Vital Reenchantments: Biophilia, Gaia, Cosmos, and the Affectively Ecological

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Conclusion: Enchanted Popular Science and Its Afterlives

With *Biophilia* (1984), *Gaia* (1979), and *Cosmos* (1980),¹ we have moved from the inexhaustibility of a handful of dirt, to a planet that will stop at nothing, including dispensing of us in a fever, to maintain life, to a cosmos that “is rich beyond measure.”² The affective ecologies with which these works present us operate at vastly different scales, but these become more reconcilable with the march of time. This final chapter looks at the findings of the last three chapters in a more condensed fashion, and in particular at what these works of reenchantment hold in common. It does not shy away, however, from the subtle ways in which they differentiate themselves. These are all works that reenchant science and modern life by mobilizing affective wonder, by drawing attention to modes of interrelation in the present, but no two attempt this in precisely the same way. There are other vectors of comparison, moreover, that allow us to see these works more meaningfully in relation to one another: In addition to how they

reenchant and what role they assign to wonder, one may look more directly at their relation to the ecological. Here, this will mean examining which role each affective ecology assigns to the human, as well as the unique vision each work provides for an anti-sentimental ecology that is, nevertheless, keenly felt.

The claims and recommendations made by these works, as well as the attitudes that they assume, are more relevant now that we have entered the so-called Anthropocene: the age of the human. The second section here moves beyond the 1980s to the future of popular science: “The Poet-in-Scientist Now” (6.2) looks at how we can understand our current ecological quandary and how the role of popular science may be evolving because of it. In a world that is increasingly influenced by the human, the task of the poet-in-scientist is, more than ever, to show the ways in which background is nothing of the sort. A new generation of poet-in-scientists currently writes not about how a potential ecological crisis will limit the horizons of and opportunities to wonder, as Wilson, Lovelock, and Sagan did, but how we are currently shaping the contours of what, thirty years ago, we were calling the crisis that must be averted. The human seen in these vastly inflated, arguably geological, dimensions might be a cause for wonder anew, although not necessarily the type of wonder we associate with pleasure.

Finally, we turn to “Paths Unfollowed” (6.3), threads that I may have taken up briefly within this work, but which cry out for further investigation. Popular science enjoys more public attention now than ever before, and my plea at the end is that scholars in the cultural studies, in particular, begin to acknowledge the unique position of popular science and the pop cultural production surrounding it in the Anthropocene. In an era in which the cultural has revealed itself to be a coextensive and constitutive subset of the natural, as well as one in which the truth claims made by scientists are fought over as never before, the figure of the poet-in-scientist cries out for further investigation.
It should be clear by now why, in the pursuit of affective ecologies that operate in the present, I have turned to these works of popular science. They are far, far more than tools that allow a scientific elite to explain the foundations of their disciplines to a lay audience. There is, indeed, very little of the ivory tower to be found in them; the poet-in-scientist authors consistently explore how they are in and of the world, and how intrinsic this is to their science. There is also less hard science in them than one might expect. Instead, one is confronted with a proliferation of what Jeanne Fahnestock refers to as the “epideictic” — appeals to wonder and, less often, application. I have focused here on wonder, the affect which directs us to the experience of countless others, and which is, I argue, reenchantment in action.

These works discuss, explore, and push the bounds of their and our own “tiny sector of nature” as we read them. They operate in and insist upon the contingency of the present. Unlike in the more traditional green environmentalisms referred to in the introduction, hope is not invested in the figure of the child, and as the children inevitably grow up, endlessly deferred. Like in Morton’s dark ecology or the Dark Mountain Project today,

5 The Dark Mountain Manifesto begins: “Those who witness extreme social collapse at first hand seldom describe any deep revelation about the truths of human existence. What they do mention, if asked, is their surprise at how easy it is to die. The pattern of ordinary life, in which so much stays the same from one day to the next, disguises the fragility of its fabric.” See Paul Kingsnorth and Dougald Hine, “Uncivilization: The Dark Mountain Manifesto,” The Dark Mountain Project, 2009, http://dark-mountain.net/about/manifesto/.
hope is rather beside the point. *Biophilia, Gaia, and Cosmos,* as Morton would have it, “ooze...through despair”\(^6\) rather than attempting to sidestep it altogether. They point us in a direction very different from that pursued by so many mainstream environmentalist groups today. Not only is there no child to speak of within these texts, but there is also no charismatic megafauna, as in Greenpeace’s polar bear stranded in an increasingly warm ocean or the World Wildlife Fund’s panda, staring plaintively at the viewer. They direct us, instead, to the task of placing the human back in a milieu from which, in any case, we were never really absent. The polar bear and panda give way to more complex and ambiguous figures: Craven, for instance, in *The Edge of Darkness,* screaming from the hillside at the men who think only in terms of their own petty affairs, in terms of *bios,* and never in terms of the planet, in terms of *zoē.* Or Björk perhaps, who in “Crystalline” listens to “crystals grow[ing] like plants” in order to conquer her claustrophobia. There is no “saving the planet” here, because the logic of this simply doesn’t compute. These figures and the attendant concepts of biophilia and Gaia demand a more fundamental reconsideration of the bounds of the human Umwelt and the way we interact within it. They call for and articulate, at least fragmentarily, a new kind of ethics — not a series of prohibitions or guidelines, but “a composition of fast and slow speeds, of capacities for affecting and being affected on this plane of immanence.”\(^7\) They are explorations of what is possible with regard to the human relation to the eco-sphere, as well as how things, referring broadly to this constellation of relations, could become *otherwise.*

6.1.1 Wonder-machines: comparing cogs and gears
It is therefore possibility, rather than hope, that permeates *Biophilia, Gaia,* and *Cosmos.* We will not, at some point in the fu-

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ture, get ourselves “back to the Garden.” Wilson, Lovelock, and Sagan insist that we already inhabit a garden and, if anything, run the risk of expelling ourselves from it if we do not acknowledge and wonder at the fact now.

The works thus powerfully oppose, in a number of ways, the disenchantment narrative discussed in Chapter 2. They do so first of all by taking science out of the lab and embedding it within and relating it to the world of the reader. Their sheer accessibility runs counter to the alienated science supposedly ushered in by the industrial revolution. Secondly, they reject with varying degrees of explicitness the validity of the disenchantment narrative itself. Lovelock does so when he critically discusses the casualness with which we imply that “early man was in total harmony with the rest of Gaia,” but Sagan’s “we are made of star stuff” and Wilson’s insistence that our humanity is a result of our affiliation with the nonhuman are variations on the same theme. Thirdly, Wilson, Lovelock, and Sagan suggest that, if anything, affective investments in the world are enriched and deepened by scientific world-views. The process of investigation becomes catalytic rather than exhaustive. And, finally, even if one does not accept the idea that science allows us to realize (in both senses of the term) our own immanence, there are plenty of leaks, of “recalcitrant fugitives from rationalization,” to be found within the works. The authors here allude to the mysterious and infinite as often as they provide explanation. This is how the works discussed refuse to pander to notions that we have lost touch with “nature,” the world, and the cosmos, and that science is wholly or mostly responsible for it.

But they also actively reenchant, and this is where wonder comes into play. Affective wonder, as the realization that the affects one is undergoing are new, is the recognition of novel relations—something entirely precluded by a supposedly disenchanted world. Wonder allows the poet-in-scientists here, and

8 Lovelock, Gaia: A New Look at Life on Earth, 107.
the reader along with them, to attend to the fullness, even the excess, of the world and the universe and one’s own participation in it. Each work examined here, however, mobilizes wonder and reenchantments slightly differently.

*Biophilia,* in its more progressive, non-evolutionarily driven forms, focuses on the inexhaustibility of life and the notion that, more than any other creature, we are formed from and informed by this infinite vitality. This does not mean, of course, that we present no concrete danger to the biodiversity of life, only that, as much as we explore and affiliate, there will always be something more to experience and possibly disentangle. There are thus sources of wonder to be found everywhere, and the “brain is prone to weave the mind from the evidence of life, not merely the minimal contact required to exist, but a luxuriance and excess spilling into virtually everything we do.” 10 Wilson speaks here of the virtual dimension of life as much as the mathematical. He returns constantly to the idea that being human means encountering other *Umwelten* and their attendant affects, and that there are more of these than we can ever know. Try as we might, we only ever experience “a tiny sector of nature” because “[m]ore organization and complexity exist in a handful of soil than on the surface of all the other planets combined.” 11 Wilson’s affective wonder draws our attention to the virtual dimension of earthly life and the degree to which we are caught up in it.

*Gaia,* on the other hand, focuses not on life in the plural, but what it is capable of accomplishing in concert. Lovelock grants agency (albeit of an impersonal sort) to a planet formerly regarded as inert, and in so doing endows everything on it (whether organic, inorganic, or something in between) a metabolic function. As Latour writes, “it reacts, feels, and might get rid of us, without being ontologically unified.” 12 The reen-

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10 Wilson, *Biophilia*, 7.
chanting genius of Gaia is that the very contemplation of the entity, the very discussion of the concept, implicates the reader in its processes. It does not merely describe a process of reenchantment, but performatively enacts this process. Whenever our sensations are revealed as affects of the earth, every affect becomes novel. In this way, human processes are endowed immediately with renewed wonder as part of the larger Gaian metabolism, rather than merely being seen as “fouling the nest.” Science, too, acquires another, more wonderful dimension as seen through Gaia. David Abram points to a Gaian science in which experimentation, as in the alchemical tradition, becomes “a form of participation, a technique of communication or communion which, when successful, effected a transformation not just in the structure of the material experimented upon, but in the structure of the experimenter himself.” The Gaian scientist, in the pursuit of wonder via the expansion of the human Umwelt, is often, like Lovelock, an instrument maker.

Lastly, and perhaps most ambitiously, Cosmos informs us that every aspect of experience, and every affect, has its origins in a stellar furnace. “We are made of star stuff” is a reenchantment rallying cry for the ages. This is the cosmic perspective in a nutshell, and it works to immediately banish anything trivial, mundane, or terrestrial from experience. Life, more than anything, becomes something at which to wonder because of the sheer unlikelihood of such entities emerging in the violence, volatility, and comparative emptiness of space. As with Gaia, every sensation becomes something at which to wonder, but this time because it testifies to our relation with the universe. Thus, something as simple as the “heat on your upturned face


on a cloudless summer’s day” is endowed by the cosmic perspective with wonder.

6.1.2 Not all anthropocentrisms are created equal
These slightly divergent modes of wondering correspond to dramatically different visions of the ecological role of the human. All three works do embrace and wonder at the sheer unlikelihood and precariousness of life, and intelligent life most of all. They are, moreover, all careful not to view the development of intelligent life as as a departure from the rest of the kingdom of life. But this, really, is where the common ground ends. There is nothing inherently ecocentric or anthropocentric about an affective ecology, and these works demonstrate that an affective ecology may be anything from wholly indifferent to the human species, as in Lovelock’s *Gaia*, to revolving entirely around it.

Wilson’s biophilia, certainly, appeals to the latter. It has earned the appellation bestowed on it in Chapter 3: the most anthropocentric conservation ethic of them all. The human in Wilson’s writing is nourished literally and figuratively by life, and exists as a kind of affective composite of it: “Humanity is exalted not because we are so far above other living creatures, but because knowing them well elevates the very concept of life.” If we are to continue this exalted existence, Wilson implies, we must have the luxuriance and excess of the rest of life with which to affiliate. Survival is entirely secondary here. As Margulis and Sagan note, a biophilic ethic involves rather “the preservation of a certain quality of human life.” Biophilia is thus anthropocentric to its very core, but its emphasis on the human affiliation with life rather than mere survival moves us to ask more interesting and relevant questions about the way conservation is done. In Chapter 3, I discussed Project Isabela, the largest ecosystem restoration project to date, involving the extermination of the bounti-

16 Wilson, *Biophilia*, 22.
ful goat populations on several islands in the Galapagos in order to restore them to the state in which Darwin first encountered them. The project was highly controversial, both because of the number of animals killed (over 100,000) and because an idea of ecological Eden took precedence over many concerns held by the native human population. A biophilic orientation would have required the abandonment of this ecological ideal, calling for questions about what human actors really desired from life on the islands. This may not have done anything to simplify matters, but it does show that biophilia’s deep anthropocentrism is one that calls for something other than conservation for conservation’s sake. Within *Biophilia*, conservation is for fueling human wonder.

Sagan’s concerns in *Cosmos* are less geared towards conservation practice, but offer a compelling dual vision of the human: Our connection to the stars simultaneously enlarges and humbles us. *Cosmos*, on the one hand, asks for the relentless, both wonderful and terrifying, expansion of the human Umwelt via the exploration of space. The probing of the universe also becomes an act of self-discovery. If we are intelligent starstuff, with the “nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies…made in the interiors of collapsing stars,” it is clear, in any case, that we occupy an Umwelt far larger than we may have assumed. Much of *Cosmos* extolls the human as “the Cosmos grown to self-awareness,” bounded as such by few constraints, and this vision is indeed anthropocentric. On the other hand, Sagan is quick at other times to remind us that, seen from space, our entire planet is but “a mote of dust in the morning sky.”18 We may be the only known instance of intelligent life in the universe, but the earth is also the only planet known to harbor life and is, seen even from the comparatively short distances of neighboring planets, very small indeed. Sagan’s plea at the end of *Cosmos* is for the protection of not only human life, but also life in general. He contends that the earth is very probably all we’ve got, and very possibly all

there is. Seen from this perspective, Sagan’s glorification of the human becomes more tempered.

*Gaia* adopts a different tack entirely. As entity and ecosophy, Gaia is refreshingly indifferent to the human but constitutes a cautionary tale for us nevertheless. On Gaia, we are but another metabolic function. We cannot separate ourselves from the affects of the earth, and the very attempt to conceive of ourselves in this manner is a kind of anthropocentrism. Lovelock describes even the notion of pollution as anthropocentric, preferring to speak of waste products that, incidentally, we share with all other forms of life. That we seem to be producing a lot of waste products is cause for only short-term concern. We may drastically limit the life-span of the human species with our activities and carry whole ecosystems with us, but life and the living assemblage known as Gaia will go on. Gaia is radically geocentric, eschewing not just an attachment to the human, but also to life as we know it, although its more general commitment to life is unwavering. If humankind wishes to make a stand on Gaia, it must do so from a human place, while at the same time internalizing that we are an organ of Gaia that is fully expendable. With Gaia, we have neither the luxury of viewing the human as the apotheosis of all life, as in Wilson’s biophilia, nor the time, as in Cosmos, to contemplate our affiliation with the stars. We are instead Gaians who must come to terms with the fact that we share the affects of the earth.

6.1.3 Anti-sentimental environmentalism

The adjectives “anti-sentimental” or “non-sentimental” have cropped up far more than I anticipated when beginning this work. As I understand it now, this focus on feeling and sensation, on affective ethics rather than a sentimental morality, is responsible for the unique and lasting contributions *Biophilia*, *Gaia*, and *Cosmos* are able to make to ecological thought. These books refuse to pander to ideas of harmony with “nature” or pretend that we have been alienated from it, whatever it is, or

its inhabitants. What they ask is that we become more sensitive to our own embeddedness and interaction in the world. I would identify four uniquely non-sentimental aspects of these works, which render them invaluable contributions to ecological literature:

1. The first is their rejection of the recognition of kinship as a driving force in ecological thought. In none of these accounts are we told to protect life because we recognize ourselves in it. Life here is valuable in the plural, in its nearly infinite manifestations and as a forceful collective with which we may affiliate and be drawn out of ourselves — with which we may, in other words, become. The so-called charismatic megafauna (i.e. tigers, elephants, bears, and, arguably, our children) are entirely left out of the works. They seek instead to persuade the reader of the virtues of encountering the “strange stranger,” living forms and Umwelten of which we cannot even conceive. Thus Wilson’s ants, with which he has no illusion of becoming friends, are at the root of biophilia as an affective ecology; it is necessary that we experience and learn to embrace their very alienness. Similarly, Lovelock advocates focusing on biochemical guilds and serving as a kind of shop steward for microorganisms, rather than proclaiming stewardship merely with regard to megafauna. Notably, he points to theories that all large mammals, ourselves included, are merely hosts for countless anaerobic bacteria, forced to retreat as the composition of the earth’s atmosphere changed. Affective ecologies recognize the full depth and breadth of affiliation that is possible, decrying the notion that we only relate to creatures like us.

2. Secondly, these works highlight how “keep[ing] in touch” need not mean pretending that we ever lost it. They firmly

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20 In their essay on Gaia and Biophilia, Sagan and Margulis directly criticize ecological orientations in which these large mammals are somehow “more equal” than other ecological actors (“God, Gaia, and Biophilia,” 357).

insist on the human as, like every other life, immanent. What they do encourage is that we attend more fully to that in which we are implicated. For Wilson, this means acknowledging the extent to which our humanity has been and continues to be formed by the nonhuman. For Lovelock, this means becoming sensitive to affects larger than ourselves of which we are nevertheless a part. He encourages us to view our interaction with Gaia as “not unlike the tight coupling between the state of the mind and the body,”22 where, in Lovelock’s world, we are neither fully mind nor body. Latour, too, takes this up, describing this process as the “slow operation that consists in being enveloped in sensor circuits in the form of loops.”23 In a kind of planetary attachment therapy, “After each passage through a loop we become more sensitive and more responsive to the fragile envelopes that we inhabit.”24 Sagan, for his part, puts forward surprisingly concrete ideas for how we might get a better sense of the human in the vastness of the cosmos. His Golden Record, carried by the Voyager probes and launched just prior to *Cosmos* in the late ’70s, is a message to the stars as much as it is an invitation to consider and wonder at our place among them. The ecological crisis, these works suggest, is one of inattention or purposeful blindness rather than alienation.

3. Thirdly, perhaps because these works were penned by scientists who were heavily reliant on technology in their professions, *Biophilia*, *Gaia*, and *Cosmos* urge the abandonment of technological pessimism. Real instruments, such as the Hubble space telescope and the electron capture detector, and imagined instruments, such as the “motion picture projector of magical versatility” and the “Ship of the Imagination,” operate in these accounts to encourage affiliation and help us cali-

22 Ibid.


24 Ibid., 140.
brate and question the ways in which it happens. Machines in these accounts have the potential to serve as instruments of wonder, allowing for the expansion of the Umwelt rather than the continuation of business as usual. Technology exists for these authors as “a kind of creative mediation between nature and humanity.”

4. Finally, these works refuse sentimentality by confronting the contingency and precarity of life head-on. Life, and the development of intelligent life, in particular, is neither taken for granted nor presented as a phenomenon that will necessarily continue; Sagan reminds us that “[w]e are like butterflies who flutter for a day and think it is forever.” Life, the human included, will rearrange itself into different shapes and then dissolve into chemical equilibrium. From this perspective, too, conservation for its own sake becomes a ridiculous notion: Just what is this Eden we seek to resurrect, and for exactly how long? Conservation is not nearly as simple as the name implies. In many cases, it is an incredible feat of resurrection and continued meddling. Keeping in mind the scarcity of life in space and time, we must increasingly ask which affects we want to preserve. At their most eloquent, the arguments *Biophilia*, *Gaia*, and *Cosmos* make for the contingency of life also bleed into those that argue for the contingency of culture. Life was and will be otherwise, and so could our relation to it. This is the ultimate feat accomplished by their non-sentimentality. Rather than making the case on terms more recognizable to us for why, for instance, we must save the rain forest, they ask us to change. Popular science, like any form of literature, is capable of invoking a people to come. Refusing to assure us of our humanity, but still speaking in the first person plural, these works ask us to become biophiliacs, Gaians, and Earthlings.

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The Poet-in-Scientist in the Anthropocene

Affective ecologies and their attendant non-sentimentality become more important in an age that is all too human. Although this work never confined itself strictly to the period in which the works in the corpus were written, we will move fully into the present day, referred to increasingly often as the Anthropocene. The Anthropocene, more than the Holocene that in theory precedes it, demands an immanent popular science and the figure of the poet-in-scientist to write and embody it. There are good reasons, in other words, why biophilia and Gaia are still terms that crop up remarkably often in popular culture, ecological circles, and why Cosmos was remade in 2014. But here we will also begin to move beyond these works, to the future of a genre that must grapple with conditions that appear at a far remove from those described by the disenchantment narrative.

But first, how can we understand the Anthropocene? It is, in many ways, more of a dream come true than a nightmare scenario for humanities scholars. This is a postmodernism, if one dares to articulate it in this way, that has come to pass — “what you have when,” as Fredric Jameson tells us, “the modernization process is complete and nature gone for good.” At least at first glance, the Anthropocene appears to be the golden ticket that finally allows us to talk to scientists about the end of nature, or, at the very least, non-essentialist concepts of the so-called natural world. There is no escaping culture in the Anthropocene; the study of the human becomes the study of the earth, and vice versa. Described by the scientific architects of the term as a “quantitative shift in the relationship between humans and the global environment” and, more specifically, “our own species” becoming “so large and active that it now rivals some of

27 Fredric Jameson, Postmodernism: Or, the Cultural Logic of Late Capitalism (Durham, NC: Duke University Press, 1991), ix. Jameson continues, “It is a more fully human world than the older one, but one in which ‘culture’ has become a veritable ‘second nature.’” Latour will pick up on the term “second nature” in his own work on Gaia and the Anthropocene.
the great forces of Nature in its impact on the functioning of the Earth System, 28 the term was in fact coined by Eugene Stoermer in the 1980s. Paul Crutzen, atmospheric chemist and Nobel laureate, made famous for calling attention to the hole in the ozone layer, popularized the term in the early 2000s. 29 It largely stayed out of non-scientific mass media until the Royal Stratigraphy Commission decided to establish the Anthropocene Working Group in 2009 to evaluate whether or not to amend earth history to accommodate a new geological epoch. 30 Whether the idea of the human as geological force appealed to the human sense of self-importance, or simply provided an interesting spin on apocalyptic rhetoric surrounding global warming and ecological crisis, it began appearing more and more often in popular science journalism. In 2011, The Economist dedicated an entire issue 31 to the notion. The term has gradually trickled into the humanities as well. Historian Dipesh Chakrabarty was already articulating the implications of the new epoch for his own discipline in 2009. 32 Bruno Latour took up the term in “Waiting for Gaia,” a 2011 lecture already referenced many times in this work, casting the nature-culture relation as a Moebius strip, and also dedicating one of his 2013 Gifford Lectures to the topic.

There are two characteristics of the Anthropocene that cast a new light on the subjects with which this book deals. Firstly, the Anthropocene corresponds neatly to events that are often connected with disenchantment but is simultaneously at odds with the disenchantment narrative. The great volume of Anthropocene literature offers several options for when the period began, although a consensus has yet to be established: the dawn of

wide-spread agriculture, at roughly 10,000 BCE, the beginning of the Industrial Revolution in the nineteenth century, and the start of the nuclear era in the twentieth century—all of which have left their mark in the soil. For those in disenchantment camps, these dates are also meaningful. The beginning of agriculture marks our supposed alienation from the cycles of nature since it meant we were no longer as dependent on circumstance for food, the beginning of the Industrial Revolution marks the union of science and technology that would go on to produce moderns that were simultaneously insatiably materialist and alienated from the authentically material, and the nuclear era presents the ultimate victory of “man” over the most elemental forces of nature. From this perspective, the Anthropocene is disenchantment come to pass: We are now as gods. However, in the Anthropocene we are also gods that are consistently outwitted by the very forces we are supposed to have mastered. This is because the Anthropocene offers us no vantage point from the heavens with which to view that which we bring upon ourselves. In the Anthropocene, the human has its fingers in everything, but cannot possibly know the nature of all that it is affecting. The human is omnipresent, and very powerful indeed, but that power is always undermined by our embeddedness and inability to fully predict the dynamics of complex systems. Seen this way, the idea of the Anthropocene powerfully contradicts the disenchantment narrative. We might wish for a state in which we were more alienated—i.e. independent—from the earth. Along with Latour, Ben Dibley insists, in opposition to the narrative of alienation, on a narrative of “attachment” to go along with the Anthropocene that “posits that science, technology, markets and so on”33 have increased the number and intensity of human connections with so-called “nature.” The Anthropocene allows us to see that we have never lost touch; we have simply

not adequately attended to our affective and material engagements with the world.

Secondly, the Anthropocene, as geological time unfolding now, directs us to a new kind of temporality. Dibley has referred to the Anthropocene as the “crease of time”\(^{34}\) and indeed it seems to present the collision of many extra-human scales with human time. For Dibley, a Marxist, the Anthropocene is the collision of “the deep time of geology and a rather shorter history of capital,” while for Chakrabarty, as a historian, it presents the more general “collapse of the age old humanist distinction between natural history and human history.”\(^{35}\) Latour, too, picks up on this, noting, “The formula ‘geological time’ is now used for an event that has come and gone more quickly than the Soviet Union! As though the distinction between history and geostory had suddenly disappeared.”\(^{36}\) Chakrabarty, moreover, states that, although we have always been able to conceive of ourselves as biological agents, the idea of geological agency “scale[s] up our imagination of the human”; we are no longer merely *bios* and *zöe*, but also *geos*.\(^{37}\) And in the Anthropocene, as never before, the present matters because it is conceivable in deep time.

It is for the Anthropocene’s strange entwining with and rejection of the disenchantment narrative, as well as its inauguration of a new kind of temporality, that the period calls for the kind of poet-in-scientist and attendant immanent popular science upon which this work has focused. The popular scientist as mere explicator will not suffice in the Anthropocene. From which place is it even possible any longer to explicate? Instead, the poet-in-scientist, I wish to suggest, must be able to illuminate the ways in which we are already tangled up, with which we, according to Barad, “intra-act,” and gesture, with the help of an embedded science, to the significance of the present. That the poet-in-scientists in this project have accomplished these tasks

\(^{34}\) Ibid., 140.


by becoming wonder-machines does not necessarily mean that the only way to approach popular science in the Anthropocene is through wonder. At the same time, there are indications that the Anthropocene offers new opportunities for exploring our relation to this particular affect.

Two more recent works of popular science point to new strategies the poet-in-scientist might pursue in the Anthropocene. The first is *The Earth after Us*, written by Jan Zalesiewicz, a geologist who also happens to be the head of the commission deciding upon the bureaucratic fate of the Anthropocene. Zalesiewicz’s prose is decidedly more detached than that explored in this work, and this is part of the conceit that drives the book: to examine “*Homo Sapiens* from the standpoint of a future paleoecologist.”

We have, in other words, all died out, and an extraterrestrial has come to Earth to exhume our civilization from the sediment filled with our building material and plastic, which have by now been compressed into a layer in the rock. Zalesiewicz is quick to point out that geological strata that already exist have been formed by life in the past, and that “[l]ife has not been passive in this regard,” but he also muses that “if we make enough of a mess of the world, we might compete with the Yucatan meteorite, or with the mysterious forces that, almost exactly a quarter of a billion years ago, suffocated most of the Earth’s oceans and killed off an estimated 95 per cent of the world’s species, bringing the Paleozoic Era to a dead halt.”

The bottom line is that, while we are not very special with regard to our general ability to leave traces, we are likely the first single biological entity to leave a trace this pronounced, and certainly the first that is cognizant of the fact. After many diverting discussions of the spirit in which these future paleoecologists might unearth us (Zalesiewicz suggests that they might regard us in much the way that we do the dinosaurs), and the chances

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39 Ibid., 5.
40 Ibid., 23, 156–57.
of finding fossilized human remains, Zalesiewicz makes the following proclamation about the impact of the human at the end of the work:

[W]hatever we as a species do from now, we have already left a record that is now indelible, even while the scale of this fossilization event is still in question, and within our power to determine. Humankind has, through its various activities, done enough to preserve its relics into the far future. The ‘environmental’ changes that we have set in train will, without a shadow of a doubt, be translated into the solid rock of the Earth. The Urban Stratum is now, in substantial part, effectively eternal. More: our actions now will literally be raising mountain belts higher, or lowering them, or setting off volcanoes (or stifling them), or triggering new biological diversity (or suppressing it) for many millions of years to come. The knock-on effects of our geochemical experiments are unpredictable in detail, but will be substantial and likely surprising. We have left our mark. However we are interpreted in some distant future, there will be little doubt that we will be associated with — and responsible for — some of the most extraordinary geology of this, or any other, planet.

That “we have left our mark” in so ostentatious a manner allows us to wonder at the scope of what we currently refer to as the ecological crisis. The present in which we affiliate is now, we are told, guaranteed to last in deep time. What is so fascinating about Zalesiewicz’s account is that the entire earth becomes, like the Golden Record, a kind of deep time capsule for the human. The difference here, of course, is that it is time itself, and not Carl Sagan and his team that will choose the contents. Zalesiewicz refuses to issue recommendations based on the fact that what we do now will be raising mountains long after our ancestors are dead, and, indeed, there is little that can be done. It

41 Ibid., 191, 159.
42 Ibid., 240–41.
becomes clear in the course of the work that our plastics and our building materials, what we leave as traces and ends up, coincidently, as effectively eternal, is not necessarily what we value. The punch that *The Earth after Us* pulls is that it directs us with its focus on our relatively impoverished existence in the strata of deep time to the richness of what we experience and make now.

The second work of popular science one might point to is Elizabeth Kolbert’s *The Sixth Extinction: An Unnatural History* (2014). Kolbert, strictly speaking, is not a poet-in-scientist, but a scientist-in-poet, a journalist and writer who has become well known for covering popular scientific topics. *The Sixth Extinction*, like *The Earth after Us*, catalogs a deed that has already been done, or at least embarked upon with such earnestness that it may as well be: the massive loss of biodiversity caused by humans. In Kolbert’s book, as in Zalesiewicz’s, however, we may wonder at the enormity of the deed. Kolbert makes it known that we can never really know precisely what we have lost and how much potential has been exhausted. The work is a study in the way in which background extinctions, which biologists speak of as happening constantly, become, in various regions around the world, nothing of the sort; background becomes foreground, as in so much of the material examined here, and background extinction moves rapidly into anthropogenic mass extinction. For Kolbert, as well, the Anthropocene is not another code word for describing our alienation from the natural world, but a kind of shorthand for the now explosive way in which we meddle with it:

One of the striking characteristics of the Anthropocene is the hash it’s made of the principles of geographic distribution. If highways, clear-cuts, and soybeans plantations create islands where none before existed, global trade and global travel do the reverse: they deny even the remotest is-

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44 Ibid., 15–16.
lands their remoteness. The process of remixing the world’s flora and fauna, which began slowly, along the routes of early human migration, has, in recent decades accelerated to the point where in some parts of the world, non-native plants now outnumber native ones. During any given twenty-four-hour period, it is estimated that ten thousand different species are moved around the world just in ballast water. Thus a single supertanker (or, for that matter, a jet passenger) can undo millions of years of geographic separation.45

Kolbert highlights unusually well the manner in which we have created, unbeknownst to us until recently, a garden of our own making. It may not be a garden we find very appealing or which will sustain us for any length of time, which she is not reluctant to point out. Nevertheless, this work adopts much of the same strategy as Zalesiewicz’s, leaving us to puzzle out why and how we ought to care about that with which the Anthropocene presents us.

These are works that follow in the footsteps of Biophilia, Gaia, and Cosmos. They direct us to an ecology of the present and insist that how we engage with the world right now does and will matter. Zalesiewicz’s paleoecologist of the future is no different from Sagan’s Ship of the Imagination or Wilson’s “motion picture projector of magical versatility”—only now the deep time lens has been turned back on us. Kolbert’s work, too, is an effort to situate the human in deep time, to explain concretely how our impact may be on par with that of an asteroid. These works, like their predecessors, embody a science that does not merely explain our contemporary reality, but exists in the midst of it and helps us negotiate positions of objectivity from which we might begin to systematically articulate what we already feel as the staggering influence of our species. Increasingly in these accounts, the world is the subject of an experiment that has no control.

Biophilia, Gaia, and Cosmos have certainly prepared the ground for works like Zalesiewicz’s and Kolbert’s, but the more recent works also react to the conditions we are now beginning to realize characterize the Anthropocene. As I alluded to before, they do not, like Rachel Carson’s Silent Spring or Wilson’s Biophilia, read as cautionary tales; much of the deed has already been done. As such, they do not expound at length on the infinite varieties of life and the wonder that arises when confronted with it. They are works, rather, that insist that an awful lot has been lost. If they offer a kind of wonder, it is characteristic of a new, bleaker kind of reenchantment centering around the human. There is wonder, possibly of a terrible sort, surrounding the realization that we have, unbeknownst to ourselves, left virtually nothing untouched. We have created a series of new Umwelten in our image, although we are far from knowing them well at all.

6.3

Paths Unfollowed: The Poet-in-Scientist Lives On

This project has opened my eyes to the wealth of work, and particularly cultural studies work, on popular science that has not been done. Aside from Lessl’s work in the 1980s,46 two volumes of essays from the ’80s and ’90s,47 and Sarah Perrault’s recent Communicating Popular Science48 (none of which are strictly cultural studies), popular science has received shockingly little

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46 See Section 5.5 in this volume.
48 As the full title, Communicating Popular Science: From Deficit to Democracy, suggests, the work takes a pragmatic look at popular science, examining its potential to democratize the institutions of techno-science (New York: Palgrave Macmillan, 2013).
CONCLUSION

academic attention. Despite the fact that it continues to garner high ratings on television, to produce best-sellers, and to launch new popular science stars like Neil deGrasse Tyson, it seems, like many other popular genres (at least until very recently), to have been largely neglected by cultural studies. It is possible that scholars in the humanities consider works of popular science insufficiently literary, or naïve in their treatment of subjectivity. I hope to have demonstrated here, however, that neither is the case. The genre is a particularly important one, even among other popular genres, because it is not merely dedicated to describing how things work. It is capable of mediating the reader’s or viewer’s relation to the scientific establishment, the planet, and the reaches of outer space, and all the more effectively because it does so under the banner of science. I would like to suggest, moreover, that the figure of the poet-in-scientist has only gained more traction since Sagan’s time, and that there are two aspects of this figure outside the scope of this work that deserve further investigation.

The first is the enormous amount of pop cultural production surrounding the figure of the poet-in-scientist. Ever since Cosmos first aired in 1980, there has been a dizzying variety of it, and the internet age is only accelerating the rate at which it is produced. Whether one looks at popular YouTube remixes of Sagan’s own work combined with Stephen Hawking’s,49 the

49 See “A Still More Glorious Dawn Awaits,” which is not only a quote from the first episode of Cosmos, but also the chorus from a 2009 YouTube video with nearly ten million views. A three-and-a-half minute musical remix of the show nearly thirty years after the fact, Sagan’s imitation of a whale provides the beat and auto-tuned lines from the series form the lyrics. “If you wish to make an apple pie from scratch,” a cyborg Sagan intones, “you must first invent the universe.” Stephen Hawking (who we are much more accustomed to hearing mediated by the digital), featured in the bridge, delivers a few lines from Stephen Hawking’s Universe, his own PBS series from the 1990s. Shots of Sagan, wondering, in awe, alternate with those of the untrammeled terrestrial and simulations of the Milky Way. melody-sheep, “Carl Sagan – ‘A Glorious Dawn’ ft Stephen Hawking (Symphony of Science),” YouTube, September 17, 2009, https://www.youtube.com/watch?v=zSgiXGELjbc. The video is the work of video artist John Boswell;
numerous documentaries dedicated to the lives of the scientists, Johnny Carson’s brilliant parodying of Sagan in the 1980s, or the sudden emergence of internet memes featuring gifs and images of poet-in-scientists like Sagan, Hawking, and deGrasse Tyson with captions like “smoke weed everyday”, it is clear that the poet-in-scientist is alive and well in the popular imaginary. A proper study of this pop cultural production would certainly also broaden the temporal scope of the investigation to include figures like Stephen Hawking, whose *Brief History of Time* would, upon its publication in 1988, not only outsell *Cosmos* and spawn its own PBS series, but give rise to several bio-pics dedicated to the man, and Neil deGrasse Tyson, whose public profile looms even larger than his poet-in-scientist predecessors. As the star of the 2014 remake of Carl Sagan’s *Cosmos* — *Cosmos: A Spacetime Odyssey* — he explicitly frames himself as Sagan’s successor, recounting his visit to Sagan’s Ithaca home as a teenager and Sagan’s kindness to him. And as with Sagan, the masses have officially dubbed him a meme, and the corresponding images and gifs, often used completely out of context, are widely available for use and re-appropriation. This is only the tip of an iceberg that testifies to the fact that, although these figures are certainly emissaries for the scientific academy, they are celebrities in their own right who have been lent some of the luminosity of the heavenly bodies that they study, and whose own star quality doubtless now informs the relation to the sky enjoyed by many of us.

Secondly, further work might investigate the unique way in which the poet-in-scientist, particularly those with back-

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50 The image, as far as I can trace it, originally appeared on Carl Sagan Rocks!’s Tumblr page, April 30, 2013, http://carlsaganrocks.tumblr.com/post/49310250368.


grounds in astronomy and astrophysics, is able to play out and often upend tensions between sincerity and authentic admiration, on the one hand, and irony and kitsch on the other. If the books and series authored by the popular scientists feature awe-filled moments that initially produce “a tingling in the spine,”53 in their afterlives online and in parody, the effect of these moments metamorphoses, almost too easily, into a cringe. This cringe, however, does not undermine the tingling, but coexists unproblematically with it. The sincerity of the scientist-priest communicated in the excess of sentiment or affect involved in the popularizing effort is only reconfirmed by attempts to inject it with irony. Perhaps because of their association with the scientific academy, the figure of the scientist-priest stands as one of the few bastions of sincerity in a cynical era. In the pop-cultural production surrounding the figure, the celebrations of wonder and the numinous can simultaneously be embraced as an alternative form of spirituality and treated as a kind of reenchantment kitsch. Gifs of Carl Sagan overlaid with text, extracted from Cosmos, proclaiming that the “total number of stars in the universe is larger than all the grains of sand on all the beaches of the planet earth”54 can thus exist side-by-side with images of Sagan in his signature turtleneck promoting the consumption of marijuana. In speaking about the infinite and numinous as often as the rational and knowable, these figures influence, in fascinating and complex ways, our relation with the scientific establishment and the world. The ambiguity of these poet-in-scientists and their attendant reenchanting tactics today, moreover, points to the fact that our willingness to embrace even this first of affects, wonder, may fluctuate according to historical moment and milieu.

This work, however, has stuck to a set of works and artifacts inspired by them that are, for the most part, perfectly sincere. *Biophilia, Gaia,* and *Cosmos,* all published within five years of one another, are important records of attempts from within the modern scientific academy to construct and explore enchanted materialisms. And they are not merely titles, but concepts that have served and continue to serve as the basis for affective ecologies with wonder at their core. They are popular science, but they are also hot philosophy, and they continue to weave us into a world from which we were never really separate, to animate the organic and the inorganic, and to make the world dance.