Life & Death in the Anthropocene: A Short History of Plastic

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Ivanhoe Reservoir, photo by, G L, courtesy of National Geographic Creative. Fig. 01

> The present is conditioned by the accumulated traces of the past, and the future of the earth will bear the marks of our present. While the manufacture of plastics destroys the archives of life on the earth, its waste will constitute the archives of the twentieth century and beyond.
>
> —Bernadette Bensaude-Vincent

In 2007, the Los Angeles Department of Water and Power (LADWP) detected high levels of bromate, a carcinogen, in Los Angeles's Silver Lake and Elysian Reservoirs. Bromide is found naturally in groundwater, and chlorine is added to drinking water in order to kill bacteria. But when exposed to sunlight, as was the case in these open-air reservoirs, the two chemicals react and carcinogenic bromate forms. The facilities serve about 600,000 people in downtown and South Los Angeles, and the city was forced to dump the water.[1] The municipal government began to build a new underground facility, but until its completion they needed a way to control this chemical reaction on the other major reservoir, Ivanhoe Reservoir. The temporary solution was to put 3.4 million black plastic balls onto the surface of the reservoir, with the idea that they would absorb sunlight, drastically reduce water evaporation, and also lessen algae growth, while stopping the chemical reaction and thus the formation of bromate.[2] The four-inch-diameter polyethylene

balls covered the surface of the reservoir, sealing out the sunlight. The newspaper images associated with this event—thousands of plastic balls being poured down a cement embankment to re-surface the water—bore a striking resemblance to contemporary art, such as the earth works and land art of the 1960s and 1970s. Viewers could easily be forgiven if they accidentally thought the event was a new piece by a contemporary landscape or installation artist, such as Olafur Eliasson or Maya Lin. But, in this case, the relationship to contemporary art was entirely accidental, speaking both to the state of art practice today and to environmental aesthetics.[3] This phenomenon, of accidental or incidental aesthetics, is a hallmark of what is being called the Anthropocene—the era in which extractavist logic and capitalist economics have drastically reshaped the chemical, geological, and biospheric conditions of the earth. From the extraordinarily beautiful colours made from tar for the World Exhibition in 1862, to the London smog that inspired Monet and other impressionists, to the trash vortex, "the largest water architecture of the twenty-first century," the re-shaping of the earth by humans has also meant the birth of entirely new colours and aesthetics.[4] The aesthetic effects—as in *aisthesis*, or affects produced by our sensorial experience of the environment—have been entirely re-ordered by the presence of plastic. The use of the term "plastic arts" was first recorded in 1624.[5] Until the invention of the synthetic polymer that we have come to know as plastic; the arts held a virtually monopoly on artifice, now it is chemical engineers who re-make and re-fashion the earth.

The inadvertent aesthetics produced by the event of covering the Ivanhoe Reservoir in plastic balls draws attention to the larger ways in which aesthetics is shifting under the conditions of the Anthropocene. These "shade balls," as they are called, are typically used to keep birds out of water near industrial facilities and airports and to stop water evaporation in petroleum operations. The LADWP initially bought three million balls to cover the Ivanhoe Reservoir (after the initial phase of introducing 400,000 balls), then nine million more for two other reservoirs in the city, and is scheduled to blanket the L.A. Reservoir, which has a surface area of 176 acres, with eighty million balls, permanently.[6] These procedures reveal what plastic does best: it acts as a sealant, a barrier, both literally sealing something off from its surrounding environment—in this case, a reservoir—while also materializing the desire for impenetrability, for objects, bodies, and selves to be discrete, for categories not to mix, for a monadic identity separated from its environment.

Plastic: The Substrate of Advanced Capitalism

The first synthetic polymer, Bakelite, was created in 1907 and patented in 1909 by Leo Baekeland. It was invented to fill consumer demand for items that were becoming more difficult to get—such as ivory and silk—as anti-colonial resistance movements started simmering, and as the earlier pillaging of resources made these items increasingly unavailable and expensive.[7] Lauded as the material of a thousand uses, plastic became the cheap alternative, the perfect substance for a burgeoning commodity society that would emerge full force in the post-WWII era. Plastic has

always been a thoroughly profit-driven material. Even when the category of what we now think of as plastics was still in formation, its nature was more "commercial than scientific," as Jeffrey Meikle argues in his illuminating and far-reaching cultural history, *American Plastic*.[8] In other words, the invention and proliferation of plastics was driven less by a need to develop new technologies, such as medical or warfare applications (although WWII boosted the use of plastics greatly), than to simply replace the objects we already had—but at a price and in a quantity that helped to instantiate a middle class defined by consumption.

Plastic created the conditions for global trade and consumerism, while these systems themselves became increasingly reliant upon various forms of plastic. As Andrea Westermann notes in her study of PVC (or vinyl) in Germany: "Plastic packaging, in particular, facilitated mass consumption [...] The new ways of handling and distributing commodities in retail and wholesale were not only based on plastic containers and plastic bags, but also required an improved stackability of goods, achieved by material innovations like shrink-wrap."[9] Indeed, the infrastructure and speed of advanced capitalism, and the fantasy of unending economic growth fuelled by extractivist policies and mass consumerism depend upon plastic. This explains why 280 million tons of plastic was produced worldwide in 2012, with a projected increase to 33 billion tons annually by 2050.[10]

Plastic can be considered the substrata of advanced capitalism.[11] It reveals our utter dependency upon petrochemicals. But its role in our life, unlike the more abstract relationship that we have with other oil products, such as gasoline or electricity, is intimate. We use plastics to eat, clothe ourselves, as sex toys, as soothers for babies. Our computers and phones, those objects we seemingly can not do without, could not exist without plastics as the lightweight portable devices that they are. Nor could the Internet, with thousands of underwater and underground cables sealed from the elements with plastic coating.[12] Plastic is ubiquitous and infiltrates so many aspects of our daily lives that its presence is easy to take for granted and also hard to fathom. It has introduced entirely new sensorial regimes with its smooth surfaces and bright colours. It also implicates us: there is no way to extract one's life in the twentieth century from plastic. This is true for people across economic classes and geographies, even if the objects we interact with and the ways we do it remain stratified. Plastic is a problem that can not be externalized. However, the value attributed to plastic, as Gay Hawkins reminds us, is not intrinsic to the material, but rather is enacted.[13] It accumulates value precisely because of how it is used, what it enables, and how it circulates through the economy.[14]

Plastic represents the promises of modernity: the promise of sealed, perfected, clean, smooth abundance. It encapsulates the fantasy of ridding ourselves of the dirt of the world, of decay, of malfeasance. As Westermann argues, "vinyl's plasticity and its chemical creation captured what high modernity expected from technology at large: a world freed from the material restrictions that nature traditionally imposed on humanity. By implication, we would also have a world freed of scarcity,

a world of plenty."[15] Plastic represents a shiny new world, one that removes people from the cycles of life and death, one that supersedes the troublesome, leaky, amorphous, and porous demands of our ancestors, our bodies, and the earth. Ridding ourselves of the demands of the earth seemed to promise a world of prosperity through scientific control. In 1941, chemist V.E. Yarsley and research manager of B.X. Plastics Ltd., E.G. Couzens, wrote that the plastic future would be shiny and bright:

> "Plastic Man," will come into a world of colour and bright shining surfaces […] He is surrounded on every side by this tough, safe, clean material which human thought has created […] [W]e shall see growing up around us a new, brighter cleaner and more beautiful world, an environment not subject to the haphazard distribution of nations' resources but built to order, the perfect expression of the new spirit of planned scientific control, the Plastics Age.[16]

This idealist dream, or dream of transcendental idealism, represents the apex of the Cartesian split, as matter itself is dictated and rearranged by the human mind. Planned scientific control envisions this clean, smooth world, sealed off from the outside—it is not just the barriers of a hazmat suit or the miracles of Tyvek house wrap, but the basic building blocks of matter that are manipulated and re-built. As Bernadette Bensaude-Vincent writes: "Matter came to be presented as a malleable and docile partner of creation—a kind of Play-Doh in the hands of the clever designer who informs matter with intelligence and intentionality. Just like the *demiurgos* in Plato's *Timaeus*, the material engineer can impose forms on a passive, malleable *chora*."[17] This dream of the ultimate passivity of nature, pliable to the wills and whims of the modern subject, has had horrifying implications. Plastic—in its production, distribution, and waste cycles—represents the inevitable corollary to unfettered economic growth: it is both intensely resource-depleting (eight percent of world oil production goes into the manufacture and production of plastics) and ecologically devastating. Indeed, plastic brings together some of the most abiding environmental concerns of our time because of its pervasiveness, banality, and longevity.

For although plastic maintains its identity under virtually all conditions, impervious to what surrounds it, all the matter that exists outside of the logic of chemical engineering (everything that existed prior to 1850, say) has been radically altered by the presence of plastic. At the present moment, nowhere on Earth can be considered free of plastic. And no one in Canada, the United States, and many other countries who has been tested has been found to be free of plastic chemicals.[18] Plastic not only spreads while maintaining its molecular form, but the plasticizers that are added to plastic (one or more of a possible 80,000 chemicals added to make plastic pliable or pink or heat-resistant) leach and off-gas; detached from the polymer bond, they are able to move into the surrounding environment and whatever bodies may be found there. These chemicals are having untold effects on the bodies and ecologies that they are now composing. In addition, "various plasticizers have been correlated with infertility, recurrent miscarriages, feminization of male

fetuses, early-onset puberty, obesity, diabetes, reduced brain development, cancer and neurological disorders such as early onset senility in adults and reduced brain development in children."[19] This is only the list of possible effects on the human body, without even beginning to account for all the *other bodies* affected by plastic and their associated chemicals.

Plastics also accumulate. They gather in the environment in the forms of blighted landscapes, bags fluttering in the wind, or lighters and wrappers found in ditches, masses of untold plastic items piled in garbage dumps, and in the gyres of the ocean, where they swirl and are eaten by many forms of marine life, from bacteria to birds, tortoises to whales. Plastics also accumulate what is around them, particularly by adsorbing persistent organic pollutants, which due to a similar chemical structure, tend to latch on to oil-based plastics. Once this happens their toxicity grows, and the threat to anything that might mistakenly take it for food also amplifies, bioaccumulating up the food chain. As plastics gain in toxicity their value depletes, they are cast off, re-entering market chains for what little profit can be made from recycling, spreading their accumulated toxins wherever they go.

They are then sifted, filtered through, recognized for their worth by those who cannot afford to participate in this throw-away culture, for those who are also placed elsewhere, out of sight of the markets of capital that rely on invisible labour in order to perpetuate this system. Recycling—first-world atonement for single-use plastics and unfettered consumption—is, for the most part, a highly costly and dangerous process. As Gay Hawkins reminds us, "What makes recycling such a labour-intensive practice, and therefore often concentrated where labour is cheap, is the demands […] plastic makes on the human, the ways in which it refuses to cooperate in processes of dematerialization and requalification."[20] The stubbornness of the material of plastic is worked through the body, and the poisons that it harbors are also transferred. It spreads its reign of death as it refuses to go away. These problems get shipped to places with fewer regulations, such as Wen'an, China, which, after twenty-five years of operating as a plastics recycling village, is effectively a dead zone with rampant and pervasive negative health effects for the population and local ecology.[21] This can be understood within the framework of what Rob Nixon calls "slow violence," the violence enacted by chemical industries, late capitalism, and paradigms of western economic growth on the rest of the planet. That is, a "violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all."[22]

Recalcitrant Matter

Plastic has an unfortunate metaphorical connotation. For although plastic is often thought of as a malleable material, as in the common use of the term "plasticity," or in the case of Catherine Malabou's conceptualization of the functioning of the brain, it is perhaps the hardest material there is.[23] It is hard, because it refuses its environment,

creating a sealant or barrier that remains impermeable to what surrounds it. It influences its environment while remaining mute to that environment's influence. Instead, plastic serves as a container, both literally and metaphorically, as about thirty-five percent of plastic produced is for the purposes of packaging. These items are then cast off, placed elsewhere, re-appearing as unsightly objects of debris and refuse. As James Marriott and Mika Minio-Paluello from Platform London—a group of activists and artists who track the relationship of oil to violence and conflict—illustrate, in a typical bucket of ice cream, we can:

> recognize a remarkable lifespan: crude oil formed 3.4 million years ago in rocks under the Caspian comes to rest on the bed of the Atlantic [as a fragment of a plastic container] for the next 10,000 years. Between these two stretches is a tiny window of transformation. It might take just 22 days for Azeri oil to be transported from beneath the Caspian to the Munchmunster plastics factory. Then the container could be moulded, filled, sold and discarded in the span of the following 40 days. In the space of only two months, this oil is extracted, transported, traded, transformed and transformed again before it is sold and ultimately trashed.[24]

Not only are the lifespans of plastic products often extremely short, synthetic polymers, derived from oil, are a kind of living dead among us. After digging up the remains of ancient plants and animals, we are now stuck with the consequences of these undead molecules, the ones that refuse to interact with other carbon-dependent life forms. For although plastics photodegrade and break apart, they do not biodegrade. That is, the pieces may get smaller and smaller, but they do not turn into something else. They do not go away. The molecules themselves remain intact, holding onto their identity. In her excellent book on the relation of the chemical industry to our notions of art, artifice, and nature, Esther Leslie writes:

> What is revealed […] is the drive of the chemical industry towards "the impersonation of life," "from death to death transfigured". Refuse turns into worth in an act worthy of alchemy, but rather than cracking the code of life itself, all that has been achieved […] is the polymerization of a few dead molecules. […] Death imitates life and reinforces its domain.[25]

And, in its proliferation and accumulation, it does indeed extend death outwards, transforming the ecologies that it now composes. Mimicking the properties of many substances that have a relation to the cycles of life and death, such as endocrines and POPs. Plastic survives, lives on, and accumulates for a projected 100,000 years.[26] This quality of the undead is what plastic is often used for: to package and preserve, to seal off bacteria and other organisms to prevent the decay of fruits, vegetables and other organic matter, and, of course, reservoirs.

This recalcitrance of matter, plastic's non-plasticity, is illustrated perfectly by an advertisement for Wemco, a laminating firm in Austin, Texas, used in July 1985:

"Plastic is forever […] and a lot cheaper than diamonds."[27] Mike Michael reflects on the fact that plastic is an entirely industrial material, existing outside of craft or domestic circuits, and he also comments on the relationship between the metaphor and material of plastic. He writes, "In a word, there is little plasticity in plastic, especially if we take plasticity to connote the potential for new or renewed connections to be rendered domestically (i.e. outside of a professional or industrial setting) and thus for the functions of plastic to be recovered or altered or adapted or invented."[28] Plastic, once it has been formed through the miracles of the chemical industry, remains recalcitrant both to biological processes as well as to human creativity. It is the materialization of the horror of identity, of the stability of form, of a futurity without change. As Luce Irigaray writes in the *This Sex Which is Not One*, "Because you need/want to believe in 'objects' that are already solidly determined. That is, again, in yourself(-selves), accepting the silent work of death as a condition of remaining indefectibly 'subject'."[29] Here, the materiality of plastic takes this epistemological framing too seriously, the relationship between the solidity of the object accepts the silent work of death by existing outside of death and life. It seals off the cyclical mechanisms of circulating matter, clinging desperately to an identity that reaches far beyond biological time and into geologic time. Plastic suggests that we in the post-Kantian world have become voracious and solipsistic subjectivities driven by a dangerously self-interested will.

Finitude

Plastic, in this sense, represents the fundamental logic of finitude, carrying the horrifying implications of the inability to decompose, to enter back into systems of decay and regrowth. In our quest to escape death, we have created systems of real finitude that mean the extinguishment of many forms of life. I take the concepts of finitude and extinguishment from Elizabeth Povinelli's forthcoming book *Geontologies: A Requiem to Late Liberalism*.[30] Povinelli uses finitude to represent a Western metaphysics of understanding death as the end of a carbon-based life form. Finitude represents the drama of existence played out in relationship to the teleological orientation of time towards our own end: a one-way trajectory from birth to growth to death, focused on the individual. Jean Baudrillard also remarks that, as we are increasingly "[p]lunged by chance [or by a blind design] into an abnormal uncertainty, we have responded with an excess of causality and finality."[31] This drama of finitude is intimately tied to our notions of existence, as an individual and as a species, and is seen explicitly in some current narrations of apocalypse within the discourse of the Anthropocene.

The Anthropocene, by relying upon the oft-cited and problematic use of the *anthropos*, seems to fulfill this narrative teleology by advancing a notion of the human as the masculinist technological agent doomed to bring about humanity's own end. What is troubling in this scenario is both the logic of finitude that it proposes—that there will be a clear, clean and defined end, rather than the much more probable scenario of ongoing devastation, species extinction, and mutation

towards a future that will become increasingly toxic but otherwise difficult to predict—and that Man will finally burn through his own glory.

This undifferentiated drama of the end is evidenced in Benjamin Bratton's explication of what he calls the "post-Anthropocenic"[32]; it is also seen in a more sinister form in those who embrace the current conditions as an opportunity to create more money and promote unfettered growth. And these are the kinds of politics associated with what Clive Hamilton has identified as the "good Anthropocene." He writes that,

> A new breed of ecopragmatists welcomed the epoch as an opportunity. They have gathered around the Breakthrough Institute, a "neogreen" think tank founded by Michael Shellenberger and Ted Nordhaus, the authors of a controversial 2004 paper, "The Death of Environmentalism." They do not deny global warming; instead they skate over the top of it, insisting that whatever limits and tipping points the Earth system might throw up, human technology and ingenuity will transcend them.[33]

This techno-utopianism is precisely the kind of logic deployed to divorce us from the conditions of being earth-bound creatures in the first place. It is interested only in the extension of a particular way of life, and the individuals who benefit from it, instead of understanding the cyclical, processual, and transformative nature of life itself.

The reign of death already spread through our naivety in believing that we could control and dominate earth systems should be enough to dissuade us from pursuing this path any further. Plastic materializes the desire to give complete freedom to the mind and to control our environment: "[P]lastic established unprecedented control over the material environment. Taken to extreme, such control implied the possibility of stifling humanity in a rigidly ordered artificial cocoon, or, in the event of a loss of control, the possibility, as a retired Du Pont chemist predicated in 1988, that humanity would 'perish by being smothered in plastic.'"[34] What we have seen is that it was exactly the rigidly ordered artificial cocoon of plastics, as well as other fallouts from chemical engineering, that are causing humanity to perish. This holding onto itself that most clearly and molecularly differentiates plastic—a materialized wish to exit the cyclical processes of becoming to which all matter is subject to—has inaugurated an era where "men shall seek death, but death shall flee from them," as Werner Herzog says at the end of *Lessons of Darkness.*[35] It is a form of nihilistic lust that pulls, like a black hole, so many of the biological organisms on earth, even as it differentially affects those who benefit from the uses of plastic and those who suffer its consequences.

Extinguishment

As an alternative framework to finitude, Povinelli asserts extinguishment, which recognizes that things live and die, re-composing in a different form, but without the drama of *the end*. Particular configurations of matter, politics, ideas, and organisms obviously cease to exist, while others come into being. However, extinguishment abandons the teleological impulse by recognizing the circularity and fecundity of living systems. *This* civilization may die, but within that death is the possibility for a reconfiguration with what may be left. Humanity will most certainly one day die off, and it wouldn't be a great surprise if that happened in the relatively near future, but that doesn't mean that species won't evolve or mutate, or that our descendants, even if primarily bacterial, won't inherit the world we leave behind. Apocalypse or the "end of Man" rids us of the questions of inheritance, of a sense of obligation and responsibility to a future, however bleak, too easily. With the concept of extinguishment comes both an acknowledgement of biological, technological, and social limits, but without the drama that would have those neatly encapsulated into a clean break. The framework of extinguishment then recognizes the fact that plastic is killing off *particular* worlds through its proliferation, even as plastic itself remains a materialization of the drama of finitude, refusing to participate in the cycles of extinguishment.

To return again to the black plastic balls in the Ivanhoe Reservoir, I want to think about the fact of their blackness, what their blackness might open up in parallel to the concept of extinguishment. Fred Moten, in a lecture titled "Black Kant (pronounced Chant)," discusses the regulatory framework that Kant applies to the aesthetic and moral regime.[36] He argues that the categories of moral and aesthetic judgment have been deployed to regulate the overabundance of the nonhuman world, the threatening fecundity that then gets displaced through racist logic onto the bodies of black people. In "Blackness and Nothingness," Moten elaborates on these themes; he writes "blackness is ontologically prior to the logistic and regulative power that is supposed to have brought it into existence but that blackness is prior to ontology."[37] Although Moten is writing specifically from the point of view of thinking about the unthinkable conditions of slavery and its continuation into contemporary black life, there seems to be a necessary reworking of the category of ontology, and the relationship to exhaustion, that bears on what it means to live with toxicity, to live in a time of mass extinctions, a time that arises precisely due to the same kinds of ontological positions that excluded blackness, and black people, from ontology to begin with. What would it mean, then, to return blackness to the black plastic balls? What new relations might we humans have to plastic if we thought of its emerging in blackness, from the black of oil, to the black of these balls? Certainly, if the fantasy of separation were abandoned, plastic might be seen as a powerful and in some respects ancient material that does not separate, but that connects us to an unforeseeable future. This future is not one that is then filled with optimism, but rather one that seeks to elide or overturn the comfort of transcendental subjectivity, and instead finds a way to live with "existence without standing."[38] It "is not only to *reside* in an unlivability, an exhaustion that is always

already given as foreshadowing afterlife, as a life in some absolutely proximate and unbridgeable distance from the living death of subjection, but also to *discover and to enter* it."[39] We must learn to enter into an untenable world, instead of operating from the fantasy that it can be barricaded against.

If we simply give in to the drama of finitude then there is no point in fighting, in organizing, in creating new economic and political systems that will allow us, or allow other species, to continue. Extinguishment offers another narrative framework for recognizing the horrors of species death but without seeing this as a pre-ordained or necessary movement. It embraces both the fecundity of life as well as the complete randomness of its systems, while proposing a model within which humans can begin to take responsibility for what we have done—but without tying this to the destiny of humanity. Exhaustion is the understanding of the cyclical movement and transformation of life through death. Exhaustion is the way in which different beings come into the world and pass through it, transforming into something else. For although, as Peter Sloterdijk reminds us, we are "condemned to being-in, even if the containers and atmospheres in which we are forced to surround ourselves can no longer be taken for granted as being good in nature,"[40] we must find ways of living without the categories and fantasies of containment, either in relation to time or in relation to matter. We must recognize the porousness of our bodies and thoughts that leach into economics and materials, that transfer our wastes across the planet and into the deep future. We must allow for a certain doubt in our thought, one that eschews mastery in favour of the idiot, and insists on practices of slowing down, of hesitation, as Isabelle Stengers suggests in her cosmopolitical proposal.[41] It is not by neatly announcing the end of days that we can begin to change the path that we are on: and even in its inevitability, we have a responsibility to account for the slow violence enacted on the poorest in the world as well as other creatures. We must finally break free of the logic of plastic.

Notes

1 Duke Helfand, "L.A. Must Dump Water from Two Reservoirs," *Los Angeles Times*, 15 December 2007, www.latimes.com/local/la-me-water15dec15-story.html.

2 Francisco Vara-Orta, "A Reservoir Goes Undercover," *Los Angeles Times*, 10 June 2008, articles.latimes.com/2008/jun/10/local/me-balls10.

3 See the conversation with Sylvère Lotringer in this volume.

4 Beatriz Preciado, *Testo Junkie: Sex, Drugs, and Biopolitics in the Pharmacopornographic Era* (New York: Feminist Press, 2013), 33. See also Nicholas Mirzoeff, "Visualizing the Anthropocene," *Public Culture* 26, no. 2 (2014): 220–226, and Esther Leslie, *Synthetic Worlds: Nature, Art and the Chemical Industry* (London: Reaktion Books, 2005), 75–78.

5 "Plastic Art," *Oxford English Dictionary*.

6 Catherine Kavanaugh, "Plastic Balls Protect California Reservoirs" *Plastic News,* 3 January 2014, www.plasticsnews.com/article/20140103/NEWS/140109973/plastic-balls-protect-california-reservoirs.

7 Jeffrey L. Meikle, *American Plastic: A Cultural History* (New Brunswick, NJ: Rutgers University Press, 1995), 26.

8 Ibid., 5.

9 Andrea Westermann, "The Material Politics of Vinyl: How the State, Industry and Citizens Created and Transformed West Germany's Consumer Democracy," in *Accumulation: The Material Politics of Plastic*, ed. Jennifer Gabrys, Gay Hawkins and Mike Michael, (London: Routledge, 2013), 76–77.

10 Chelsea Rochman, Mark Anthony Browne, Benjamin S. Halpern, et al., "Policy: Classify Plastic Waste as Hazardous," *Nature* 494 (14 February 2013): 169–171.

11 My understanding of substrate is informed by Craig Dworkin's analysis, where no matter how mundane or "blank" an object may appear, it plays a crucial role in the complex articulation of communicative networks. See Craig Dworkin, *No Medium* (Cambridge, MA: MIT Press, 2013).

12 For a detailed examination of the historical, political, and environmental dimensions of underground cables, specifically those that traverse the oceans, see Nicole Starosielski, *The Undersea Network* (Durham: Duke University Press, forthcoming 2015).

13 Hawkins writes: "Plastic is represented as something that seems to have an unfolding logic already within it—it is an instrument for capital accumulation. The assumption is that plastic has intrinsic economic values that are realized in processes of industrial research or market application." Gay Hawkins, "Made to Be Wasted: PET and the Topologies of Disposability" in *Accumulation: The Material Politics of Plastic*, ed. Jennifer Gabrys, Gay Hawkins and Mike Michael (London: Routledge, 2013), 49.

14 For further reading on the importance of the cultures of circulation as the enabling matrix of social forms, see Dilip Parameshwar Gaonkar and Elizabeth A. Povinelli, "Technologies of Public Forms: Circulation, Transfiguration, Recognition," *Public Culture* 15, no. 3 (Fall 2003): 385–397; and for an analysis of the relationship of circulation to cities and infrastructure see Alexandra Boutros and Will Straw, eds., *Circulation and the City: Essays on Urban Culture* (Montreal: McGill-Queens University Press, 2010), especially Will Straw, "The Circulatory Turn."

15 Westermann, "The Material Politics of Vinyl," 69.

16 Victor Emmanuel Yarsley and Edward Gordon Couzens, *Plastics* (Harmondsworth Middelsex: Penguin, 1941), 149–52.

17 Bernadette Bensaude-Vincent, "Plastics, Materials and Dreams of Dematerialization," in *Accumulation: The Material Politics of Plastic*, ed. Jennifer Gabrys, Gay Hawkins and Mike Michael (London: Routledge, 2013), 22.

18 Max Liboiron, "Plasticizers: A Twenty-first-century Miasma," in *Accumulation: The Material Politics of Plastic*, ed. Jennifer Gabrys, Gay Hawkins and Mike Michael (London: Routledge, 2013), 134.

19 Ibid., 142.

20 Gay Hawkins, "Made to Be Wasted," 64.

21 Adam Minter, "Plastic, Poverty and Pollution in China's Recycling Dead Zone," 16 July 2014, www.theguardian.com/lifeandsytle/2014/jul/16/plastic-poverty-pollution-china-recycling-dead-zone.

22 Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2011), 2.

23 See Catherine Malabou, *What Should We Do With Our Brain?* (New York: Fordham University Press, 2008); Catherine Malabou, *Plasticity at the Dusk of Writing: Dialectic, Destruction, Deconstruction* (New York: Columbia University Press, 2010); and Catherine Malabou, *Ontology of the Accident: An Essay on Destructive Plasticity* (Cambridge, UK: Polity, 2012).

24 James Marriott and Mika Minio-Paluello, "Where Does This Stuff Come From?" in *Accumulation: The Material Politics of Plastic*, ed. Jennifer Gabrys, Gay Hawkins and Mike Michael, (London: Routledge, 2013), 180–181.

25 Leslie, *Synthetic Worlds*, 8.

26 This is the number given by Anthony Andrady, a chemical engineer and leading expert in plastics. See Alan Weisman, "Polymers Are Forever," *Orion* 26, no. 3 (May–June 2007): 16, www.orionmagazine.org/index.php/articles/article/270. However, one of the troubling things about plastic is that its lifespan is unknown.

27 Quoted in Meikle, *American Plastic*, 25.

28 Mike Michael, "Process and Plasticity: Printing, Prototyping and the Prospects of Plastic," in *Accumulation: The Material Politics of Plastic*, ed. Jennifer Gabrys, Gay Hawkins and Mike Michael (London: Routledge, 2013), 33.

29 Luce Irigaray, *This Sex Which is Not One* (Albany, NY: Cornell University Press, 1985), 115.

30 For notes and talks that relate to this argument in her upcoming book, see Elizabeth Povinelli, "Geontologies of the Otherwise," *Cultural Anthropology* (13 January 2014) culanth.org/fieldsights/465-geontologies-of-the-otherwise; Elizabeth Povinelli, "Keynote Speech" (presented at The Anthropocene Project: An Opening, Berlin, Germany, 20 January, 2013), youtu.be/W6TLlgTg3LQ; Elizabeth Povinelli, "Geontologies: Being, Belonging and Obligating as Forms of Truth" (talk presented at The Northern Institute, Charles Darwin University, Darwin, Australia, 1 October 2013), youtu.be/oRcEydtnM3w.

31 Jean Baudrillard, *Fatal Strategies: The Crystal Revenge* (New York: Semiotext(e), 1990), 12.

32 For an elaboration of Bratton's argument, and his particularly troubling assertion of accelerationism, see Benjamin Bratton, "Some Trace Effects of the Post-Anthropocene: On Accelerationist Geopolitical Aesthetics," *e-flux* 46 (June 2013), www.e-flux.com/journal/some-trace-effects-of-the-post-anthropocene-on-accelerationist-geopolitical-aesthetics.

33 Clive Hamilton, "The New Environmentalism Will Lead Us to Disaster," *Scientific American* (19 June 2014), www.scientificamerican.com/article/the-new-environmentalism-will-lead-us-to-disaster.

34 Meikle, *American Plastic*, 9.

35 *Lessons of Darkness*, directed by Werner Herzog (1992).

36 Fred Moten, "Black Kant (Pronounced Chant)," (paper presented at the California Institute of the Arts, Valencia, California, 18 March 2014).

37 Fred Moten, "Blackness and Nothingness (Mysticism in the Flesh*)," The South Atlantic Quarterly* 112, no. 4 (Fall 2013): 739.

38 Bryan Wagner, *Disturbing the Peace: Black Culture and the Police Power after Slavery* (Cambridge, MA: Harvard University Press), 1.

39 Moten, "Blackness and Nothingness," 746.

40 Peter Sloterdijk, *Terror from the Air* (Los Angeles: Semiotext(e), 2009), 108.

41 Stengers wrties: "It is a matter of imbuing political voices with the feeling that they do not master the situation they discuss, that the political arena is peopled with shadows of that which does not have a political voice, cannot have or does not want to have one. […] The cosmopolitical proposal therefore has nothing to do with a program and far more to do with a passing fright that scares self-assurance, however justified." Isabelle Stengers, "The Cosmopolitical Proposal," in *Making Things Public: Atmospheres of Democracy*, ed. Bruno Latour and Peter Weibel (Cambridge, MA: MIT Press, 2005), 996.