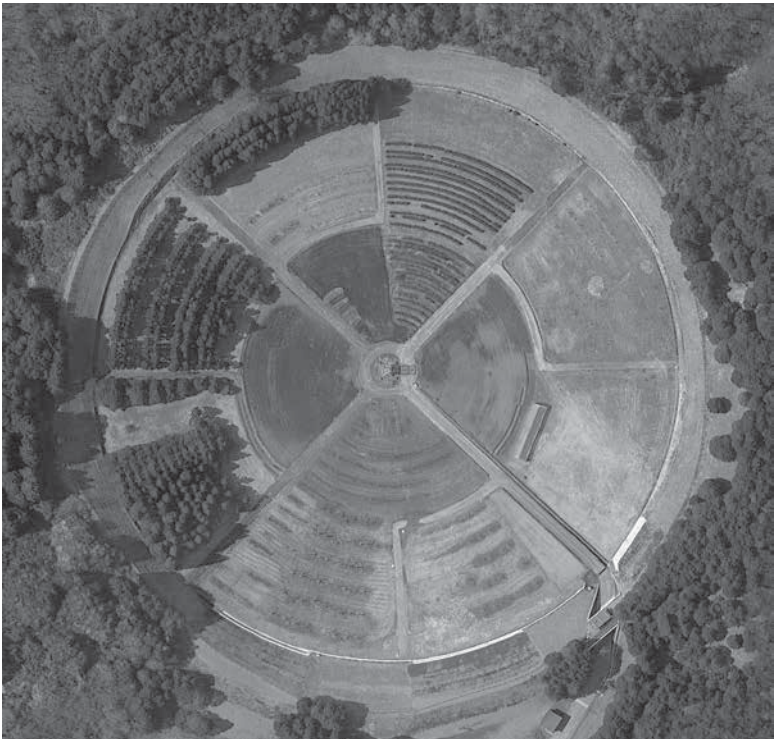


Fig. 13. Gamma Field in Ibaraki, Japan; photo courtesy of Google Earth.

The tests, conducted mainly at night, involved large towers and aircraft spraying clouds of tularemia, Q-fever, and anthrax over gridded test patterns carved into the desert floor. These bacteria were the product of decades of laboratory study and selective breeding for particular traits, such as their ability to be airborne or survive under particular conditions. Depending on the nature of the test, the grids were populated by mice, rats, guinea pigs, sheep, rhesus monkeys, and on several occasions, human beings.

During Project Whitecoat, human volunteers from the Church of Seventh Day Adventists in Frederick, Maryland were flown directly to Dugway, where they were driven at night by bus to the desert test site. Each subject was told to sit in a chair, arranged at regular intervals, separated by great distances. The subjects were instructed to "breathe normally" when they heard the sound of the sprayers in the distance. Following the test, the subjects were picked up, once again by bus, though this time the driver wore a containment suit to protect him from the now potentially pathogenic volunteers. The subjects were then flown back to Frederick, where they were quarantined at Fort Detrick and monitored for sickness. If successful, the subjects would become ill for a period of days and then recover. The disease they were exposed to, Q-fever, was intended to be a biological weapon that could sicken and disable a population for a period of time, without causing mass casualties. Under normal conditions, the illness has a death rate of one in thirty.[9]

Since the chemical and biological weapons ban in the early 1970s, Dugway has redirected its mission away from weapons development toward protective gear testing. Today the site houses some of the nation's largest facilities for growing and spraying pathogenic bacteria and viruses, and maintains an on-site repository of many deadly germs. Throughout its history, Dugway has served as a playpen of contained catastrophes, where worst-case scenarios are continuously enacted and reenacted. It is in a state of constant preparation for, and against, anthropogenic apocalypse. It is the ultimate postnatural habitat, in which fear becomes the primary

9 Ed Regis, *The Biology of Doom: America's Secret Germ Warfare Project* (New York: Macmillan, 2000).

driver of selection. Whether or not the beginning of the end of postnatural history is likely to be found here, the site is an exemplary homage to the imaginative capacity for closure.

Changes in Humans

It is worth recalling that postnatural change is not unidirectional. We do not simply sculpt the world to our liking and stop there. Our environment, in turn, is constantly sculpting us; the changes we make to organisms have consequences for how humans conduct themselves. In nearly every case, the changes humans have made to an organism push back against us and inspire further changes to the constitution of the human. If we revisit the early moments of postnatural history, the human domestication of dogs very likely occurred in parallel with the discovery of pack hunting, a practice that wolves had mastered long before modern humans came on the scene. It is thus not outlandish to ask: to what extent have humans been domesticated by dogs?

Similarly, the development of agriculture allowed humans to live at higher densities than ever before. Then we began to stockpile food. Seed was shared and traded, and in doing so, the plants we thought we had placed under our control had quietly tricked us into carrying them around the world. As our newly stationary communities grew, so did our need to defend these resources. Cats found employment by catching the rodents who ransacked our seedstocks, an opportunistic partnership that continues to this day. And, later on, the rodents seduced us into propagating them in expensive laboratories, where we in turn visit upon them every imaginable form of genetic suffering.

Every living thing that we have heritably altered has also altered us. Because of our obsession with unusual dog breeds, we have created a habitat so specialized that some of these breeds can now only exist with our help. The various regimes of selective breeding, mail-order semen, and artificial insemination used in specialized breeds of dogs, pigs, and cattle have assigned humans a job so essential that if we were to quit, the result would be their inevitable extinction. And the list of animal breeds that can no longer reproduce without human intervention is only growing: corn, English Bulldogs, and Belgian Blue Cattle are just a few of the organisms that require human help, either as cross-species sexual facilitators or midwives.

The Postnatural Footprint

While we began by making the case that there is a biological and genetic component to the Anthropocene, we would like to close with a discussion of the postnatural influence upon the properly geological strata of the Anthropocene. The imprint on the landscape resulting from domestication and the industrial alteration of food crops can easily be seen from a satellite orbiting Earth. Across the continental plains and into the barren deserts one can see a repeated pattern of green circles laid upon a grid. The hallmark of automated irrigation systems, they are also the product of crops that have been selectively bred and engineered to exist at high densities and thrive in poor soil conditions. They are monocultures, symptomatic of the economic pipelines that produce them, determined by the mechanization that defines their habitat.

They must be the same size and must all reach maturity at the same moment; indeed, uniformity is an essential quality of industrialized agriculture.

If we were to point our satellite toward the mouth of the Mississippi River, a river which drains half of the continent of North America, we could see a visible signature of industrial agriculture: the huge algal blooms that periodically occur due to the intensity of fertilizer runoff from American farmland. In order to grow the yields that we now require, human-cultivated plants need their soil to be regularly treated with synthetically produced ammonia, which "fixes" single nitrogen atoms in order to produce nitrogen compounds that can be utilized as fertilizer.[10] Prior to the discovery of the Haber-Bosch process for synthesizing ammonia over one hundred years ago, there were natural limits to how much food could be produced by an acre of land and, as a consequence, how many people could be fed by it. Since the introduction of synthetic fertilizer, the world's population has grown four-fold; we now live atop an agricultural system entirely dependent on fossil fuels, which make their own geological impacts and contributions to the Anthropocene.

The crops produced using fossil fuels and industrial farming techniques are, in turn, fed to cattle in concentrated animal feeding operations (CAFOs). These operations allow the animals to be raised at higher densities and grow to greater sizes than could have been imagined even several decades ago, similar to their agricultural feedstocks. Uniformity also still rules the day, as the animals must fit the dimensions of the processing equipment used to make their

10 See John Gerrard and Michael A. Morris, "Corn Bomb: A Short History of Nitrogen 1660–2008," *Collapse VII: Culinary Materialism* (July 2011): 85-118.

way from slaughterhouse to human feeding establishments. From our satellite-enhanced anthropogenic vantage point, these CAFOs are engines producing a fountain of inexpensive meat, methane, sewage, and occasionally, disease.[11] They are a part of a feedback loop that both responds to and creates new desires.

Postnatural changes are a product of a complicated renegotiation between human desire, the autonomous vitality of living organisms, and simple contingency. It is impossible to predict with any degree of specificity what the consequence of any single action will be. It is also impossible to separate the changes we make to the biology of an organism from the resulting changes to its larger ecology. They continually create one another, with human desire as the fuel in the engine, or the nitrogen in the soil.

To conclude, we revisit the basic difference between what we refer to as postnatural and what is generally described as the Anthropocene. Although both concepts are connected to human-driven influence over the Earth's ecosystems, it would be tempting to divide them according to geological and biological registers. However, the postnatural is a specific construct that remains irreducible to the biological dimension of the Anthropocene.

As we explained above, our definition of the postnatural hinges on biological changes that are both heritable and intentional. Heritability means that the changes are, evolutionarily speaking, "in play." In this sense, they may also be out of our control. They may push back and consequently alter us, perhaps on an evolutionary level. Mutation and natural

11 Stephanie Strom, "Virus Plagues the Pork Industry, and Environmentalists," *The New York Times*, 14 July 2014.

selection will continue regardless of human input. For a feral genetically engineered organism, yesterday's genetic containment strategy becomes tomorrow's adaptive advantage.

By focusing our attention on changes that are also intended, we have selected a specific area of research distinct from the broader debate related to the Anthropocene. By using this more precise lens, we get an inkling of what it is that humans want from the life that surrounds them. Desire is made flesh, even if the signature of human intentionality at this scale evades identification within the geological strata to come. Human intentionality is fuzzy, accompanied as it is by all the conflicts and internal contradictions that emerge from the interpretation of cultural work. This situates the postnatural outside the realm of pure science and, more remarkably, in the zone of human culture.

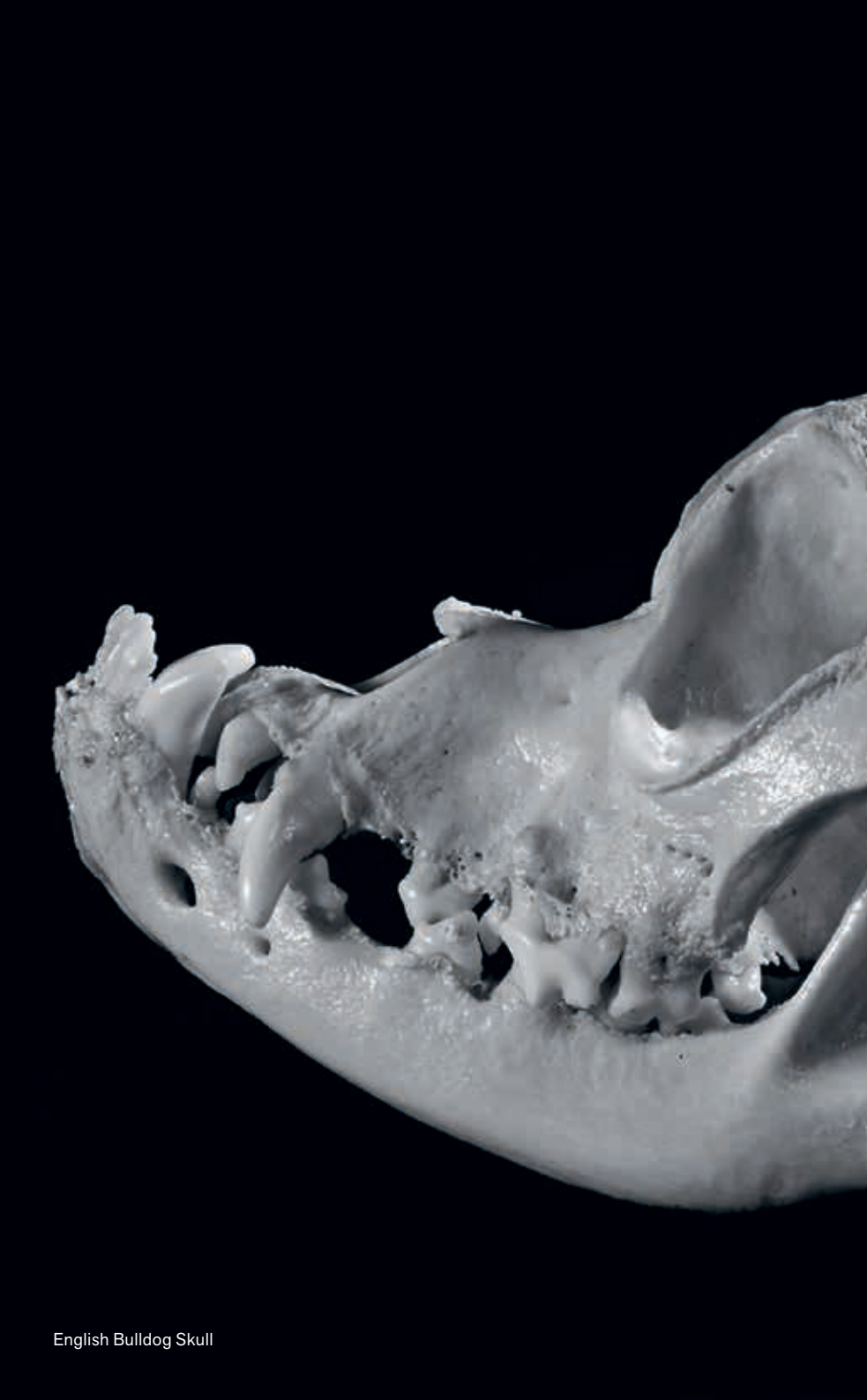
If we were to propose a place in the library to locate the postnatural, it would not be alongside ecology, biology, or even the Anthropocene; instead it would exist in a wormhole that paradoxically disappears and reappears alongside books on textiles, architecture, engineering, military history, agriculture, design, religion, sports, music, art, and erotica. It is one of the oldest forms of cultural production, present in our stone-age cave dwellings, our rented apartments, our organic vegetable gardens, and our industrial plantations. We cannot avoid it any more than we can avoid ourselves.

Stereoscopic Photographs of Domesticated Dog Skulls

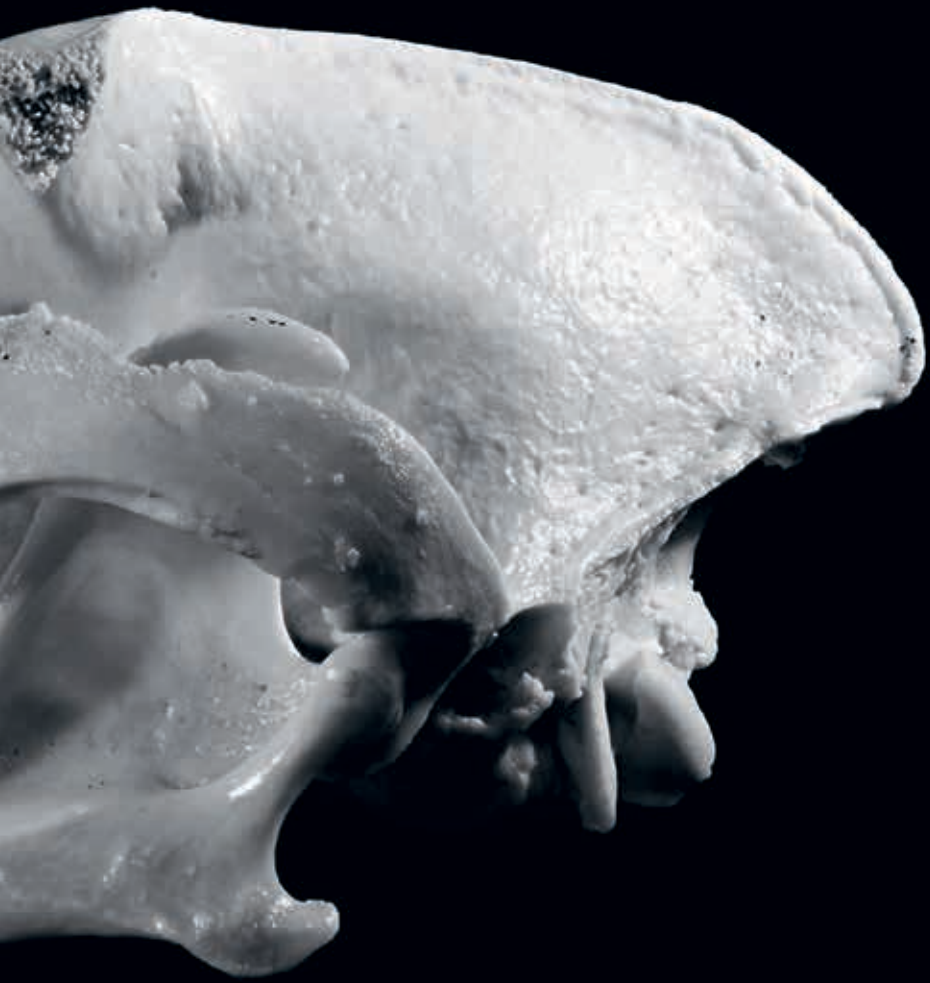
Images from the Center for PostNatural History, Pittsburgh

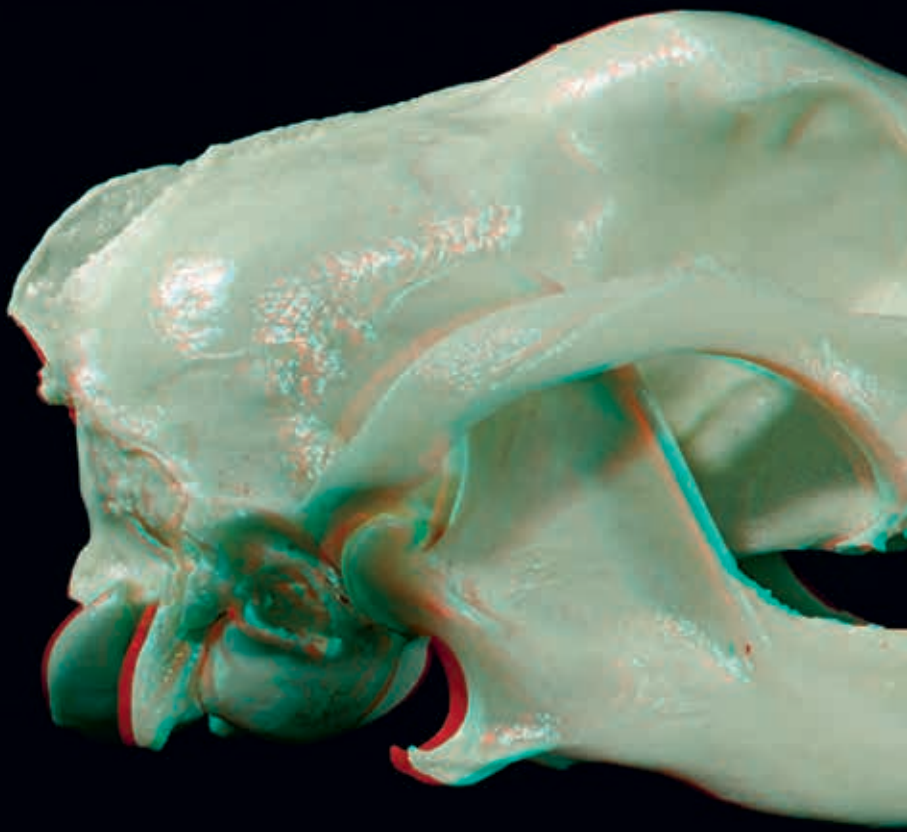
Just as the mark of the Anthropocene is etched into the landscape in the form of deforestation, mineral deposits from mining operations, and trace amounts of radiation from atomic testing, so is it etched into the morphology of living organisms that have been shaped through the interventions of human breeders. Nowhere is this more clear than in domesticated dogs. Dogs are the first species known to have been domesticated. The difference between the largest and smallest breeds of dog is the largest of any species in the animal kingdom. The sometimes bizarre changes to the shape of the skulls is best seen with the aid of the third dimension. Behold, this is the biological architecture of the Anthropocene.

All photos courtesy of the CPNH.

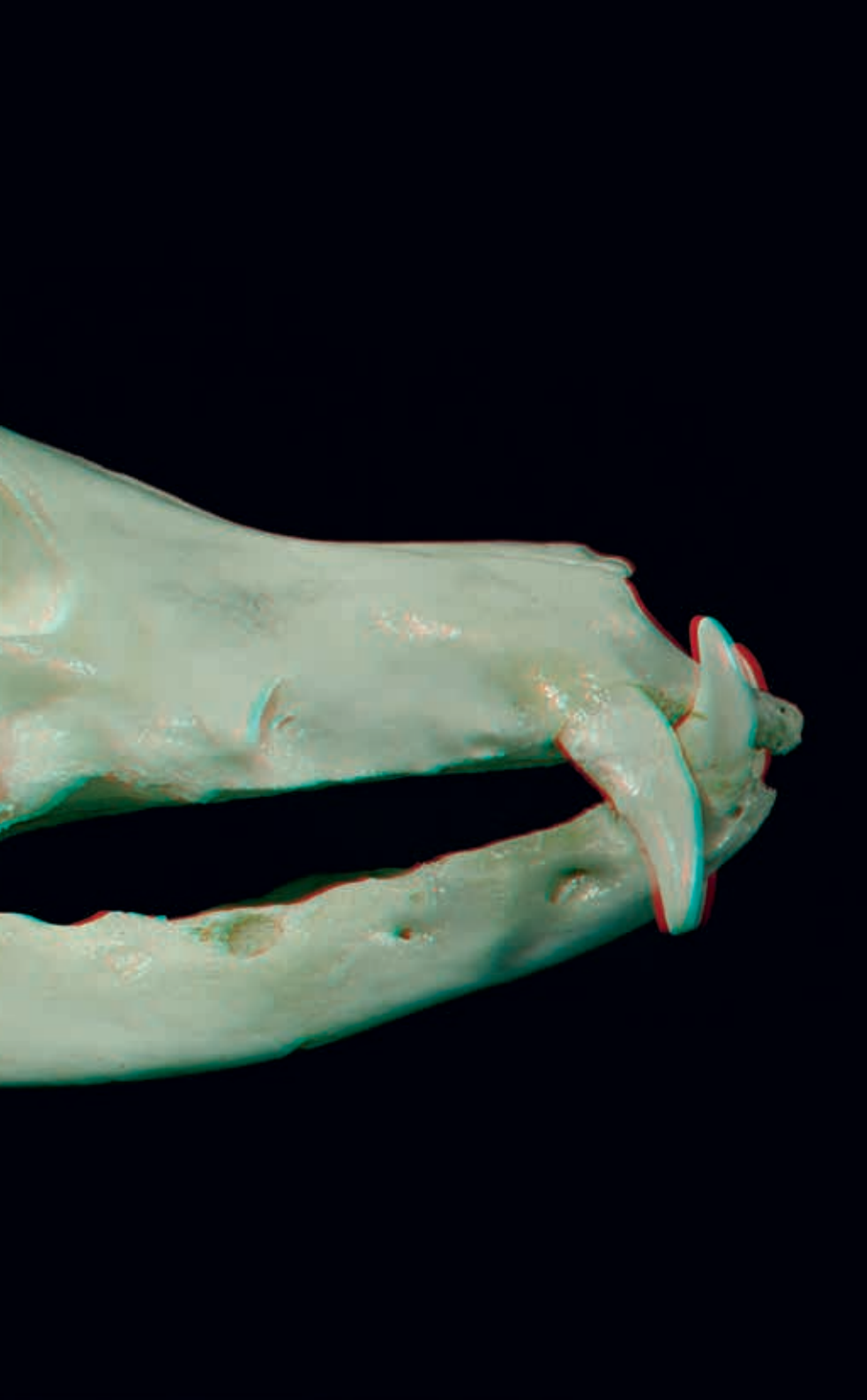


English Bulldog Skull

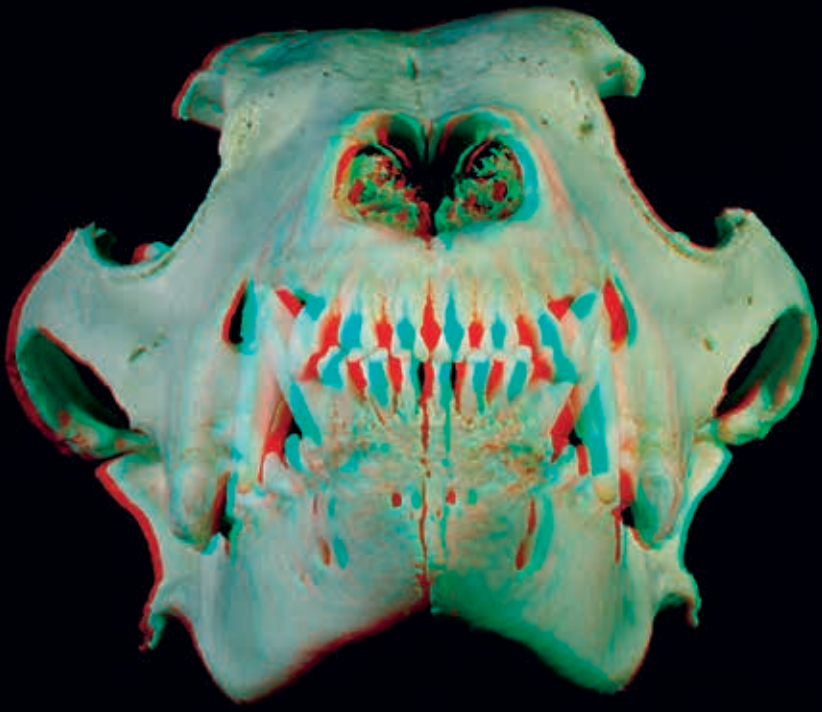




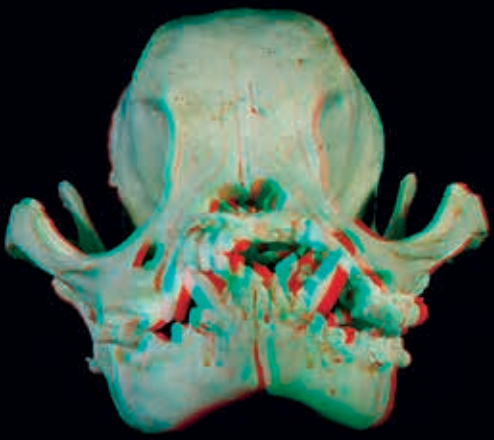
Aged Borzoi Skull



Bulldog Skull



Great Dane and Pug Skulls



→ Continuing from page 29

Part 2: Unbecoming, Animal

by Mitchell Akiyama

> What were the secrets of the animal's likeness with, and unlikeness from man? The secrets whose existence man recognised as soon as he intercepted an animal's look.
>
> In one sense the whole of anthropology, concerned with the passage from nature to culture, is an answer to that question. But there is also a general answer. All the secrets were about animals as an intercession between man and his origin. ... Animals interceded between man and their origin because they were both like and unlike man.
>
> — John Berger, *About Looking*, 1980

Sound recording, like all storage media, is both murderous and benign. Wax cylinders, aluminum discs, magnetic tape, solid-state flash cards; all bring about the death of a sound, entombing it without physically injuring the subject. Perhaps this is why the philologist E. P. Evans described Richard Garner's recording apparatus as a "scientific weapon of phonetic precision."[1] If describing the gramophone as a weapon seems overstated, it was neither the first nor the only time that a storage medium would be compared to a technology of war. The very language associated with the recording of animals—"capturing" animal calls with "shotgun microphones" while on sound "safaris"—suggests a latent predatory impulse waiting to be activated each time the recordist hits the red button.

1 Quoted in Radick, "Primate Language and the Playback Experiment, in 1890 and 1980," *Journal of the History of Biology* 38, no. 3 (2005): 462.

Media are never innocent; they are accessories to all sorts of violence. Recording technologies allow their users to size up the quarry and to develop plans of attack. Or, they capture and hold the subject to scrutiny without its consent.

In 1882, the French polymath, scientist, and photography pioneer Étienne-Jules Marey announced the invention of his chronophotographic gun. The camera, capable of firing off twelve photographic frames per second, was inspired by the murderously precise, mechanical repetition of the Gatling gun.[2] According to Friedrich Kittler, "The history of the movie camera … coincides with the history of automatic weapons."[3] Shooting with the gun was more than just a metaphor; Marey's device borrowed both the form and the operational logic of the machine gun. The shape of the camera was hardly incidental, nor was it a unique solution dreamed up in isolation; the chronophotographic gun crystallized thirty years of discourse about the ability of storage media to stand in for actual weapons, particularly when it came to either capturing the likeness, or the corpse, of an animal. Marey's images, many of birds and other animals, differed from the imminent cinematographic seriality in that each successive image was captured on the same plate. Iterations of an animal in motion would pile up on the pictorial surface: a menagerie of one. Contained and comparable to itself, a given subject could be removed from the field in likeness in a sort of bloodless taxidermy.

2 Paul Virilio, *War and Cinema: The Logistics of Perception*, trans. Patrick Camiller (London: Verso, 1989), 15.

3 Friedrich Kittler, *Film, Gramophone, Typewriter*, trans. Geoffrey Winthrop-Young and Michael Wutz (Stanford: Stanford University Press, 1999), 124. Donna Haraway's work on turn-of-the-century naturalist Carl Akeley reveals a similar connection between media and warfare. Akeley developed an eponymous camera for shooting

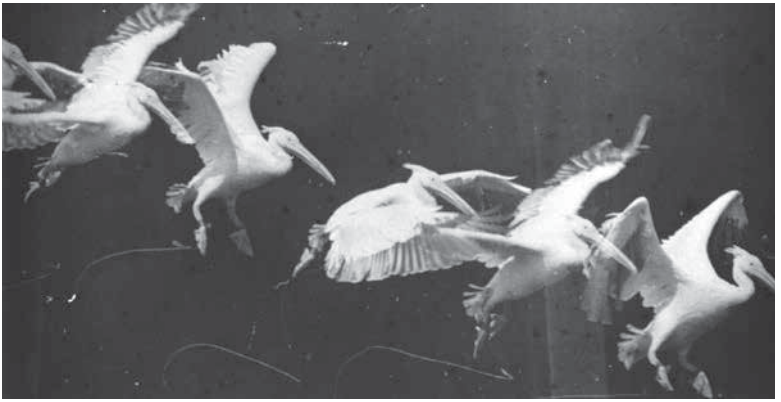


Fig. 05. Flying pelican captured by Étienne-Jules Marey's chronophotographic gun, circa 1882; image public domain.

"With the chronophotographic gun," writes Kittler, "mechanized death was perfected: its transmission coincided with its storage."[4] This paradoxical entanglement between the technological immortality promised by photography and the destruction threatened by the machine gun also occurred on a more literal level. In the 1850s, at the height of British colonial power, taxidermy and photography were employed almost interchangeably to preserve exotic game for both glory and science. Both techniques aspired to similar representational ideals: the naturalistic representations of exotic landscapes and the preservation of the authentic likenesses of their wild inhabitants.

in the field, an instrument that would be added to the arsenal of the Army Signal Corps during World War I. Donna J. Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (Routledge: New York, 1989), 43.

4 Kittler, *Film, Gramophone, Typewriter*, 124.

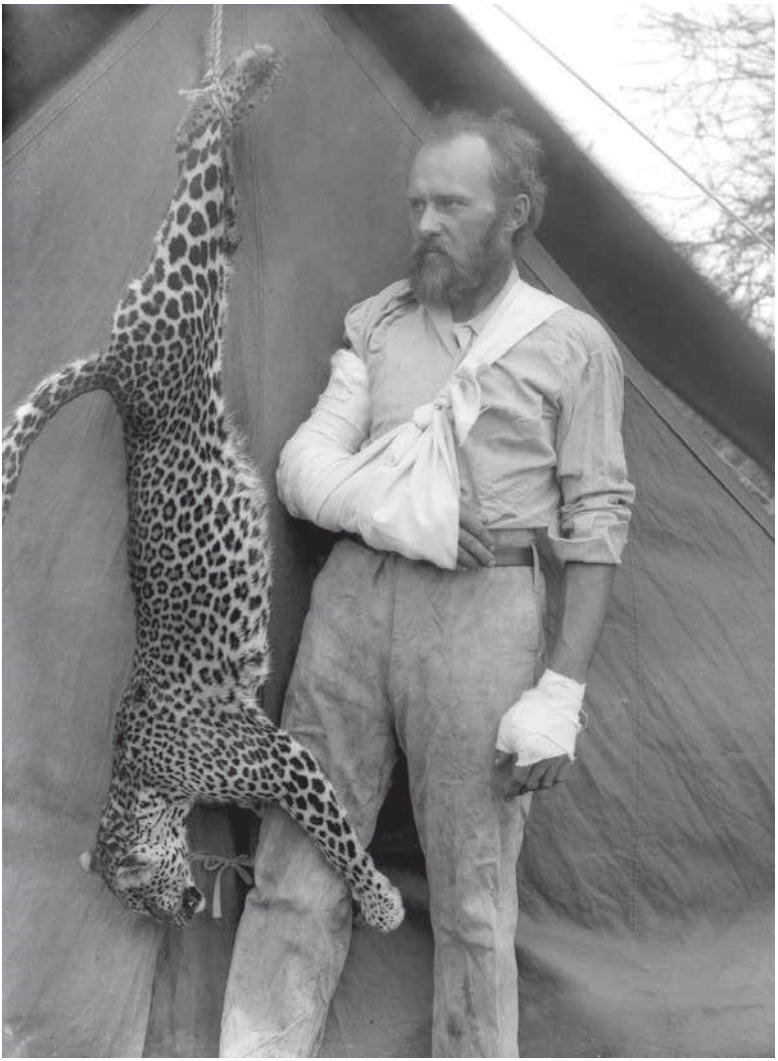


Fig. 06. Carl Akeley with a dead leopard, 1896. Attacked by the animal during an expedition, Akeley killed it with his bare hands; image courtesy of the Field Museum, Chicago, and Getty Images.

In his history of these twin colonial storage technologies, however, the historical geographer James Ryan underscores that stalking game with a camera was no less predatory a practice than hunting with a rifle, nor was it considered any less heroic. Ryan singles out one individual, Edward Buxton, for his revealing attitude towards hunting and photography. Buxton, a wealthy British politician and conservationist, championed the camera as "an alternative weapon to the rifle."[5] In his 1902 book promoting the conservation of African game, the reformed hunter extolled not only the virtues, but also the adventure of "camera stalking." Buxton wrote, "[Photography] demands more patience and endurance of heat and other torments, more knowledge of the habits of animals—in a word, better sportsmanship than a mere tube of iron with a trigger; and when a successful picture of wild life is obtained it is a higher achievement, even in the realm of mere sport, than a trophy, however imposing."[6] Implicit in Buxton's advocacy for the camera over the rifle is a claim that non-lethal hunting was a more masculine pastime. This was expressed even more overtly by Buxton's contemporary, Carl Akeley, the taxidermist and conservationist whose work is enshrined in his eponymous wing at the American Museum of Natural History in New York. In spite of his extensive experience shooting animals with more lethal weapons, Akeley promoted camera hunting as a more valorous form of capture: "camera hunting takes twice the man that gun hunting takes."[7]

5 James R. Ryan, "'Hunting with the Camera': Photography, Wildlife, and Colonialism in Africa," in *Animal Spaces, Beastly Places: New Geographies of Human-Animal Relations*, ed. Chris Philo and Chris Wilbert (London: Routledge, 2000), 212.

6 Quoted in ibid., 211, with further references.

7 Quoted in Haraway, *Primate Visions*, 43.

What Buxton and Akeley's championing of photography makes clear is that, while shooting with a camera replaces literal violence and killing, there is a figurative, symbolic remainder of physical violation. As Susan Sontag writes,

> [T]here is something predatory in the act of taking a picture. To photograph people is to violate them, by seeing them as they never see themselves, by having knowledge of them they can never have; it turns people into objects that can be symbolically possessed. Just as the camera is a sublimation of the gun, to photograph someone is a sublimated murder—a soft murder, appropriate to a sad, frightened time.[8]

The entanglements of violence and storage, death and preservation, are not exclusive to the visual economy. Sound recording, too, commits soft murders. And, as with the camera, the relationship between field recording and hunting excedes mere metaphor by way of technical affinities. As was the case with cinema, war machines have in some cases provided inspiration, if not a technical blueprint, for sound recording devices. Peter Paul Kellogg, the renowned ornithologist and recordist, based his parabolic microphone on the sonic reflectors used by WWI aircraft to locate enemy aircraft.[9] The microphone was further ensconced in the arsenal of media weaponry in the 1950s with the invention of the "shotgun" microphone. Marey would have known better than to dismiss this as mere metaphor, considering the pedigree of its inventor, Fritz Sennheiser, the pioneering German sound engineer who honed his skills during the Second

8 Susan Sontag, *On Photography* (New York: RosettaBooks, 2005), 10.
9 Don Stap, *Birdsong* (New York: Scribner, 2005), 30.

World War by transmitting coded military messages.[10] World War Two, as Sennheiser witnessed, was fought as intensely with media technologies as it was with ballistics. The Allies and Nazis were engaged in a media arms race, struggling to develop more portable, higher fidelity ways of storing sound. The German development of magnetic tape recording in the lead-up to WWII was a particularly important advancement for the Nazi Ministry of Information. The new technology made it possible to broadcast prerecorded programming that was indistinguishable from a live transmission. The regime capitalized on this technique of sonic deception, disseminating ersatz live broadcasts from the Führer in order to propagate misinformation as to his whereabouts.[11] The Allied side was equally invested in recording technology's potential to deceive. The US military took advantage of all the means of sound reproduction available, using disc recordings of construction, troop movements, etc., and then mixing them down onto magnetic wire. These sonic montages of a wartime soundscape were then played over loudspeakers in order to draw the enemy into firefights with ghostly adversaries.[12] Magnetic recording did not simply yield sonic

10 Margalit Fox, "Fritz Sennheiser, 98, Executive, Dies," *The New York Times,* 25 May 2010, www.nytimes.com/2010/05/26/technology/26sennheiser.html.

11 Steve Goodman, *Sonic Warfare: Sound, Affect, and the Ecology of Fear* (Cambridge, MA: MIT Press, 2010), 43.

12 Philip Gerard, *Secret Soldiers: How a Troupe of American Artists, Designers, and Sonic Wizards Won World War II's Battles of Deception against the Germans* (New York: Penguin, 2002). See also Goodman, *Sonic Warfare,* 41–4. The entanglement of acoustic technology and warfare stands alongside the historical alliance between optical machinery and the military industrial complex. According to Virilio, "the battlefield has always been a field of perception. The war machine appears to the military commander as an instrument of representation, comparable to the painter's palette and brush." Cinematic technologies up the stakes of militaristic visuality: they extend perception beyond "normal" human faculties. They not only represent but reveal; they rationalize the field of battle, making it a unit of analysis. Paul Virilio, *War and Cinema: The Logistics of Perception*, trans. Patrick Camiller (London: Verso, 1989), 8.

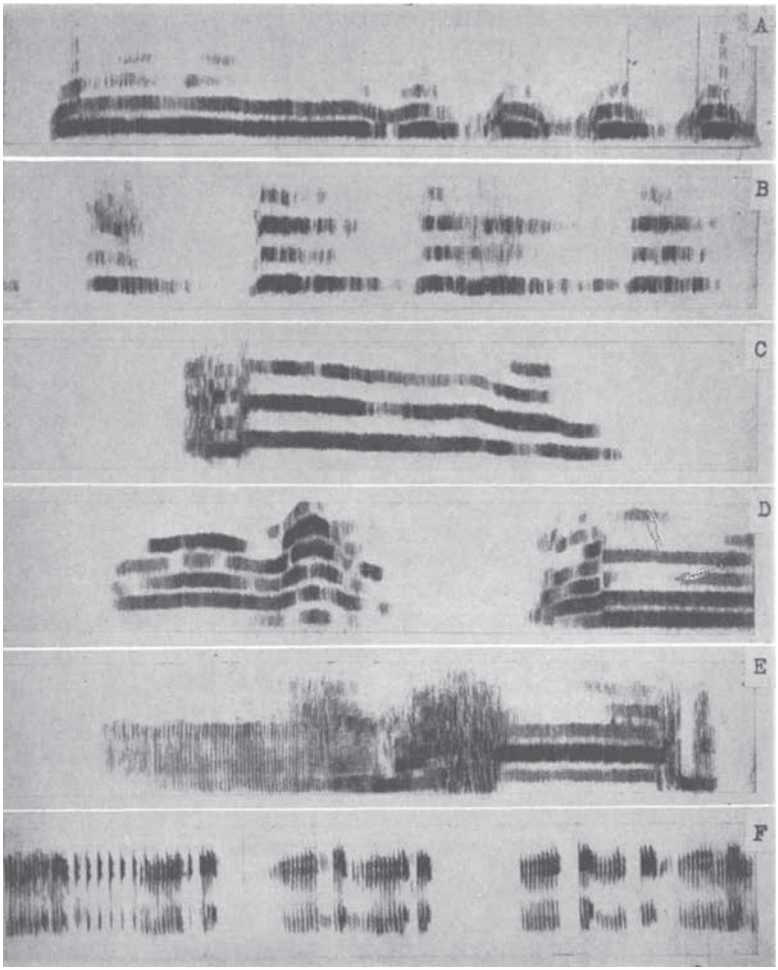


Fig. 07. Spectrographic representations of various animals sounds. (A) Newfoundland dog, (B) small dog, (C) & (D) wolf, (E) cow, (F) frogs. W. Koenig et al., 1946; image courtesy of ASA Digital Library.

materials whose fidelity held the power to deceive the enemy (and eventually the object of biological research); because of its resistance to shock and vibration it allowed for a more consistent, more stable means of capture. Wartime refinements produced a lighter and more portable technology, making it the ideal medium for recording in the field.[13]

This history of military research also demands a reconsideration of the spectrograph, a technology equally entangled with warfare. Development of the instrument began with peaceful intentions; the device's inventor, Ralph K. Potter, imagined that the spectrograph could turn birdsong into a score, but his main hope for the technology was that it would allow the deaf to *read* telephone calls and improve their ability to enunciate the phonemes that they could not hear. But Potter's dream for legible speech was quickly appropriated by the military when his invention was recast as a tool for submarine detection.[14]

13 David Morton, *Off the Record: The Technology and Culture of Sound Recording in America* (New Brunswick, NJ: Rutgers University Press, 2000), 59.

14 Peter R. Marler, "Science and Birdsong: The Good Old Days," in *Nature's Music: The Science of Birdsong*, ed. Peter R. Marler and Hans Slabbekoorn (San Diego: Elsevier, 2004), 1. It should be noted that various iterations of sonar had been in use since the early twentieth century, but it was limited in its ability to identify the sonic signature of specific objects. On the history of sonar and its role in naval warfare, see Willem D. Hackmann, "Sonar Research and Naval Warfare 1914–1954: A Case Study of a Twentieth-Century Establishment Science," *Historical Studies in the Physical and Biological Sciences* 16, no. 1 (1986). For a discussion of the cartographic uses of sub-marine sound, see Sabine Höhler's history of the mapping of the ocean floor. Höhler ties the electrical technique of sonic detection at a distance to the mechanical practice of "sounding" the depths of the ocean floor. Sabine Höhler, "Depth Records and Ocean Volumes: Ocean Profiling by Sounding Technology, 1850–1930," *History and Technology: An International Journal* 18, no. 2 (2002).

It would seem that all sonic technologies emerge from and/or tend towards militaristic applications. Sound recording and playback have been used to commit physical violence,[15] just as they have functioned as technologies of detection and deception. It is this latter use—the practice of tricking subjects into believing a recording to be real—that returns us to the worlds of animals. After all, what is Richard L. Garner's experiment but a controlled way of fooling an animal into responding, a means of using sound recording to trick animals into giving up their voices? Others have used similar techniques to literally capture the creatures themselves. Poachers in Cyprus and Italy, for example, have for decades used recordings of songbirds to entice their quarry to land on tree branches coated with an inescapable adhesive.[16]

A legacy of control and deception binds the hunter, the soldier, and the scientist. Sound recording is an *apparatus* that divides the world, separating the self and the other. Giorgio Agamben writes, "The term 'apparatus' designates that in which, and through which, one realizes a pure activity of governance devoid of any foundation in being. This is the reason why apparatuses must always imply a process of subjectification, that is to say, they must produce their subject."[17] An apparatus intervenes in the world of inchoate beings, entities whose place in the world has yet to be determined by human epistemology.

15 See Jürgen Altmann, "Acoustic Weapons – A Prospective Assessment: Sources, Propagation and Effects of Strong Sound," *Cornell Peace Studies Program* 22 (1999), 165–234; Goodman, *Sonic Warfare*; Mitchell Akiyama, "Silent Alarm: The Mosquito Youth Deterrent and the Politics of Frequency," *Canadian Journal of Communication* 35, no. 3 (2010), 455–71.

16 Jonathan Franzen, "Emptying the Skies," *The New Yorker*, 26 July 2010.

17 Giorgio Agamben, *What Is an Apparatus? And Other Essays* (Stanford: Stanford University Press, 2009), 11.

Agamben's definition of an apparatus expands on Foucault's already broad view of the governmental *dispositif*:

> Further expanding the already large class of Foucauldian apparatuses, I shall call an apparatus literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions, or discourses of living beings. Not only, therefore, prisons, madhouses, the panopticon, schools, confession, factories, disciplines, juridical measures, and so forth … but also the pen, writing, literature, philosophy, agriculture, cigarettes, navigation, computers, cellular telephones, and—why not—language itself, which is perhaps the most ancient of apparatuses—one in which thousands and thousands of years ago a primate inadvertently let himself be captured, probably without realizing the consequences that he was about to face.[18]

According to Agamben's reading, one of the fundamental functions of the apparatus is the production of human subjects: "apparatuses are not a mere accident in which humans are caught by chance, but rather are rooted in the very process of 'humanization' that made 'humans' out of the animals we classify under the rubric *Homo sapiens*."[19] The emergence of *Homo sapiens*—both as a biological being, and as a figure of knowledge—can be written as a dynamic process whereby the animal is systematically and decisively expelled from the realm of the human. Western philosophical thought, from Aristotle to the

18 Ibid., 14.
19 Ibid., 16.

Bible, through to Hegel and Heidegger, has constituted the human and the animal as differing in essence, despite their occasional, coincidental inhabitation of bipedal bodies. To become human, in this tradition, is to create a perpetually renewed "caesura" between two natures as a means to transcend or evacuate all vestiges of bestiality.[20]

The primate captured by the apparatus of language would become the human that would go on to recapture this self-same primate in the apparatus of sound recording. However, it was a linguistic apparatus that allowed *Homo sapiens* to cleanse the species of its simian origins. Not all apparatuses always create discrete, proper human subjects; sometimes they go awry and undo the categories they are meant to establish and police. The status of the human is always a fraught and troubled construct, even at its assumed origin. After all, we are told that it was a loquacious snake that expedited humankind's excommunication from paradise. To paraphrase Louis Leakey, either we must redefine speech, redefine the human, or accept diabolical serpents as our linguistic counterparts. Or, we might take the Good Book with a grain or two of salt by acknowledging that there is a specter that haunts human confidence about its own uniqueness. It is a ghost that mutters, perhaps incoherently, but certainly distinctly, into the horn of a phonograph recorder, into the ears of a late-Victorian simian linguist, before gently coaxing a French philosopher to put on some pants and feed the cat.

20 Agamben, *The Open: Man and Animal*.

Fig. 08. 1920s acoustic mirrors used for aircraft detection in South England; now ruins in a bird reserve; photograph courtesy of Charles Stankievech.

Robert Zhao Renhui: Singapore 1925–2025

Images from The Land Archive

Robert Zhao Renhui's photographic series chronicles the significant changes in Singapore's natural and urban landscape. The images address issues of land reclamation, national boundaries, ecological transformation, pollution, conservation, and the morphodynamics of the iconic skyline.

The photographs capture an ongoing interaction among the city's human-made infrastructures, its more natural spaces, and nonhuman creatures. What one sees, on the one hand, is Singapore's architecture as documented in several aerial views of the country's tallest buildings, as well as its ubiquitous public housing. On the other hand, there are glimpses of the island's less obvious forms of wildlife, including fauna living in Marine Parade (animals native to the wildlife reserves), which together contain one of the largest collections of captive animals. Some of the few remaining truly wild animals also occasionally appear.

The Land Archive manages an extensive collection of documents from private memoirs—historical maps, and photographs to oral history interviews and audio-visual material—some of which date back to the early nineteenth century.

All images courtesy of the artist.

Untitled

Ulu Tiram

Sand from Ulu Tiram
Ulu Tiram Bukit Timah

Overlooking Bukit Panjang
Gali Batu

Singapore Tree

Singapore Wild Dogs

Man with Motorcycle

Jurong Hill

Contributors

MITCHELL AKIYAMA is a Toronto-based scholar, composer, and artist. His eclectic body of work includes writings about plants, animals, cities, and sound art; scores for film and dance; and objects and installations that trouble received ideas about perception and sensory experience. Mitchell recently completed his Ph.D. in communications at McGill University, Montreal. His doctoral work offers a critical history of sound recording in the field and examines a diverse range of subjects, from ethnographers recording folksongs in southern American penal work camps to biologists trying to determine whether or not animals have language to political valence of sound art practices.

LAUREN B. ALLEN is a biologist and learning researcher who focuses on understanding how people learn to respond to the complex socio-scientific challenges that we collectively face, including, for example, the power of genetic engineering and its accompanying human exploits, and adapting to a changing global climate. Lauren studies the learning that happens outside of formal educational spaces, examining learning through human interaction in museums, galleries, and other public spaces.

BIANCA BALDI is an artist born in Johannesburg. Recent exhibitions include The 8th Berlin Biennale of Contemporary Art at KW Institute for Contemporary Art, Berlin; *Zero Latitude*, the Goethe-Institut, Johannesburg; *Poltroneria*, Museo Apparente, Naples; and *Home Stories*, Villa 102 KFW, Frankfurt. Bianca grew up in KwaZulu-Natal, South Africa and studied at the Städelschule in Frankfurt am Main, The Michaelis School of Fine Art, Cape Town, and IUAV University of Venice. It is by way of an image-making and installation practice that she approaches "borrowed" and lost narratives in her work, using means such as photography, film, video, and writing, as well as publishing.

SETH DENIZEN is a researcher and design practitioner trained in landscape architecture and evolutionary biology. Since completing research on the sexual behavior and evolutionary ecology of small Trinidadian fish, his work has focused on the aesthetics of scientific representation, madness and public parks, the design of taxonomies of urban soil, and most recently the political ecology of desertification in China. He currently lives in Hong Kong, where he teaches in the Division of Landscape Architecture at the University of Hong Kong.

THOM VAN DOOREN is a senior lecturer in Environmental Humanities at the University of New South Wales in Sydney and a Humboldt Research Fellow at the Rachel Carson Center in Munich (intermittently, 2014–16). He is the author of *Flight Ways: Life and Loss at the Edge of Extinction* (Columbia University Press, 2014), *Vulture* (Reaktion Books, 2011), and numerous articles and chapters on the ethical and political dimensions of conservation and extinction. He is currently writing a book about crows around the world that explores the challenges and possibilities of a multispecies ethics for the Anthropocene. He is also a founding co-editor of the journal *Environmental Humanities*. www.thomvandooren.org

NATASHA GINWALA is an independent curator, researcher, and writer originally from India. She was a member of the artistic team at the 8th Berlin Biennale for Contemporary Art 2014 (with Juan A. Gaitán). Her recent work also includes the multi-part curatorial project *Landings* (with Vivian Ziherl) presented at Witte de With Center for Contemporary Art, Rotterdam; David Roberts Art Foundation, London; NGBK, Berlin (as part of the Tagore, Pedagogy and Contemporary Visual Cultures Network); Stedelijk Museum and Tropenmuseum, both Amsterdam; and other partner organizations (2013–ongoing), as well as *The Museum of Rhythm* at the Taipei Biennial 2012 (with Anselm Franke). Natasha has contributed to several publications, including *Afterall Online*, *Art Agenda*, *Manifesta Journal*, *e-flux Journal*, *Pages Magazine*, and *Scapegoat Journal*. Her recent essay "The Fortress is Adjacent to the Mountains" appears in *Textures of the Anthropocene: Grain Vapor Ray* (Cambridge, MA: The MIT Press 2015/ Berlin: Revolver Publishing 2014). In September 2014, she was curator-in-residence at Hordaland Kunstsenter, Bergen.

ARVO LEO grew up in Roberts Creek, Canada, and numerous places around New Zealand. He received an M.F.A. from the Piet Zwart Institute, Rotterdam, in 2011, and a Bachelor of Media Arts from the Emily Carr Institute of Art and Design in Vancouver in 2006. Recent exhibitions include: Biennale de l'image en mouvement 2014, Geneva (2014); *House Advantage*, 221A Gallery, Vancouver (2013); *Brooding Chambers*, The Storefront, Berlin (2013); *This Is the Cow*, Western Front, Vancouver (2012); *Material Information*, Galleri Format, Bergen (2012); *Magic, Love, Trade, Objects*, Art Genève, Geneva (2012); *The Work Locates Itself*, Columbia University, New York (2012); *Bosch Young Talent Show*, Stedelijk Museum, 's-Hertogenbosch (2011); and *Will and Objecthood*, Gallery DOR, Brussels (2011).

KARTHIK PANDIAN is an American artist who has had solo exhibitions at the Whitney Museum of American Art, New York; Midway Contemporary Art, Minneapolis; White Flag Projects, St. Louis; Vilma Gold, London; Rhona Hoffman Gallery, Chicago; Richard Telles Fine Art, Los Angeles; Béton-salon, Paris; and, Federica Schiavo Gallery, Rome, among others. His work has been featured in group exhibitions including the 2012 edition of La Triennale at the Palais de Tokyo; the inaugural LA Biennial at the Hammer Museum; the 4th Marrakech Biennial; *Film as Sculpture* at Wiels Contemporary Art Centre, Brussels; and the Artists' Film Biennale at the ICA, London, in 2014. In 2011, he was the recipient of a Louis Comfort Tiffany Foundation Award. He holds an M.F.A. from the Art Center College of Design, and a B.A. from Brown University.

RICHARD W. PELL works at the intersection of science, engineering, and culture. He is the founder of the Center for PostNatural History (CPNH), an outreach organization dedicated to the collection and exposition of lifeforms that have been intentionally altered through selective breeding or genetic engineering. The CPNH operates a permanent exhibition facility in Pittsburgh, Pennsylvania, and produces traveling exhibitions that have appeared in science and art museums throughout Europe and the USA. The CPNH has been awarded a Rockefeller New Media fellowship, a Creative Capital fellowship, a Smithsonian research fellowship, support from Waag Society, and ongoing support from the Kindle Project.

ANNA-SOPHIE SPRINGER is a curator, writer, and co-director, with Charles Stankievech, of K. Verlag. Her practice merges curatorial, editorial, and artistic commitments by stimulating fluid relations among images, artifacts, and texts in order to produce new geographical, physical, and cognitive proximities, often in relation to historical archives and the book-as-exhibition. She has previously worked as Associate Editor of publications for the 8th Berlin Biennale for Contemporary Art and as an editor for the pioneering German theory publisher Merve Verlag, before launching K. in 2011. Her previous projects as curator include *EX LIBRIS* at Galerie Wien Lukatsch, Berlin, and other venues, which explored various libraries as curatorial spaces. Her forthcoming exhibition *125,660 Specimens of Natural History*, co-curated with Etienne Turpin, will open at Komunitas Salihara, in Jakarta, Indonesia, in August 2015. Anna-Sophie received her M.A. in Contemporary Art Theory from Goldsmiths College, University of London, and her M.A. in Curatorial Studies from the Hochschule für Grafik und Buchkunst, Leipzig. In 2014 she was the Craig-Kade Visiting Scholar-in-Residence at Rutgers University.

AXEL STRASCHNOY is a visual artist from Buenos Aires, currently based in Helsinki. His long-term and research-focused projects include *Kilpisjärvellä* (2011–12), a planetarium film on exploration in northern Lapland under the Northern Lights (Museo de Arte Moderno de Buenos Aires, Buenos Aires, and Mirta Demare Gallery, Rotterdam); *La Figure de la terre* (2014), a short film based on the book *The Figure of the Earth* by eighteenth-century French mathematician and explorer Pierre-Louis Moreau de Maupertuis (Del Infinito Arte, Buenos Aires), and the lecture-performance series *Notes on the Double Agent* (2013–ongoing). Of late, he has followed the Neomylodon's trail back to its cave in Last Hope Sound, Southern Chile, and is in the midst of preparing a multi-part traveling exhibition to bring the Neomylodon's remains back together, 120 years after its discovery. Other recent exhibitions and screenings include, *Emerging Media Artists*, Edith-Russ-Haus, Oldenburg (2014); *Opening Archive*, Ateneum Museum Library, Helsinki (2013); Fulldome Festival, Zeiss Planetarium, Jena (2014); Flaherty Seminar, Colgate University, Hamilton (2014); and the Melbourne International Film Festival (2013). He also participated in Le Pavillon residency at Palais de Tokyo (2008–09) and trained in Art History at the University of Buenos Aires.

KATHARINA TAUER is a German graphic designer currently living and working in Berlin. After completing her M.A. in Art Direction with a focus on type design at ECAL (École cantonale d'art de Lausanne) in 2012, she moved to London and built up a solid, year-long work experience at Zak Group. Katharina now works on self-initiated projects, as well as commissions and freelance jobs, maintaining a focus on book design and the cultural sphere.

ETIENNE TURPIN is a philosopher researching, curating, and writing about complex urban systems, the political economies of data and infrastructure, visual culture and design, and Southeast Asian colonial scientific history. He is Vice-Chancellor's Postdoctoral Research Fellow at the SMART Infrastructure Facility, Faculty of Engineering and Information Sciences, and Associate Research Fellow at the Australian Center for Cultural Environmental Research, Faculty of Social Sciences,

University of Wollongong, Australia. He is also the founder and director of anexact office, a design research practice committed to multidisciplinary urban activism, curatorial and artistic experimentation, and applied philosophical inquiry, based in Jakarta, Indonesia. Etienne is the Co-Principal Investigator of PetaJakarta.org, a research project studying the social consequences of infrastructure transformation as a result of rapid development and climate change. Through community engagement, institutional ethnography, and novel approaches to social media platforms, data-gathering, and designed engagement, Etienne's research develops new tools, techniques, and methods for Applied GeoSocial Intelligence Engineering to help democratize processes of urban transformation by meaningfully engaging the concerns and capacities of the urban poor.

ROBERT ZHAO RENHUI is an artist from Singapore working mainly with photography who often, however, adopts a multi-disciplinary approach by presenting images together with documents and objects. His recent exhibitions include the Busan Biennale (2014); Daegu Photo Biennale (2014); Moscow International Biennale of Young Art (2014); PhotoIreland (2014); Singapore Biennale (2013); President's Young Talents (2013); The Institute of Critical Zoologists, Chapter Arts Centre, UK (2012); Photoquai, Paris (2013); The International Festival of Photography, Mineiro Museum, Brazil; and Engaging Perspectives, CCA, Singapore. He has also exhibited at the Noorderlicht Photo Festival; Format Festival, Derby, UK; Lianzhou International Photo Festival; Fukouka Asian Art Museum, Japan; Photo Levallois, Paris; Seoul Arts Center, Korea; GoEun Museum of Photography, Korea; The Zabludowicz Collection, London; Shanghart, Shanghai; and PPOW Gallery, New York. His work has been awarded The Deutsche Bank Award in Photography, University of the Arts, London (2011); the United Overseas Bank Painting of the Year Award, Singapore (2009); Sony World Photography Awards (2010 and 2011); as well as honorable mentions in *Photo Levallois* (France, 2008). In 2010, he was awarded the Young Artist Award by the Singapore National Arts Council. His work has also been featured prominently in *ArtAsiaPacific*, *Artforum International*, *ArtInfo*, *Fotografia*, and *Punctum*.

ANDROS ZINS-BROWNE began studying ballet at an early age at the Joffrey Ballet School, New York City. After completing a degree in Art Semiotics at Brown University (1998–2002), he moved to Brussels to study at the performing arts research and training studios P.A.R.T.S. (2002–06). He later pursued a research program in the fine arts department at the Jan van Eyck Academie, Maastricht (2010–11). Aside from his performances as a dancer with Jonathan Burrows, Mette Ingvartsen, Tino Sehgal, and Maria Hassabi, his own creations—on which he often collaborates with visual artists—have been presented across Europe, including the Stedelijk Museum, Amsterdam; Centre Pompidou, Paris; Dance Umbrella and the ICA, both London; HAU, Berlin; Kaaitheater, Brussels; and the Theater Festival Impulse, Köln-Düsseldorf, where he received the Goethe-Institut Award for *The Host*. In 2015, he will premiere his upcoming performance *The Middle Ages*, and continue his collaboration with artist Karthik Pandian on their *Atlas* project with a performance premiering in September.

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Series Co-editors
Anna-Sophie Springer
& Etienne Turpin

Associate Editors
Kirsten Einfeldt & Daniela Wolf

Art Director
Charles Stankievech

Designer
Katharina Tauer

Copy Editors
Lucas A.J. Freeman
& Jeffrey Malecki

Editorial Assistants
Miriam Greiter
& Martin Hager

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10557 Berlin, Germany
www.hkw.de

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