**Aesthetic Responses to Synthetic Biology:**

**The Ethics of Governing Evolution**

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 It is clear today that the 21st century will largely be shaped by the resonant effects of humankind’s presence on planet earth. We have reached a point where the by-products of human industry and human lifestyle are affecting every planetary system from the smallest of micro to the largest of macro. Arising from the midst of this cacophonous fray are new and revolutionary technologies including the emerging biotechnologies. Synthetic biology is a fairly recent phenomena that aims to combine the previously distinct fields of biology and engineering. The guiding metaphor of the field is that of the ‘biological toolbox;’ a treasure trove of genetic material which practitioners believe can be organized, measured and mined for ‘cut and paste’ novel biological creations. The potential ramifications of the coming synthetic biology boom are legion. On the positive side we may be able to create synthetic fuels that solve our energy crises, find ways to grow food faster and cheaper, engineer life forms to conserve our planet’s biodiversity and grow organs to save human lives. On the downside, human beings have not historically been known to manage complexity or international collaborative efforts very well. The scale of ethical harmony and coordinated governance required to navigate this transformative time with grace is beyond any that we have ever attempted. We have found our ultimate purpose as a human collective: “To be caretakers of a planet, custodians of all its life forms and shapers of its (and our own) future…” (Anderson, 1987, 10) Whether we are ready or not, we must now learn how to effectively ‘govern evolution.’ (Anderson; Dator) The subversive science of ecology is being tested to its limits by climate change and ever expanding human populations and the 21st century will be a time when we see whether there is a newly ‘viable human’ to arise from the chaotic environmental turbulence that we have literally constructed for ourselves. (Berry, 1999) Understanding the roots of our current situation and the responsibilities that come with governing evolution is the first step towards successfully ‘surfing these tsunamis of change’. (Dator, 1999)

**The Persistence of Binaries**

*Culture is not only nature expressed in another form.*

*Rather the reverse: the action of nature unfolds in the terms of culture;*

*that is, in a form no longer its own but embodied as meaning.*

*~Mashall Sahlins (Descola, 2013, 38)*

*Earth as a biospiritual planet must become for us the basic referent in identifying our own future.*

 ~ *Thomas Berry (59)*

The conceptual roots of the modern ontological nature/culture binary stem from a western, euro-centric hegemonic narrative cemented in the scientific and industrial revolutions. These roots are so deeply interwoven with the fabric of modernity that they have become habitual aspects of our understanding of what it means to be human. The scientific and technological revolutions that have emerged from this prevailing worldview have consistently supported a perceived boundary separating human life from all other non-human modes of existence. I say perceived because we have never in fact been separated from non-human forms of existence physically or philosophically. The illusion of boundary, of separation, is perhaps the greatest category mistake upon which modernity rests. William Connolly argues, as homo sapiens-sapiens “We are not unique, we are merely distinctive.” (Connolly, 49) Peter Singer argues for a new political identity that he calls a ‘Darwinian left’: “It is time for the left to take seriously the fact that we are evolved animals, and that we bear the evidence of our inheritance, not only in our anatomy and our DNA, but in our behavior too.” (Singer, 6)

It is increasingly apparent that the non-human multitudes comprise a majority of our physical human bodies. For Connolly now is a time when we must embrace this complex human/non-human entanglement and become hyper-attentive to the ‘fragility of things.’ Enhanced sensitivity to fragility and emergent complexity in this imagining, produces a foundational ethics and capacity for visceral responses – what we might call gut reactions – that serve our higher purpose. In Hawaiian the term na’au is used to refer to this deep inner knowing that literally is imagined to emanate from the gut. Perhaps it’s no coincidence that the obesity epidemic born of our modern addiction to cheap processed foods has severed this, our most primeval tie to the non human forcefields within which we move. So much so that some psychiatrists now prescribe probiotics to counter psychiatric disorders ranging from OCD to ADHD and many in between. As Connolly argues, “Microbes not only work on us, many become infused into our neurons and viscera to help *constitute* our very moods and performances.” (Connolly, 49)

In the 21st century, I believe that we are witnessing a crescendo of the nature/culture bifurcation through the rapidly evolving technological advances of biotechnology and synthetic biology, and our advance into the responsibilities of governing evolution. While this ontological bifurcation seeks to systematically divide the *natural*from the *synthetic*, technological advances simultaneously call into question the boundaries between these two manufactured understandings of reality through an increasing number of hybrid nature/culture assemblages. These assemblages are characteristically enmeshed, making the delineation between where the preexisting ends and the manufactured begins nearly impossible to decipher. The implications of the emerging biotechnologies call into question existing frameworks of governance and ethics, which have historically been based upon physical boundary making, and normative understandings of what it means to be human in the world. At the same time, the agency of non-human actors is being re-conceptualized as a vital force in shaping arenas as varied as politics, economics, health and even consciousness. “This is the project of the coming era: to create a social and political order – a global one – commensurate to human power in nature. The project requires a shift from evolutionary meddling to evolutionary governance, informed by an ethic of responsibility.” (Anderson, 9) I position this ‘new materialism’ as a re-conceptualizing precisely because indigenous peoples have long understood, internalized and often ritualized the integral relationships between life and matter, human and non-human. This is not a journey of discovery, but more categorically one of remembering and of resurrecting a practice of reverence. It seems that a new political imaginary which embraces the political agency of non-humans, understands the effects of porosity and cross-border contagion and invests itself in an ethics deeply informed by innovative aesthetic translations of the world is needed to move us forward into the biotechnological era with grace.

 With the transformation of bodies and life through the processes of biotechnology, we are being asked to question the very foundations upon which our systems of decision making, governance and ethical imaginaries are based. For Eugene Thacker, this means reexamining “what constitutes a ‘body’…how biological ‘life’ is defined…how emerging biotech fields are affecting our common notions of what it means to have a body, and to be a body?” (Thacker, 2004, 1) These new ontological positions require bold moves away from the perspectives of cultural materialism, Marxist ecology, essentialism and the dominant rationality of scientific process that has prospered since the scientific revolution. For Philippe Descola, “the reification of properties attributed to nature and culture found in research programs, gnoseologies, and heterogeneous systems of values can only lead to an impasse in the enterprise that commands my attention, understanding the diversity of relationships that humans establish between themselves with non-humans.” (Descola, 2013, 77) Calling for a more ‘symmetrical anthropology,’ philosophers like Descola, Latour, Bennett, Steigler, and others aim to reexamine and subsequently reassemble the nature/culture bifurcation. The goal is nothing short of political transformation through embracing the foundational political entanglements of life and matter. The new vision is likely to resemble a network of diverse, complex, boundary-less and ultimately enmeshed assemblages. It is time that we get comfortable with such ambiguity, fluid within the navigation of previously delineated borders and separations, cognizant and celebratory in the boost of reverence that is necessary to make these conceptual leaps. For Latour, the ‘we’ who have never been modern “did not designate a specific people or a particular geography, but rather all those who expect Science to keep a radical distance from Politics,” and ‘we’ are being asked to critically and honestly reexamine our genealogy. (Latour, 2013, 8)

 Humans are faced today with a host of ecological crises of our own making, the scope of which “obliges us to reconsider a whole set of reactions, or rather conditioned reflexes, that rob us of all our flexibility to react to what is coming.” (Latour, 2013, 7) Our somnambulant commitment to neoliberal ideologies has foreclosed certain capacities for flexibility that are natural to the human being. In a world where billions live on less than $1 per day, flexibility has given way to frailty. This lack of flexibility is a fatal handicap in a time of rapid and unpredictable change, but thankfully we have not been robbed of our ultimate creativity as emergent beings. Just look at the innovations coming out of any 21st century slum to be assured of the inherent and stubborn creativity of the human. But it is our responsibility to finally and publically acknowledge the fact that we have entered an era of *governing evolution*, a new geological epoch, which is collectively being called the *Anthropocene.* First named by ecologist Eugene F. Stormer and widely popularized by atmospheric chemist Paul Crutzen in the early 2000’s, the Anthropocene era is defined by the fact that human activity and influence is significant enough to have permeated every aspect of living and non-living matter from the macro to the micro on our planet and even beyond into space. The extensive saturation of human influence brings great responsibility for which humankind is not sufficiently prepared at the present moment. In this new epoch, “Governance is inextricably connected with the growing human responsibility for all the things the word ‘evolution implies: the survival and extinction of species, the changing ecology of the planet, the biological (and cultural) condition of the human species itself.” (Anderson, 1) Our investment in the neoliberalization of life, the privileging of commodification as a primary means of value-making and the implications of the fantasy of an a-political, static and *Reality* made knowable through the lens of scientific knowledge have led to a situation where multiple systems (social, economic, environmental, political) are currently primed for either collapse or transformation. We are at a point where it seems the center will no longer hold. To navigate this brink, we must look honestly at our politics, create new metrics of value and enliven the subjectivity of various modes of existence with their due philosophical and emergent weight. “It thus hardly makes sense to oppose, as modern epistemology does, a single and true world, composed of all the objects and phenomena potentially knowable, to the multiple and relative worlds that each one of us creates through our daily subjective experience.” (Descola, 2013, 78) The current and future flurry of biotechnological innovation is trending towards neoliberal logics that are based on ethics of commodification and governance structures invested in traditional nation-states, physical borders, boundary-making, control and surveillance. I believe that these trends deserve rigorous examination and reconsideration for the futures if we are to take seriously the agency of non-human life forms and the responsibilities implied in governing evolution. Co-existing, co-producing, overlapping and always relational, the fractal structure of reality is thus understood as always in a state of flux with no beginning or end where traditional practices of boundary making no longer make sense. In this space we can begin to embrace the possibilities and openings provided by alternative worldviews such as the ‘perspectival reality’ of Amerindian thought which demonstrates how “the world is inhabited by different sorts of subjects or persons, human and non-human which apprehend reality from distinct,” and equally valid, “points of view.” (Viveiros de Castro, 2012, 45) The seminal question to be asked of those governing evolution: just because we can, does it mean we should?

**Subversive Science(s) – from Ecology to Biotech**

Equally as critical to the advent and logics inherent in biotechnology and synthetic biology today is the concept of *ecology*. Co-evolving in the mid 20th century with the theories and philosophies of cybernetics in the work of thinkers like Gregory Bateson and Norbert Wiener, the concept of *ecology* has come to encompass a belief in the inherent dynamic equilibrium in natural systems. The basis of ecological thought proposes that natural systems are based on a stability that is persistent in harmony without human interference and that, when artificially disturbed, will always evolve back toward that preexisting stability and harmony. This mechanical vision of ecology has been extensively challenged by ecologists, and yet dominant public narratives retain the myth that ecological balance is ‘nature’s way.’ A systemic view of nature, that nature is comprised of predictable, repeatable and knowable systems, has paved the way for the 21st century belief that biological systems can be ‘engineered’ to do whatever it is we humans want them to do: that life can be built from scratch using biological building blocks and engineered in controllable, predicable ways by humans. (<http://critique-of-pure-reason.com/the-use-and-abuse-of-vegetational-concepts-adam-curtis-on-cybernetics-ecology-and-power/>)

From the early ecological movements sprang different voices with varying ideas about a common dilemma: how to heal humankind’s relationship to the earth. For social ecologists like Murray Bookchin, Rene Dubos and Roderick Nash, the answer, inspired by earlier thinkers like Peter Kropotkin, lie in harmonizing the needs of humans with the needs of the natural world. (Chase et al, 1991, 14) For more radical ecologists like Earth First activist Dave Foreman, inspiration was derived from reification of ‘pure’ wilderness and the work of earlier philosophers like John Muir, Aldo Leopold and Henry David Thoreau. (Chase et al, 1991, 17) The radical ecology vision left little room for humankind, seeing instead preservation of pure wilderness for wilderness sake as the primary aim and objective of any environmental agenda. More conventional modes of environmental activism arose and cemented in international not for profit organizations like the World Wildlife Fund, Conservation International, The Nature Conservancy and others whose work continues today and has often come under scrutiny for the perception, real and imagined, of increasing entanglement with multinational corporations and political agendas.

 While it is impossible to trace a distinct source for the dualism that was established with the nature/culture divide, it is clear that the birth of Science as a mode of knowing the world was critical to humankind’s vision of itself as separate and superior to an exterior Nature. Believing specifically that the Western version of scientific reality was the one and only true reality, scientific objectivism became the core, operating paradigm upon which modern civilization has been built through violent histories of colonialism and oppression fueled primarily by imperialism and a rush to capitalism. The central belief in a preexisting objective reality waiting to be discovered has left all other visions and experiences of reality outside the realm of serious consideration for politics, governance and social relations by the dominant Western paradigm. “In other words, we do not envision non-Western civilizations, or even pre-modern Western ones, as complete systems of conceptualization of the world alternative to our own, but as more or less exotic ways of accounting for the state of the world that our own system of conceptualization has established.” (Descola, 2012, 33) Clinging desperately to the Western conceptualization of a predetermined, preexistent scientific Reality, we now find ourselves at the brink of a new technological explosion with the bio-technological sciences. In this emerging era, humankind is taking ‘control of nature’ from the macro to the micro and endeavoring to become a creator and manipulator of life. This blurring of the lines requires a new narrative, new metaphors and new understandings of ethics and governance. Our renewed relationship with non-human actants is critical to the path forward. “If there is one area where [we] need to learn something from ‘the other cultures,’ as you say, it is surely this one. Once freed from Bifurcation, nothing will keep you from reconnecting with existents with which you have in fact never ceased to interact.” (Latour, 2013, 205)

           If it is true that “by the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism,” what does that do to our politics? (Harraway, 1991, 4) How do we begin to form an ethics that engages in the notion of slowness, of careful selection, that pushes against the race to innovation that has characterized the 21st century? An ethical practice of biotechnology and synthetic biology requires a deep understanding of, the power of non-human agency and the concepts of both “scientific uncertainty and cross borderness.” (Zhang et al, 2011, 5) Jane Bennett’s ideas around porosity are especially useful when thinking about the relations of power between human and non-human objects. We know that the human body is porous. We pass massive amounts of material, chemicals, microbiotic organisms etc. through our skin alone. We can also consider activities like breathing, ingesting, excrement and the porosity of each cell down to the very most micro of levels. This porosity does not know boundaries and is indifferent to the governance structures of the human political and in many cases indifferent to the human. There is a constant exchange of information and material between human and non-human bodies that requires a completely different ethical and political framework. The nature of this ubiquitous and relatively indifferent porosity is tied to what Bennett calls the ‘power of the its.’ Things have power, not least because of their porosity and incessant interaction with other bodies. (Bennett, 2011) For Harraway, this indifference is linked to the notion of cyborgs as “illegitimate offspring of militarism and patriarchal capitalism, not to mention state socialism,” which “are often exceedingly unfaithful to their origins.” (Harraway, 1991,9) The idea that humans are capable of synthesizing life forms and controlling the results is a potentially catastrophic fiction.

These prescient realities have ramifications for humans and human agency that we are just beginning to uncover and understand in the Western academy, but which, it can be argued, have long been understood by indigenous cultures. As Noenoe Silva and Jon Goldberg-Hiller explore, Hawaiians have a concept called *kino lau* that addresses the interaction and relation between and within human and non-human bodies. They specifically address the “cultural distinction between beings that have *kino lau*  (which we translate as having many bodies—human and nonhuman) and beings that remain within a given body,” such that a plant, rock or animal can actually hold genealogical ties and material significance to humans. (Goldberg-Hiller & Silva, 2011, 431) What this reminds us it that the ‘its,’ the non-human bodies, have power and agency directly related to humans. Think of common ailments like cancer, food poisoning or chemical sensitivities and the nuances of this worldview can suddenly become legible to the logics of science.

Also useful to this discussion is the notion of scientific uncertainty as delineated by the authors of *The Transnational Governance of Synthetic Biology.* They emphasize the need to “recognize that scientific uncertainty is not merely temporary but endemic: not merely calculable risks, but provisional unknowns, unknown unknowns, and even willful ignorance or a conscious inability-to-know. Such 'non-knowing' cannot be overcome simply by acquiring more knowledge: increasing knowledge often leads to increasing uncertainty.” (Zhang et al, 2011, 2) The existence of uncertainty and an admission to un-knowability would seem to *demand* a principle of slowness and careful deliberation. Added to this un-knowablility, the prescient ideas around thing-power and the creative capacity of non-human beings should certainly encourage us to prioritize slowness and deliberation, a careful consideration of the distant order consequences of present day synthetic hybrids. Meanwhile, we are propelled forward by neoliberal ontologies that require speed, efficiency and rabid competition to maintain their existence. The material parameters of commodification require constant innovation and do not allow any space for slowing down. And we must add to this conundrum the ‘cross borderness’ and porosity of non-humans. Traditional governance structures that rely upon special and national relationships no longer apply in the world of biological intermingling. A cell or a seed is indifferent to the fact that it is not welcome, that it is not following the ‘rules’ or that it has crossed boundaries into inhospitable territory and these realities have far reaching consequences for surveillance and discipline in the futures as states and corporations aim to control the resources being constructed from the innovations of biotechnology – innovations which often have their genesis in traditional, genealogical knowledge transfer and localized genetic resources. How are we to govern human control over non-human bodies that have direct effects upon human lives or the reverse? What are the implications when these non-human hybrids are owned and controlled by human corporations or government agencies? What are the ethics surrounding creation and destruction of non-human bodies that, while built for human purposes, ultimately have independent agency, desires, philosophies and potentially rights? These sorts of issues become increasingly salient and urgent as we push deeper and farther into the realms of synthetic production of biological beings. This reshaping of the boundaries between biology (nature) and technology (society) are demanding new types of policy and new frames for thinking about biological realities.

**The Neoliberalization of life – We can’t take the politics out of the political**

*The first man who, having fenced off a plot of land [enclose un terrain], thought of saying, this is mine, and found people simple enough to believe him, was the real founder of civil society. How many crimes, wars, murders, how many miseries and horrors might the human race had been spared but the one who, upon pulling up the stakes or filling in the ditch, had shouted to his kind: Beware of listening to this imposter; You are lost if you forget the fruits of the earth belong to all and that the Earth [Terre] belongs to no one.*

*~Jean Jacques Rousseau (Elden, 2013, 1)*

*…much more importantly, it is unclear whether humanity should be*

*encouraged to seek a solution to our problems through new technologies if that*

*enables humanity to continue our path of perpetual consumption, global environmental destruction and unanticipated social transformation.*

*~Dr. Jim Dator*

 The political economy of late-late capitalism is a moving assemblage – its loose joints and disparate edges always threatening to tear at the fragile fabric of communities in the midst of their struggle to hold a center. And we must become painfully aware, if we have not already, that in this day and age, the very notion of community and the heterogeneity that deeply place-based community cultivates is under heated attack from many sides. This is the fate of our neoliberal embrace, for as William Connolly suggests, “neoliberalism is a form of biopolitics that seeks to produce a nation of regular individuals, even as its proponents often act as if they are merely describing processes that are automatic and individual behavior that is free.” (Connolly, 2013, 59) What happens when science is conducted in the service of capital? When we attempt to suture knowledge across domains, like science, politics and economics, we engage in a “project of aligning multiple (and multiplying) arenas of expertise and systemic knowledge – the lacuna-ridden totality of it lacks both head and center, and the ‘alignment’ of these spheres is responsive to the need to constitute hegemony.” (Robertson, 2004, 369) In this way, it becomes clear that the *forms of articulation* specific to each knowledge system, what Latour would call each specific *mode of existence*, cannot be accurately translated without defying the particular logics of that form. (Robertson & Latour) Capital cannot ‘see’ nature in the way that it may be seen by a scientist and for politics, it is critical that we begin to acknowledge what is lost and what is gained in this exchange, intended or otherwise: “although legal and capital logics have come to depend heavily on scientific information in maintaining certain aspects of neoliberalism, *getting hold* of this information in a useful form can be problematic – if not impossible.” (Robertson, 2004, 371) Where “the knowledge system of science is being put into new articulatory relationships with the standards of capital, and scientific data are doing important new work in expanding the circuits of capital,” we need to ask for whom is the work being done? (Robertson, 2004, 371) If the benefits of science and technology are tied ultimately to commodity as the sole measure of value, what other critical values are being subsumed? “Analytically nature finds itself cleaved: from the material point of view, it is no more than one of the components allowing the satisfaction of needs; from a social point of view, it is no more than one of the elements that conditions the shape of the relationships that men weave between themselves.” (Descola, 2012, 40)

 The pervasive narrative of “progress through discovery” is at the core of America’s founding myth. (Jasanoff, 2012, 178) This myth has informed the commodification of biotechnological advances and the commodification of life forms. “Whether nature resides in inanimate land or in living things, what the law rewards is the act of economic agency that takes something that was fixed, embedded, and immovable and makes it specific, dynamic, and commercially value-laden. In short *lively*.” (Jasanoff, 2012, 181) Capital requires circulation and movement according to very specific articulations that preclude the participation of those not versed in its logics. In America, this movement towards capitalization in the realm of biotechnology has been politically articulated most visibly in the emerging discourse around the ‘bioeconomy’ and recent international trade agreements like the Trans Pacific Partnership (TPP). The 2012 Obama Administration’s document the *National Bioeconomy Blueprint* aims to establish both the very idea of a bioeconomy and to cement America’s place within it as a world leader. The document lays out a decisive plan tailored to capitalizing on the economic opportunities of the bioeconomy while specifically noting that “These advances raise important ethical and security issues that are also top priorities for the Administration, but go beyond the scope of this document.” (National Bioeconomy Blueprint, 2012, 2) Running counter to the call from Latour for slowness, this blueprint calls for “a steady flow of new products and services that address American’s needs.” And policies “to foster an ecosystem that supports discovery, innovation, and commercialization” and that help “accelerate progress to market.” (National Bioeconomy Blueprint, 2012, 3) As we sit at the imagined frontier zone of biotechnology and synthetic biology, we can discursively frame the neoliberalization of biotechnology as a 21st century process of enclosure, the “transformational sequence appropriation-displacement-exploitation-accumulation.” (Li, 2007, 19) And we can analyze the overtures of policy such as the Bioeconomy Blueprint and the TPP as masking deeper ‘subterranean practices’ of commodification, dispossession and ultimately the appropriation of life in the service of capital. (Li, 2007, 28)

 How did we arrive at this point, where life itself has come to be seen as commodity, in the first place? In tracing the movement of things between nature and culture or life and capital certain seminal cases such as *Diamond v. Chakrabarty* in 1980 and *President and Fellows of Harvard College v. Canada* (aka the OncoMouse case) in 2002 are important. In the first, the Supreme Court of the United States ruled that Ananda Chakrabarty, a General Electric research scientist, could patent a new bacterium that he had created synthetically in a laboratory. At the heart of this ruling was the narrative of “mining nature for extractable entities that can freely circulate” according to the logics of capital accumulation. (Jasanoff, 2012, 169) In other words, the invention was a conversion of nature to property and the court believed that greater public good would be achieved if this invention were allowed to circulate as a commodity with capital value attached to it. This landmark decision opened the way for similar readings of synthetic and genetic manipulation of higher order animals. When Harvard subsequently patented the first transgenic mammal, the OncoMouse modified to increase susceptibility to cancer for research purposes, Canadian courts conversely ruled in 2002 that “higher animals could not be viewed as compositions of matter under the Canadian Patent Act.” (Jasanoff, 2012, 173) Where discourse surrounding Chakrabarty centered on bacterium as “absolutely inanimate,” “dead chemicals,” effectively objects for human use, unworthy of respect as independent life forms, the discourse in the Canadian case operated around an understanding of the mouse as an independent life form rather than a composition of genetic material or matter. The Canadian justices in that case, “held that higher life forms did not constitute a ‘manufacture’ or ‘composition of matter’ within the meaning of the term *invention* in the Patent Act.” (Jasanoff, 2012, 180) These decisions surrounding the movement of nature to property have framed the commodification of life and we can expect to see many more similar cases coming in the near future. What is important to note is that while these decisions have primarily been occurring in the western world, the nature of neoliberal globalization means that impacts reverberate throughout the world and are frequently most acutely felt in developing nations - which are also often the source of genetic and natural resources.

Sheila Jasanoff argues that “the task of managing technologies has to go far beyond the model of ‘speaking truth to power’” and that there is a “growing awareness that even technical policy making needs to get more political – or, more accurately, to be seen more explicitly in terms of its political foundations.” (Jasanoff, 2003, 225) We need to bring the politics back in and stop pretending that science is an objective observer and collector of truths. Sufficient accountability has been absent from the production and use of scientific knowledge and this responsibility needs to be reinstated. What Jasanoff terms the ‘technologies of humility’ are one attempt to address this widening chasm between our rush to innovation and inherent scientific uncertainty;

*technologies of humility confront ‘head-on’ the normative implications of our lack of perfect foresight. They call for different expert capabilities and different forms of engagement between experts, decision-makers, and the public than were considered needful in the governance structures of high modernity. (Jasanoff, 2003, 227)*

A coherent blueprint for *technologies of humility* has yet to be articulated, but what is clear is that we need a way forward where science embraces and openly imbricates its relation with politics; a way forward that transparently acknowledges the responsibilities inherent in creation and innovation, the risks as well as the rewards.

**Rewriting the narratives – Reinventing the human**

*The physical property of the body separates a person from all others, whereas the soul is a dynamic, invisible substance which is constantly seeking contact outside…for the Arakmbut, whereas the body gives a distinct form to a person, the nokiren [soul] reaches out in dreams to others – not just humans but also species and spirits.*

 *~ Andrew Gray (Viveiros de Castro, 46)*

*There is no such thing as a self-contained individual in the vegetal world.*

*~ Joseph Campbell (Moyers, 127)*

            Myth and metaphor are powerful discursive and cultural tools for both invoking and cementing deep layers of meaning within human society. These layers of meaning reverberate upwards into daily, lived experience in ways that are often unarticulated. Latour invokes the Allegory of the Cave to describe modernity and I think this is appropriate. In this allegory a group of people are chained to a wall in cave and can only see the dark wall of the cave, they cannot see anything behind them. They only have access to shadows on the wall made by things passing a fire that is at the mouth of the cave, they are never able to see the things themselves. Only the philosopher who has been freed of her chains can leave the cave and see reality as it is, only the philosopher can translate back this reality to the others who remain in the cave. (Latour, 2004, 10) Today that philosopher has taken form as the scientist and nature as the reality to be translated. But what if we are to take seriously the entanglements of human and non-human life forms and the agency of the it-stuff such that we no longer see either science or nature as static *or* knowable. Such a metaphor will look radically different and will require radically different ethical frameworks. Perhaps it is the metaphor of the shape-shifter seen throughout Indigenous mythologies that will inform our future understanding of reality. That neither exclusively human nor non-human being which can change shape and is never static or knowable except from moment to moment and in specific context. The trickster.

For Thomas Berry, this is the work of ‘reinventing the human at the species level,’ and it involves resurrecting our “archetypal sense of the Cosmic Tree and the Tree of Life.” (Berry, 1999, 70 & 160) The symbolic integrity of the tree and all its parts reminds us that what is done to one part of the organism affects all the rest in immediate and visceral ways. Doctors working at the forefront of holistic medicine have realized that the moment something touches the lips of a patient, the body reacts to that substance. A whole host of responses ensue simultaneously and immediately such that one’s pulse will instantaneously quicken in response to an allergenic substance. We are as enmeshed as emergent beings as is the tree and we are connected to all the other microbial life forms within our bodies in unseen and critical ways. For Berry, reinventing the human involves a radical rethinking of cultural forms, but with synthetic biology we are being challenged with remaking the human in ever more literal and corporeal ways. What will mark the boundaries between emergent life and designed or engineered life and how will we navigate those blurred lines in the future?

           Another metaphor in need of reimagining is that of the ‘code.’ Whether it be the computer code or the genetic code, the science of biotechnology is predicated on conceptualization of a ‘code’ which progresses in linear, predictable form and which can be translated or ‘read’ so that is can be replicated, re-inscribed or translated yet again into a different biological or technical ‘language.’ The linear readability of the ‘code’ discounts the possibility of the types of radical, spontaneous shifts in matter that quantum physics and indigenous cosmologies both address. Perhaps a more useful metaphor is that of the conversation. This metaphor vests power in the relation between things, both human and non-human, such that the engagement or entanglement itself indelibly changes the structure and the material of the things so engaged. This metaphor would allow for a better reading and contextualization of longer order effects rather than operating from a sense that the components of a life form are static, identifiable and exchangeable in the same way in perpetuity. Indigenous perspectives are seminal to a reframing of hegemonic ontologies around biotechnology. From the Hawaiian conception of *kino lau* to the Amerindian perspective which conceptualizes “a spiritual unity and a corporeal diversity” such that we might envision “multinaturalism” as opposed to “multiculturalism,” there are myriad Indigenous cosmologies with potential to inform and reform the broken relations of nature/culture in the dominant discourse that have wrought so much destruction and brought so much risk to bear. (Goldberg-Hiller & Silva; Viveiros de Castro)

Looking to anarchist perspectives, Kropotkin’s thesis at the turn of the 20th century asks that we question the basic assumptions of ‘survival of the fittest,’ that in fact “Mutual Aid and Mutual Support carried on to an extent which made me suspect in it a feature of the greatest importance for the maintenance of life, the preservation of each species, and its further evolution.” (Kropotkin, 1902, 2) Fast forward to the 21st century and we see how the biohacking movement, inhabited by biotechnology enthusiasts and activists, aims to put science back in the hands of the average citizen. Infused with anarchist philosophical foundations, biohackers and the biohacking spaces they create are set up in communities and freely open to the public so that anyone can learn how to participate in biotechnology and synthetic biology. This radical reimagining of power structures has its genesis in the Critical Art Ensemble and the first biohacking space in New York City, Genspace. In their book *Digital Resistance,* the Critical Art Ensemble attempts to “reveal the ideological infrastructure of the technology and its representation, and to demonstrate that even the smallest Utopian possibility contained in the rhetoric would probably not be generally realized by most of the world's population.” (Critical Art Ensemble, 2000, 46) This is a direct challenge to the metanarrative of benevolent technology as the arbiter of progress and is central to the critique of the ‘bioeconomy’ where synthetically produced beings are made infinitely available in service of neoliberal profit motives. The ‘biohacking’ project seeks to subvert efforts to control and concentrate biotechnology in the hands of corporations by making the technology and the knowledge accessible to as many people as possible while also raising the specter of harmful possibilities, including possibilities of surveillance and state control, that must be considered for the futures.

 The power of epistemological alternatives to normative representations of reality lies at the crucial and tentative intersection of rewriting myth/narrative and lived activism. We must remember, as Linda Tuhiwai Smith argues, “Taking apart the story, revealing underlying texts, and giving voice to things that are often known intuitively does not help people to improve their current conditions.” So that while we can acknowledge the importance of intellectual critique, “it provides words, perhaps an insight that explains certain experiences – but it does not prevent someone from dying.” (Smith, 1999, 3) The question of remaking the world beyond existing binaries thus must become one of substantial and actionable political change. In these alternative worldviews beyond the nation-state, neoliberal political and philosophical imaginaries are potential pathways for the types of change that truly dismantles and reconfigures dominant narratives in revolutionary ways.

 Paul Rabinow addresses this challenge through the idea of ‘human flourishing:’

 *Flourishing is a translation of a classical term, eudaimonia, and as such a range of other possible words could be used: thriving, the good life, happiness, fulfillment, felicity, abundance, and the like. Above all, flourishing should not be confused with technical optimization, as we hold that our capacities are not already known or fixed in advance. We do not understand flourishing to be uncontrolled growth, progressivism, or the undirected maximization of existing capacities. (Rabinow,* 2013)

Demanding that we shuck the outmoded meme of ‘sustainability’ in favor of much more aspirational goals of human (and non-human) flourishing, Rabinow’s project is to insist “that the question of what constitutes a good life today and the contribution of the biosciences to that form of life must be vigilantly posed and re- posed…The core question and challenge of our experiment, then, was this: How might synthetic biology be made to contribute to (and participate in) a mode of practice guided by—if not uniquely dedicated to—an ethic of flourishing?” (Rabinow, 2013)

**Ethical and Aesthetic Imaginaries – Just because we can, does it mean we should?**

*…we have to consider that the collective is made up of humans and nonhumans capable of being seated as citizens, provided that we proceed to the apportionment of capabilities.*

 *~ Bruno Latour (2004, 232)*

*Cyborgs are not reverent, they do not remember the cosmos.*

*~ Donna Harraway (1991, 8)*

 In *The Ecological Thought*, Timothy Morton asks whether non-humans such as animals can experience aesthetics and whether the experience of aesthetics is a complex or simple cognitive state, perhaps shared by all living beings? (Morton, 2010, 13) In critically examining ethical imaginaries for the biotechnology futures, I argue that we should flip this questioning on its head and begin with the theorization that aesthetics are in fact a basic and physiological form of communicating ethics between modes of existence such as living/non-living or human/non-human. Joseph Campbell called this ‘the problem of beauty.’ In an interview with Bill Moyers he asked, “When a spider makes a beautiful web, the beauty comes out of the spiders nature. It’s instinctive beauty. How much of the beauty of our own lives is about the beauty of being alive?” (Moyers, 1991, 100) Re-instilling our ethical imaginary with this positioning allows for incorporating both humility and reverence, two concepts that I find critical to the task of undoing the destruction wrought by nature/culture binaries. Cultivating our sensitivity to the inherent aesthetic communication of non-human beings and things requires specific courage in a world full of apparent suffering, but I believe that this courage is crucial and we can no longer afford to deny our complicity in the state of things as they are. In theorizing our relationship to the aesthetic idea of *pollution*, Michel Serres writes:

*I cannot smell the sludge of pig excrement (however biodegradable), or quiver with nausea when I am close to a paper mill, or suffer from asthma near a freeway, or hear the noise of an airplane or an engine without my body understanding in animal fashion that the objects emitting these smells, fumes, and sounds are taking possession of the space they inhabit or cross. (Serres, 2011, 40)*

How might these sensory communications better inform our ethics? Are we, as humans, simply in denial of a fundamental aesthetic logic because its existence requires changes and commitments that seem insurmountable in the face of modernity?

Arising from the growing realization that both scientific uncertainty and the inherent porosity of biotech innovations have led to a situation of nearly unbridled risk, Jasanoff and others in the field of science and technology studies see that ethics of humility and deliberation, akin to Latour’s notion of slowness, are largely absent from the neoliberal position. Sheila Jasanoff writes of the technologies of humility as “methods, or better yet institutionalized habits of thought, that try to come to grips with the ragged fringes of human understanding – the unknown, the uncertain, the ambiguous, and the uncontrollable.” (Jasanoff, 2003, 227) In particular, when it comes to biotechnology, Jasanoff writes that “biotechnology is caught on the horns of a very particular dilemma: how to justify its promises of innovation and progress credibly when the interests of most scientists are unacceptably aligned with those of industry, government, or – occasionally – ‘public interest’ advocates.” (Jasanoff, 2003, 231) The clear trend towards privatization in the realm of biotechnological innovation and the recent history of intellectual patent laws and controversial trade agreements such as the Trans Pacific Partnership (TPP) all point to the increasing salience of this dilemma in public policy for the futures. The “very concept of a natural law is inadequate for much of reality,” and the explosive creativity of the natural world is truly and “inherently beyond prediction.” Instead, the “new scientific view of emergence brings with it a place for meaning, doing and value.” (Kauffman, 2008, 4-6) Emergence drives a deep renewal of reverence, of relish in mystery, an ethical imaginary dissatisfied with mere reason: “Because of this ceaseless creativity, we typically do not and cannot know what will happen. We live our lives forward, as Kierkegaard said. We live as if we knew, as Nietzsche said. We live our lives forward into mystery.” (Kauffman, 2008, xi) For Martin Heidegger this idea manifests in an ‘openness to mystery’: “Releasement toward things and openness to the mystery belong together. They grant us the possibility of dwelling in the world in a totally different way. They promise us a new ground and foundation upon which we can stand and endure in the world of technology without being imperiled by it.” (Heidegger, 1966, 55) Similarly, for Bernard Stiegler, technological knowledge alone is never enough “because technological knowledge is pharmacological, that is, it has the ambivalent structure of a *pharmakon*: it is always at one potentially beneficial and potentially harmful.” (Stiegler, 2011, 28) Embracing reverence and an admission of the uncertainty and un-knowability inherent in creative emergence will be foundational to the ethics required of a biotechnological future.

Might we find in this future a place for militants engaged in the powers of micro-political performance? William Connolly asks us to imagine the power of the micro-political in a fragile world of incredible complexity. By positioning role performance as political experiment, he subtly argues for the microbial infection and amplification of day-to-day activity, indicating that small deliberate choices can lead to entrenched behaviors much in the same way that ingestion of the toxoplasma microbe can eventually lead to schizophrenia. “Role experimentations and the shape of the pluralist assemblage thus infect one another.” (Connolly, 2013, 188) To ignore the tacit role performances with which we engage constantly is to succumb to the habitual nature of practices that “condense previous relations of overt power.” (Connolly, 2013, 183) Instead, we are being asked by the inherent fragility of things to intentionally foster micro-political-performances that enhance our militant democratic possibilities. Whether it is a small group of students, gathering to discuss political theory, or a blog written to critique neoliberal ideologies, or a smile given to a stranger in a crowded public space, or a garden, planted in an abandoned city lot to grow food and feed a neighborhood, these microscopic daily acts of political will reaffirm that “there is no zone of complete neutrality in a world of role performances” and that there are “significant relays between role performance, self-identity, and the formation of larger political constellations.” (Connolly, 2013, 184) In the same way that we are constantly made and re-made by the microbial biological realities at work within our bodies, our politics are constantly made and re-made by the micro-political choices and identifications we collectively propagate. The resonance from these micro-political choices cannot be discounted. Ervin Laszlo’s work with quantum physics informs an understanding of non-local consciousness and resonance. Physicists “see each particle as a string that makes its own ‘music’ together with all the other particles. Cosmically, entire stars and galaxies vibrate together, as, in the final analysis, does the whole universe.” (Laszlo, 2007, 10)

**“The Wild” as an aesthetic imaginary to inform and embrace complexity**

*We mistake the wild if we think of it as mere random activity or simply as turbulence. (Berry 51)*

*As we enter the 21st century we experiencing a moment of grace.*

*Such moments are privileged moments.*

*~ Thomas Berry (1999, 196)*

To capture the positive potential for human and non-human flourishing held within the burgeoning field of synthetic biology, I argue that we should take our philosophical musings about emergent complexity and make the move to a new aesthetic imaginary represented by ‘the wild.’ “We might consider, then, that the wild and the disciplined are the two constituent forces of the universe, the expansive force and the containing force bound into a single universe and expressed in every being in the universe.” (Berry, 52) The typical synthetic biology laboratory represents a curiously ironic aesthetics. A photograph of Wendell Lim’s lab at the University of San Francisco shows plastic bottles, petri dishes and fluorescent lights and reminds us of the controlled and artificial aspects of scientific experiment. How ironic that this kind of space would be the material site where new life in all its wild and attendant complexity could be first imagined and ultimately born?

To reconcile these ironies and find graceful ways forward into an uncertain future we will need to continually reexamine the normative narratives that underwrite scientific discovery. The ethical platforms from which innovation spring have become more and more critical as we become cognizant of our responsibilities in governing evolution. Once ‘subversive’ sciences are now beginning to have the capacity to quite literally remake the world.

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