

# A Symbiological Approach to Sex, Gender, and Desire

in the Anthropocene

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Recent developments in molecular biology imply that classic distinctions between nature and nurture or biology and culture are not applicable to the human ecological niche. Research in epigenetics shows that the effects of culture on nature go all the way down to the gene and up to the stratosphere, and the effects of biology on culture are similarly inextricable (Gilbert) (Griffiths; Meloni). Living systems almost invariably involve the interaction of many kinds of organisms with a diversity of technologies. The Anthropocene—the age of human cultures and technologies impacting on natural environments—changes rapidly, and to understand and manage its functioning requires perspectives from each domain. Symbiology is the study of such relations-in-process. The kinds of relations we study include mutualism, parasitism, domination, recognition, separation, solubility, symmetric mutuality (relations among equals in power or status), asymmetric mutuality (relations among unequals--parents/offspring, teacher/pupil, human/nonhuman animals), reciprocity, alienation, isolation, autonomy, and so forth, and these relations are discernible throughout nature and all cultures, implying a politics.<sup>i</sup>

The first part of this essay will describe a symbiological approach to gender and sexuality; the second, a symbiological approach to literature and some examples of gender and sexuality in symbiological literature. Both are intended to provide more intimate accounts of the Anthropocene than the typical big pictures of global warming and climate change. While grand and world-historical, to be sure, the Anthropocene also affects the most intimate aspects of our lives.

## I. Sex, Gender, Desire

<sup>1</sup> Forthcoming *Angelaki: Journal of the Theoretical Humanities and Women Writing Across Cultures*, Ed. Pelagia Goulimari (Routledge 2017)

The nature of sex and its relation to gender are questions that fall centrally within the remit of biophilosophy. Both sex and gender should be understood as the outcomes of developmental processes more or less stabilised by a wide variety of more or less variable factors. Understanding the nature of these processes and their social and biological causes is essential for comprehending the nature of gender, its relation to sex, and the extent to which these are mutable.

Within the symbiological approach, we do not ask what percentage of our sex or gender or sexuality is due to nature (biology) and what to nurture (culture). Because symbiology denotes a loop of continuous interrelated developments between nature, culture, and technology, it is better to understand sex, gender, and sexuality as dynamic, developmental systems, as processes rather than fixed entities or identities. For complex multicellular organisms, development is not predetermined “in the genes” but a continuous process of interaction between the developing organism and its environment or niche (Odling-Smee). Although the normal paradigm of a human animal tends to be an adult in the so-called prime of life, we could as easily think of a fetus, a child, or an old person: what is fundamental, biologically, is a life cycle, a process, or a development.

This symbiological approach to sex and gender contradicts a popular biological “big picture” that assumes that different evolutionary pressures lead to sexually specific genes, which lead to sexually differentiated brains, which lead to gender-specific behaviours. Our genomic loop, rather, describes the genome as neither static nor fixed, not a programme that directs development of the organism but rather one participant in a dynamic process highly sensitive to a range of the external influences that make up its particular niche. Parents provide genomes for their offspring, but they also provide the sequence of environments that channel development in particular directions.

Whereas reductionist methodologies tend to analyze a thing into its (usually smaller and smaller) parts, a process is naturally analysed into stages, although in neither case can we assume that the divisions are clear or unambiguous. Even before birth, in the maternal pre-natal niche, each of the four stages of sexual differentiation is permeable to environmental interference.<sup>ii</sup> However, the following provides a sufficiently clear series of stages for present purposes.

1. *Chromosomal sex.* Most women have two X chromosomes, and most men have an X and a Y chromosome; and they originated from a fertilised egg with those chromosomes. The word ‘most’ is very important, however. First, not all humans have either an XX or an XY genotype. There are people with XYY, XXY and XO chromosomes (or karyotypes), of which the first are generally assigned a male gender, and the last two are generally treated as female. Second, for various reasons, now including elective reassignment, later stages in gender development do not always coincide with chromosomal sex.

2. *Fetal gonadal sex.* By 12 weeks most foetuses have embryonic gonads, irreversibly committed to becoming either testes or ovaries. The development of testes appears to be triggered by a gene on the Y chromosome the product of which binds to a gene on chromosome 17, and triggers a cascade of events involved in the production of the testes. A different sequence of genetic events pushes the as yet undifferentiated gonad in the direction of becoming an ovary. The Y chromosome gene just mentioned is known as the Sry gene, which stands for Sex Reversal on the Y chromosome, echoing the curious idea, dating from Aristotle, that being female is a default. The persistence and untenability of this idea is noted by two experts on the relevant genetics: “The discovery that gonads develop as ovaries in the absence of the Y-chromosome (or, more specifically, the Sry gene) supported the prevailing view that the testis pathway is the active pathway in gonad

development. However, as Eicher and others have emphasized, the ovarian pathway must also be an active genetic pathway” ( (Brennan) citing (Eicher)). Of course, if the Sry gene is indeed the relevant “switch” it might equally well be described as preventing ovary development. In neither case is the ensuing genetic cascade fully understood.

3. *Fetal hormonal sex.* As the gonads develop they begin to produce their characteristic mix of hormones. The reproductive system, under the influence of these hormones, begins to differentiate towards characteristically male or female physiologies. Again, this depends not only on the production of hormones, but also on the proper functioning of receptors that recognise these hormones. So, for example, occasionally XY foetuses carry a mutation that hinders androgen recognition, and produces children born with highly feminised external genitalia. If everything follows the standard path, however, this leads us, finally, to

4. *Genital sex,* the standard criteria that are used to distinguish the sex of babies at birth.

The process of foetal differentiation, then, is complex and multifactorial. While most babies will be born either with an XY genotype and typical male physiology, or with an XX genotype and female physiology, there are many ways in which these typical outcomes can be derailed. It is no surprise that there are a significant number of atypical outcomes, sometimes described as intersexed, or, more normatively, moralistically, “Disorders of Sex Development.”

The next crucial point in human development is, of course, birth. This is the point at which the wider community decides whether a baby is a boy or a girl. In the cases where this decision is difficult, standard medical practice has been to attempt to adjust the baby to one or other of the standard kinds. This often involves surgical reshaping of the external

genitalia and treatment with hormones. The *exhaustive* division of people into two sexes is not a reflection of how things are in the world but of a social policy that everyone must be assigned to one or other of these categories. Very recently Germany, Australia and New Zealand have allowed babies to be registered at birth as of indeterminate sex, though this move is highly controversial, and has been criticised by some advocates for intersex people as maintaining a fixed and determinate set of categories.

To a rough approximation gender begins at birth, though techniques of foetal surveillance such as ultrasound may rapidly be changing this. And the countless institutions that enforce gender—Fausto-Sterling calls them gender fortifications (2012, 10)—require that it be decided on which side of this fundamental dichotomy every individual falls. On endless forms we must say whether we are male or female—a question generally framed as a request for our sex, though more accurately it should ask for our gender. As noted above, however, in some places this dichotomy is being challenged, and the effects of this on the gendered organisation of social life are as yet impossible to predict.

At any rate, after birth development moves on. Developmental processes tend to be very stable for good and obvious reasons. Indeed life would be impossible if there were not developmental processes that fairly reliably reproduced in offspring the characteristics of parents. Parents not only provide genomes, they provide for their offspring the sequence of environments that channel development in the typical direction. This may be no more than providing exactly the right place to deposit an egg, or it may involve creating a complex built environment such as a bird's nest, a beaver's dam, or a termite mound (Odling-Smee, Laland and Feldman, 2003). It will often also involve imparting behaviour through imitation or other kinds of training; and the training imparted will typically be that to which the parent, in its development, was exposed.

Humans have taken the complexity of these developmental processes far beyond anything else in the natural world. The environments, or epigenetic niches as biologists call them, in which we place our children have reached a bewildering complexity, parenting is an often frighteningly difficult skill, and socially provided institutions from maternity wards to universities are designed to contribute to the development of our offspring. Because so much of the developmental matrix in which humans grow is constructed by us, it follows that we have unparalleled abilities to change the developmental trajectories of our children. As with everything else in the Anthropocene, it is not easy to change these institutions, still less is it easy to predict the consequences of changes that we make; but it is possible. Feminist scholars have for decades been pointing to the variety of gender systems found in different places and at different times, and they have consequently inferred that the presence of a particular system is always contingent. Our critics, committed to a biologically reductive view of gender development, have claimed that this diversity is largely illusory. But given the symbiological approach to development there is no reason to suppose that things are not as they so clearly seem. The institutions and norms surrounding gender development have diverged in different places and over time, and the gender system has changed too. Gender is thoroughly norm-ridden. We teach our children how boys and girls, men and women ought to behave, and often that they ought to behave differently from each other.

We are now in the position to turn from sex and gender development to the development or evolution of *desire*. Being gay, lesbian, straight, bisexual or pansexual is a developmental outcome. Like all human developmental outcomes it results from a complex interaction between internal, including genetic, and external causes. Fausto-Sterling's research on the development of desire is probably the clearest to date. She asks, how do events in the social sphere become events taking place in an individual? How does

information cross the border from outside to inside an organism? (2012, 14). Sexual desire has a neurophysiological component that individuals interpret as pleasure and attraction. Over time, an underlying neurophysiology develops in response to specific experiences of pleasure/attraction and perhaps aversion. To study the development of adult sexuality and desire, we must start by understanding the physiology and embodiment of pleasure from infancy—Fausto-Sterling says parenthetically “Freud—are you still there?” (2012, ch. 6 loc. 1394)—through childhood, adolescence, young adulthood, into middle and old age, through all the stages of a life cycle. Dopamine, a chemical made in the human midbrain by nerve cells with a reputation for strongly responding to rewards, may also incite aversive responses to non-rewarding situations. Erotic tastes, like tastes for fast food or slow death, *develop* over time; desires evolve through inner and outer events (see (Berlant).

A final striking perspective on the ontogeny of desire, the developmental process that leads to the orientation toward one object of desire rather than another, is provided by the much-debated issue of pornography. Prominent feminists have suggested that pornography, or certain forms of pornography, may promote violence against women or normalize various demeaning treatments of women. This may well be so. Psychiatrist Norman Doidge ((Doidge)) provides a compelling argument that pornography can, at any rate, radically reshape sexual desire. He describes patients becoming increasingly addicted to pornography and simultaneously increasingly unable to become sexually excited by their live partners. He also describes the evolution of pornography from the relatively uncomplicated depiction of sexual intercourse to the growing menu of violent, abusive, or simply Other genres currently available on the internet. As an example of the outside coming in, of neuroplasty or the brain altering due to external environment, Doidge reports that consumers of internet pornography may reach a state where they are sexually aroused not just by thinking about the activities performed in pornography, but by thinking of the

computer itself, so that boys become aroused by the sound of the operating system when the computer is switched on.

Desire, it appears, is indefinitely malleable, and can be shaped in the most unexpected ways. Fausto-Sterling concludes that bodies are not bounded: to understand sex, gender, and sexuality we have to study how sensory, emotional, and motor experience becomes embodied. We should accept the complexity and contextual nature of desire.

The picture I have sketched is one in which sex, gender, and sexuality point to the most typical outcomes of developmental processes, but outcomes from which many individual trajectories diverge. At birth, or perhaps sooner as prenatal surveillance becomes more and more routine, the male/female dichotomy of sex is normatively enforced, with medical intervention common in response to atypical individuals. This dichotomy is then the basis for a more systematically normative dichotomous gender fortification. While it is still commonly supposed that the stages of this process are largely determined by genes, the growing understanding of the complexity of human development, and of the deep entanglement of internal and external influences that development involves, make this kind of genetic determinism wholly implausible. Essentialist perspectives on sex, gender, and sexuality are misguided.

So what of the future? Sexual differentiation is no more immune to external, epigenetic influences than are other aspects of physiological development within the Anthropocene. The system of gender differentiation may act causally on physiological articulations of sex. As many individuals fall in the gaps between male and female, hetero- and homosexuality, there is much to be said for relaxing the normative dichotomies. Rather, we might see male and female pathways within a wider range of possibilities, perhaps ever widening as we increase our tolerance of diversity. Even further, exceptions to



sex/gender/sexuality dichotomies should be welcomed as reminders of the flexibility and open texture of the developmental process.

## II Sex, Gender and Sexual Desire in Symbiological Literature

A symbiological approach to modern literatures might consider how global processes criss-cross local niches with their particular mixes of nature, culture, and technology. Because they tend to represent total environments of nature, culture, and technology, novels may be especially productive sites to explore biological, cultural, and technological relations-in-process, including the processes of gendering and desire. (After a lifetime of literary engagement, I cannot think of a novel that does not include gender, even if only, as in some science fiction, through its negation or sublation.) Elsewhere I have considered certain geopolitical commodities linking the production and reproduction of life: water, cotton, tea, rice, petroleum, coffee, tobacco, sugar, bananas, opium, or other commodities around which lives and literatures are built. I have considered literatures about total environments, such as novels called *Yeast*, *Oil*, *Water*, *Salt*, *Men of Maize*, *Wolf Totem*, *Rickshaw Boy*, *Opium Family*, and so forth. Here I use SU Tong's novel *Rice* (1990), as an example of how a symbiological approach can make sense of literature that might otherwise seem to be merely decadent, or even pornographic, in superficial senses.

Because of the preoccupation of “worrying about China” (Davies) that was central to modern Chinese literature before the founding of the People's Republic, the extreme forms of Decadent literatures that appeared in transitions from traditional to modern societies throughout the globe were infrequent in Chinese literature. There is one author, however, whom reviewers typically brand as decadent. Here are some typical quotations from Su Tong's 1990 novel *Rice*:

“The subtle fragrance of raw rice and the strong scent of a woman’s sex achieved a wondrous unity on the palms of his grimy hands.” (Su, Trans. 1995, p. 78)

“Rice enveloping feminine flesh, or feminine flesh wrapped around rice, always drove him into a state of uncontrollable sexual desire” (129)

“Whoring was his great pleasure. And wherever he went he carried a small cloth bag filled with raw rice; at the critical moment, he would take out a handful and cram it inside the woman.” (159)

Reviews of *Rice* in both the Asian and Anglophone press—here randomly selected from the internet--responded with condemnations of its decadence: “Disgusting”; “Graphic perspective on the psyche of cruelty”; “Sadistic”; “extreme egotism”; “There is no reprieve, no justice and no individual triumph. At the end, the reader is just left exhausted; as having gone through a dark tunnel of despair and wickedness only to perversely yearn for more”; “All of his peasants are ignoble; all of his capitalists are corrupt; and there’s no redemption in sight.” Yet one review, in the *New York Times* (20 Nov. 1995), makes the novel sound like Dostoevsky. Although Dostoevsky is much more than Decadent, his readers will know that he also frequently exhibits the concerns and characteristics of Decadent writers of the later nineteenth century, during which Russia, like Europe generally, was undergoing massive change in response to the processes we associate with modernization (Gagnier). The *Times* reviewer could be writing of *The Brothers Karamazov* (1878-1880) transposed to 1930s Shanghai: “The Great Swan Rice Emporium is turned into a minor sort of hell. There are loose women, gangsters, sexual predators, gamblers, weaklings, tyrants, prostitutes—the whole ill-favoured, deformed human family.”

Yet in our symbiological view, in *Rice*, Su Tong was following the events of China in the 1930s and showing typical decadent patterns of distorted relations of part to whole:

civil war between communists and nationalists; war with Japan, in which torture was rampant and many were betrayed by collaborators; catastrophic flood and famine; widespread venereal disease; and “the Food Problem” around rice, the traditional symbol of Chinese civilization and Heaven’s bounty. In the novel, rice is food, rice is wine and vinegar to drink and bathe in (as relief from syphilis), rice is a bed to sleep and have sex on. Rice fills the vaginas of wives and prostitutes and is a murder weapon to smother, and a tool of suicide to strangle, children. Rice gives people their names like Rice Boy, and it is the only source of wealth.

For those of us interested in the relation of literary forms like Decadence to social formations, it is significant that rice is the geopolitical commodity par excellence. Providing 23% of the world’s calories, in the 1930s it manifested itself as the Food Problem and the nationalists tried desperately to regulate its balance of trade, while, partly in response to the Food Problem, Chairman Mao conceived of the Great Leap Forward of the 1950s. The 1930s were an era of war and modernization, in which China arguably became a modern national economy through a regime of social surveys and quantification, in part in response to the Food Problem (Lee, (April) 2010). The response to the Food Problem was so intense that high-ranking members of the Guomindang proposed that Chinese universities should stop admitting students of humanities and laws for a decade in order to promote science and technology exclusively. Rice was in every sense of the theoretical terms, a geopolitical *actant* and an *event*.

My point is that rice, the decadent fetish in the novel—Freud also defined fetishism as a repressed relation between part and whole (Freud, 1927)—is the geopolitical commodity as decadent fetish, representing the protagonist’s lost home and lost mother, the only source of consolation/compensation for extreme loss and subsequent lives of humiliation. “Settling finally on the storeroom, he rolled up his mat and fell asleep naked on a mound of

rice. It was rice, and rice alone, that had a calming, cooling effect on him; all his life it had comforted him” (241). The last lines of the novel show the relation of part to whole at that moment in China’s history, “RICE—His head moved toward the mound of rice as he uttered one last word. . . He knew only that he had been an orphan ever since he could remember, and that he had fled Maple-Poplar Village during a catastrophic flood. The last image he ever saw was of himself floating on the surface of a boundless expanse of water, moving farther and farther away, like an uprooted rice plant” (266).<sup>iii</sup> Rice represents the whole that is lost as the uprooted, abject, migrant individual must find his way in a shattered world. Rice was in every sense of the theoretical terms a geopolitical actant and an event, but it was also a psychological actant and event in the individual: a well documented case of the outside coming inside, the macro becoming micro.

Sharona Muir’s *Invisible Beasts* (2014) is, more explicitly than Su Tong’s, fiction grounded in the life sciences that illuminates the interdependence of living things and their natural and technological environments. The protagonist Sophie is an amateur naturalist with the rare ability to see invisible, sentient creatures that share a symbiotic relationship with humankind. She composes a bestiary and records her meditations on sex, evolution, extinction, truth, and self-knowledge. A typical passage reads:

Cities are growing all the time, and animals evolve with them. Rats chew through lead and cement; songbirds add the sounds of car alarms and construction equipment to their repertoires. Cliff swallows are evolving shorter wings for faster takeoffs from roadways to their nests in overpasses. (73)

In another passage, Muir develops the idea of species co-evolution, through the very literary character of the wolf (see *Wolf Totem*, the Big Bad Wolf of “Little Red Riding Hood” and fairy tale; the proverbial Wolf at the door; Freud’s “Wolf-Man,” Werewolves, and so forth).

The wolf is the untamed antecedent (the Unconscious?) of the domesticated dog, and just as humans have both untamed and domestic capacities, both are with us today:

Thousands of years before humans began domesticating livestock, wolves domesticated humans. Enjoying our garbage heaps, wolves who were bold and friendly set out to make us share the warm, safe spots at our firesides where cooking went on, and the choicest scraps were to be had. They learned our body language better than any other nonhuman species. . . and became dogs. Since then, we have evolved in intimate mutuality. Anyone who thinks that dogs are mere servile pets may learn from the following tale how our consciousness is controlled by those whom we think we have mastered. (79)

Muir emphasizes that uniquely for humans it is a *choice* to see the interdependent, symbiological picture, and this concurs with my original account of symbiology at the beginning of this essay. I surmised that the relations of co-production and co-evolution “are discernible throughout nature and all cultures, implying a politics.” Although all species are affected by the Anthropocene, only humans can reverse, stabilize, or sustain it. Only humans have the power to alter the ecosphere irrevocably and therefore only humans have the responsibility to manage it. “The present, or Holocene, mass extinction is not the only one in life’s history. It is the only one caused by a single organism capable of seeing the big picture, understanding its own destructive role, and changing that. . . . If I saw the big picture. . . it was because I had to make a choice” (153).

The Epilogue to *Invisible Beasts* has Sophie the Naturalist reading a love letter “with Plato and a Dog”:

Aristophanes said, “Love is the desire and pursuit of the whole.” The desire and pursuit of wholeness lead us to embrace. . . a mystery too great to encompass, as

unending as nature because it is nature, the endlessness of the universe itself in which we are born and die, that haunts every intimacy. . . Love remains unknowable.

Knowing that, the smile of Cupid deepens. . . And a naturalist, having sought truth, is satisfied with observation and hypothesis. (251-2)

There is a rise in symbiological literature and it is curious that as it dwells on species' interdependence, co-evolution, extinction—on species' dying and being born, on sex and death--it so often returns to love. *Love in the Anthropocene* (2015) by the environmental philosopher Dale Jamieson and writer Bonnie Nadzam has chapters on places, things, activities, and events. The stories are set in a future time, though one overlapping in many ways with our own, when Nature is entirely an artefact, when the rivers, as well as the fishes, are artificial ("Flyfishing"). (Already today, more seafood that people consume is produced by aquaculture (fishfarming) than by fishing ((Jamieson)12).) In "Carbon" the poor are removed from model cities on shorelines rapidly disappearing into the sea. Milk, steak, grapes are all artificial; dating is "off-grid" with robotic fucking machines or virtual partners ("Holiday"). As the authors say, "technology and the Anthropocene are joined at the hip" (24). In "Shanghai," families are no more, having been relegated either to a sentimental or an oppressive past. Domed cities keep lethal climates at bay. In the final story, "Zoo," the zookeeper is caretaker of the last of species, and he cannot tell whether women are attracted to him for himself or for his last remaining Tiger. He also does not know whether he himself knows/loves the Tiger more than the woman.

Interestingly, like *Invisible Beasts*, *Love in the Anthropocene* also ends with a Coda on "Love." Jamieson and Nadzam ask, "How will love arise in a world without nature as we have known it? ("Coda," 212). They cite Iris Murdoch that "love is the extremely difficult realization that something other than oneself is real" (202). As the ravenous ego blocks out

everything else and prevents us from seeing or knowing others, love is the antidote to narcissism.

The Anthropocene threatens to give us a narcissist's playground—a nature that is only the extension of ourselves and our desires, without independent meaning or sustenance. Love relationships are not possible in a world that consists only of oneself and one's projections. . . In many ways the task before us in the Anthropocene is the same task that has always been before us: to get the dear self out of the way enough to be able to really see and come to know—in relationship—the world of other people, plants, animals, oceans and rivers around us. But there may be more at stake, now, as well. (205-207)

The authors draw our attention to how inextricable our loves, our desires, have been with nature and natural scenes: holidays in the country or at the seaside, walks in the park and on rivers and cliffs, swimming together, “make-out point,” campfires, cookouts, until sometimes nature itself is the beloved: the Sahara sands, the Bitterroot Mountains, Five Flower Lake, Point Lobos. Now:

Imagine a world of endless drought: no rain, no tin roofs, no soaked flowers, and a lot more from our familiar world missing besides. Will experiences like this or the art that expresses them be accessible to us? Will we even be able to understand the loves of our parents or grandparents? . . . [R]each into your real or imagined memory and recover those feelings of joy and wonder as you were creering down [ski] runs. . . It was just you and the mountain, you and the wind; no condos and no snow-making machines. Now imagine that Monsanto has brought you “Ice-9,” a nanoparticle that forms the nucleus for fluffy snowflakes that don't melt and stick. The snow-making machines are gone, and every day

is a powder day. Is this better: Do you love the experience more? Or has the object of your love slipped away? (209-210)

As with Doidge's example above of boys who desire their computers more than their live partners, *Love in the Anthropocene* shows that Nature was never simply a background or static context against which humans acted out their ambitions. Rather, the loop between human culture, Nature and technology is mutually constitutive. The Frankfurt School called this the Dialectic of Enlightenment, when humans created technologies that came back to recreate them (Adorno). Like our sex and our gender, desires will change with our technologies until past loves may be as unrecognizable as our grandparents' old photographs:

We may once have thought of nature as the backdrop against which we lived our lives—pretty scenery to be sometimes plundered for its resources, or to write songs about—but the Anthropocene throws into stark relief that nature is not a “background” and never has been. It has always been a part of our lives—a part of us as we are part of it. (210-11)

The danger is that our instrumentalism, encoded in our technological languages of efficiency, management, finance, governance, command and control, will have wiped out the obscure object of desire before we know it.<sup>iv</sup>

The languages of sciences, technology, and economics dominate the discourse: can it be done? How much will it cost? But there are other questions that the Anthropocene will ask and other languages in which they must be discussed: should it be done? What will we become if we follow that path? The Anthropocene will challenge not just our science and technology, but also the



human heart in ways that are difficult to predict but which we're already beginning to experience. (211-12)

*Love in the Anthropocene* concludes, "The question we ask may seem simple but is fundamental: how will love arise in a world without nature as we have known it?" (212).<sup>v</sup> The same can be asked of a world of sex, gender and erotic mutability.

We may conclude that, having sought truth, a symbiological approach, is satisfied with observation and hypothesis. What we observe is that the enhanced use of technology in human niche-construction distinguishes humans from other animals. While many animals use technology—beavers build dams, bees build hives, birds build nests-- humans are the (most) technological animals. What is universal is our biological evolution as humans and our exceptional ability to transform nature through our use of technology, which in turn transforms us. Genomic ecology tells us that the mutual effects of biology and environment go all the way down into the gene and up to the stratosphere, and that it is not what is in your genes, but what your genes are in, that makes the difference.

Developmentally plastic, creative or destructive, rational or irrational, multisexed and polyamorous, humans are the protean life forms par excellence, the creatures whose nature is not to have a nature, as Giovanni Pico della Mirandola put it in the fifteenth century (Pico della Mirandola). Reflection on this natural history of change and difference tells us that things can and will change. Therefore, hope is the natural consequence of the genetic under-determination of the human phenotype, but resentment and despair are ever in the wings for when we fail to live up to the promise of our freedoms.

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## Notes

<sup>i</sup> This manifesto of a symbiological approach has much in common with process biology, actor-network-theory, and object-oriented ontologies, and may be considered a fellow traveller with the positions of Bruno Latour on actants and matters of concern, Isabelle Stengers on events and causes of thinking, and Andrew Pickering on the mangle of practice (see (Latour) Stengers "Including Nonhumans in Political Theory: Opening Pandora's Box?" in (Braun), (Pickering)). It also has some sympathy with the thing theory of Jane Bennett and Bill Brown and the treatment of circulation in Arjun Appadurai (Bennett; Brown; Appadurai). However, the symbiology manifesto has actually evolved out of years of interdisciplinary research and administration, most recently at Egenis, the Centre for the Study of Life Sciences, at the University of Exeter, and out of a life-long study of the kinds of total environments that are presented in world literatures. I am also grateful to Dr. Jos Smith, British Academy Postdoctoral Research Fellow, and Exeter's ECLIPSE Environmental Humanities Group, for comments on a draft of this essay.

<sup>ii</sup> The following section is indebted to the work of biologist and gender theorist Anne Fausto-Sterling. Her *Myths of Gender* (1985) pioneered biologically informed criticism of purportedly scientific accounts of gender difference, a project developed in new directions in *Sexing the Body* (2000). The outline of the stages of sexual differentiation here closely follows her *Sex/Gender* (2012). What follows is also indebted to the work of my longtime collaborator John Dupré. See (Barnes; John Dupré; John Dupré) (*Anne Fausto-Sterling Myths of Gender; Anne Fausto-Sterling; Anne Fausto-Sterling Sex/Gender: Biology in a Social World*).

<sup>iii</sup> This image is striking for more than one reason. Professional biologists anecdotally advise that one cannot claim to be seriously engaged with a crop until one has woken up from dreaming that one was re-embodied as a crop plant in the ground. See Steve Hughes, Review of *Rice: Global Networks and New Histories*, eds. Francesca Bray et al (Hughes) (Bray).

<sup>iv</sup> For an operationalized study of how the language of global processes can become codified, self-referential, and detached from everyday language, concreteness, and human participants, with world-historical effects, see Moretti and Pestre on the World Bank (Moretti).

<sup>v</sup> One answer may well have been predicted in that very early breviary of Decadence, J. K. Huysmans's *A Rebours* (1884), frequently translated as *Against Nature*:

(A)rtifice was considered by Des Esseintes to be the distinctive mark of human genius. Nature, he used to say, has had her day; she has finally and utterly exhausted the patience of sensitive observers by the revolting uniformity of her landscapes and skylines. After, all, what platitudinous limitations she imposes, like a tradesman specializing in a single line of business; what petty-minded restrictions, like a shopkeeper stocking one article to the exclusion of all others; what a monotonous store of meadows and trees what a commonplace display of mountains and seas!

In fact, there is not a single one of her inventions, deemed so subtle and sublime, that human ingenuity cannot manufacture; no moonlit Forest of Fontainebleau that cannot be reproduced by stage scenery under floodlighting; no cascade that cannot be imitated to perfection by hydraulic engineering; no rock that papier-mâché cannot counterfeit; no flower that carefully chosen taffeta and delicately coloured paper cannot match! (Huysmans) p. 22 loc. 857.

Yet *A Rebours* would lead Huysmans, as his contemporary Barbey d'Aureville put it, either to the foot of the cross or to the muzzle of a pistol, i.e., to religion or to suicide [Huysmans loc.

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3768: Barbey, "Le Roman Contemporain," *Constitutionnel*, [28 July 1884)]. And others in their different ways, such as the Futurists or Walter Benjamin, have also observed that the love of technology for its own sake typically leads to war (see "The Work of Art in the Age of Mechanical Reproduction: Epilogue" in (Benjamin).