Decolonizing Racial Bioinformatics: Governing Education in Contagion and Dehiscence

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1 Prologue

Immanuel Kant's idea of the *good life* cast its object in racist terms (Gilroy 2005; Harvey 2000).[1] Rather than delineate the object of his inquiry, Kant parroted racist platitudes about life to pontificate upon the conditions of an object he took for granted. Kant took Modernist liberties, literally, with his entitled position and discussed, at length, the adjective that qualified the very object of his assumed privilege. Kant's elaboration of that which is 'good' demarcated 'universal' activities associated with living morally, but within a racist hierarchy that had radically excluded the object of 'life' from so many.

We agree with Paul Gilroy (2005: 9) that 'Kant compromised himself by associating the figure of the "Negro" with stupidity and connecting difference in colour to differences in mental capacity provides a useful symbolic marker'. One useful marker is David Harvey (2000: 532) who understands Kant's racism as an 'an intellectual and political embarrassment'. Moreover, as Harvey (2000: 533) noted, Kant's racism contains 'a more sinister side to it', an evil in which Kant's project of universal moral reasoning masks as education.

Harvey (2000) locates Kant's racist educational philosophy through Martha Nussbaum's articulation of education, and specifically her ideas about geographical knowledge, anthropology, and the limits of difference. Harvey (2000) is concerned that Nussbaums's ideas about education simply circulate the very racisms that Kant

[1] We have decided to not reprint Kant's racisms. They can easily be located through our citations.

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used to develop his ideas about universal moralisms. As Harvey (2000: 531) noted, 'Nussbaum merely follows Kant (without acknowledging it)'.

2 Introduction

Our discussion of Kant provides an important context, but our chapter does not interrogate Kant's racism, nor do we discuss his, and others', compromised educational projects. Literatures that examine how Kant's racism has sullied (Western) philosophy are increasingly available (e.g., Eze 1997; Mills 2014; Yancy 2004), and literatures that discuss his failed educational project are frequently found within literatures about decolonizing education (e.g., Bhambra et al. 2018). In short, we agree with Lundy's (2014) rebuke of Kant when he noted that 'what the good life looks like cannot be prescribed in advance. One could only say that the good life is a life capable of sustaining an active experimentation … and an exploration of the limits, in every direction, of our will.'

Rather, our brief prologue is intended to illustrate how ideas of 'life' and vitality continue to be presupposed, rather than explicitly examined and discussed (Canguilhem 1991; Deleuze 2005; Foucault 1998). As such, Giorgio Agamben, continuing his longstanding critique of Kant, stated,

> It will be necessary … to embark on a genealogical inquiry into the term 'life'. This inquiry … will demonstrate that 'life' is not a medical and scientific notion but a philosophical, political and theological concept, and that many of the categories of our philosophical tradition must therefore be rethought accordingly. In this dimension, there will be little sense in distinguishing between organic life and animal life or even between biological life and contemplative life and between bare life and the life of the mind. Life as contemplation without knowledge will have a precise correlate in thought that has freed itself of all cognition and intentionality. *Theōria* and the contemplative life, which the philosophical tradition has identified as its highest goal for centuries, will have to be dislocated onto a new plane of immanence. (Agamben 1998: 239)

For our purposes, we are concerned that assumed notions of life, like Kant's, animate dead educational practices, often through viral racist practices.

Notwithstanding the philosophical neglect that 'life' has received, today we grapple with new developments in bioinformatics that encourages a rethinking of what constitutes life. Bioinformatics 'imagines and promises superior forms of life that are both utopic in intent and haunted by dystopic envisioning of a humanity (and humanities) "left behind"' (Mikulan and Rudder 2020: 618). Mikulan and Rudder (2020: 618) suggest that 'coming to terms with this contentious duality requires an education to not only respond to futures without humans as we know them', but to engage in (im)possible praxes of future forms to come, and built against the history/category of Man. Education continues to insist that all life matters, even if many of these expressions of equality are steeped in juridico-economic effects of colonial and imperial histories masked as moral prescriptions used to govern a 'good life'. Regardless of education's insistence on equality, life scientists

are continually engaged in an effort to discover ways to create new and better forms of vitality through bioinformatics. Implicit in this bioinformatic search is the reminder and admission that all life does not matter equally.

2.1 Chapter Intent and Organization

Today, the idea of life has become the contemporary 'framing problem' because 'new modes of knowing life – ranging from epigenetics, virology, neuroscience, and nanotechnology to geology, astrobiology, and cosmology – present critical theory with the task of creating concepts' (Weinstein and Colebrook 2017: 4). For Weinstein and Colebrook (2017: 70), the task of creating concepts arrives from the fact that 'ways of thinking about, knowing, and transforming life dramatically change what might count as living and the epistemic and ontological status of life itself'. Of course, it was just a few decades ago that education governed preferential forms of life eugenically, betraying so many of its Modernist propositions. As Weinstein and Colebrook (2017) noted, contemporary advancements in bioinformatics re-raise – but also, re-trouble – historical discourses in education concerned with its disciplinary practices of treating life as an evolutionary determined concept (or, as we discuss shortly, *closed system*), particularly with regard to raciality [the *sine non qua* onto-epistemological signifier of coloniality (da Silva 2014)].

This chapter is theoretical and speculative. It is designed to unsettle conceptions of education and interject additional problems into the institutions of education and its concomitant practices. We do not provide obligatory recommendations or improvements to enable the continuation of this Modernist institution. As such, our speculations and problematizations are designed to escape education rather than to improve or reform it (Webb and Mikulan 2021). The chapter utilizes four bodies of literature: critical life studies (Pearson 1999; Weinstein and Colebrook 2017); educational bioinformatics (Peters et al. 2021a), and machinic reasoning and thought (Parisi 2013). The fourth body of literature that we draw upon are literatures that discuss how the assemblages of life, information, biomedia, bioinformatics, and machinic thought condition, and are conditioned on, categories of race, racism, and raciology (Brown 2015a; Gilroy 1998; Jackson 2020). We delimit our discussion to issues of anti-Black racism and in relation to discussions about Black 'para-ontologies', or the ways blackness functions to displace or exceed ontology (Moten 2008) and virtuality (da Silva 2014).

We sketch an alternative set of logics and practices concerning education as it stands at the precipice of the next, but incredibly powerful, bioinformatic era. Rather than understanding bioinformatics as a disciplinary locus to optimize, enhance, improve, reform, or more efficiently practice education, we treat bioinformatics as a locus laden with possibilities to escape education (Ball 2020; Ball and Collet-Sabé 2021; Webb and Mikulan 2021). In other words, we examine some of the possibilities that bioinformatics have to escape the biopolitical and disciplinary registers that education will likely use to filter bioinformatic developments in order for greater

biopolitical control (Deleuze 1992). We utilize the idea of 'contagion' to examine the transmogrifying aspects of bioinformatics and data in education, and speculate how these aspects can facilitate escape (Parisi 2013). We examine how *digital contagions* in bioinformatic technologies 'take on a life of their own', and discuss some of the implications this has to escape biopolitical theory and educational governance.

The chapter begins by providing a brief overview of bioinformatics and discusses the implications this emerging industry has for educational governance. We discuss how data and life morphs, mutates, and changes – without human intervention – by drawing on Luciana Parisi's (2007, 2013) concept of *contagion*. In her work on artificial intelligence, Parisi (2007: 32) argued that the life is produced through 'contagious transmission rather than filiative heredity'. We work with her idea of contagion to counteractualize (Deleuze 1990) vitalist conceptions of life, and particularly racialized ideas of life, that continue to be used to govern education through naive and racist ideas like Kant's *good life*. In other words, the chapter argues that data and life operate in contagious and dissipative ways that provide energetic opportunities to challenge, and possibly escape, Modernist and biopolitical ideas of education designed to assemble, enhance, multiply, and select preferential forms of life.

The chapter notes that contagion is also a dangerous aspect of any life – a condition that education utilizes repeatedly to steer and govern human capital production through fear. We discuss how contagion produces errant and necrotic forms of life that simultaneously interrupt evolutionary determined enunciations of life and interject potentially explosive mutations. We note, then, that contagion presents an additional problem to the future of educational governance – *that representative epistemologies and ontologies are no longer about human notions of production, reproduction and selection but contingent practices of contagious silicon-based objects and thanatropic non-human processes*. In other words, we believe that control can be increasingly displaced from education and educational governance by accelerating our contagious bioinformatic moment.

Our premise is that bioinformatics are caught within the bifurcating logics of 'life' (e.g., either closed or open; passive or active; given or produced; mechanical or vital; dead or alive; human or nonhuman). As a result, educational subjects and bodies are also caught between (at least) two systems of governance, especially when the scale with which the question of the digital is measured remains the scale of an organism. On one hand, education continues to treat life and bodies as evolutionary determined and hence selected, disciplined and trained; and, on the other hand, education governs life and bodies as something that are immanently plastic, that constantly exceed disciplinary enclosures, and that can be infinitely modulated or 'optimized' (Deleuze 1992). We conclude with discussing the limits of active, biocentric vitalism (agency, reason, self-possession) which are embedded in education, educational governance, and particular articulations of bioinformatics (e.g., computational biologies). Rather than understanding life within humanist traditions (e.g., a contained subject position), we propose a speculative reading of bioinformatics as a particular moment of 'excess contagion'. We argue that bioinformatics is a scientific and technological force that exceeds enclosures, but one that

education will try to harness in order to widen its own limits by optimizing the desires to financialize, privatize, and develop 'human capital' (Becker 1964; Brown 2015b; Foucault 2008).

If bioinformatics can simultaneously equalize and exacerbate unequal forms of life, we conclude paradoxically, that accelerating this bioinformatic moment might instantiate a 'decoloniality of informatics' through the proliferation of contagious, uncertain, errant, necrotic, and mutant life. Rather than reform education and its anti/racist declarations of vitalist life, we suggest an accelerated use of 'contagious bioinformatics' as a way to proliferate unknown becomings for new kinds of intra-connectivity, especially between human and inhuman networks of relationality. Luciana Parisi (2004: 134) characterized our moment of contagious bioinformatics as the 'symbiotic assemblage of non-analogous modes of information … multiply the lines of transmission – stimuli and receptions – between all modes of communication: a virus, a human being, an animal a computer'. Contagious bioinformatics for a people yet to come ….

3 Bioinformatics and the Biomediated Body

The term *bioinformatics* is a portmanteau for technological capacities and abilities that treat 'biology as digital information, and digital information as biology' (Peters et al. 2021b: 370). Bioinformatics can be defined as 'the application of computational tools to organize, analyze, understand, visualize and store information associated with biological macromolecules' (Luscombe et al. 2001). Perhaps the most well-known example of bioinformatics has been the global endeavour to map the human genome, and bioinformatics is increasingly used in a wide range of endeavours including developing vaccines for diseases, psychopharmacology and personalized therapies, and within structural and functional genomics. As Craig Venter (in Peters et al. 2021c: 2) puts it, '[w]e can digitize life, and we generate life from the digital world. Just as the ribosome can convert the analogue message in mRNA into a protein robot, it's becoming standard now in the world of science to convert digital code into protein viruses and cells.'

We limit our discussion of bioinformatics to endeavours designed to alter epidermis and epidermal growth factors. The literature sometimes refers to this particular area of bioinformatics as *skinomics* – 'a field of bioinformatics applied specifically to skin biology … Skinomics has been expanding into extensive genome-wide association studies, e.g., of psoriasis, proteomics, lipidomics, metabolomics, metagenomics, and the studies of the microbiome.' (Younis et al. 2017) For some, skinomics portend a future where … '"skinomics" techniques will be mature [enough] to become applicable to the personalized dermatology practice of the future' (Younis et al. 2017).

In addition, one of the significant computational tools used in bioinformatic research is artificial intelligence (AI).[2] Increasingly, 'there is growing interest in the application of [AI] techniques in bioinformatics' (Narayanan et al. 2002: 91), because '[AI] can be used to analyze process and categorize the gigantic amount of biological data in less time. Numerous AI algorithms have been developed and used in bioinformatics analyses.' (Hanif et al. 2019: 114) A key aspect to our argument lies in the ways AI operates within the technological assemblage of bioinformatics. More specifically, we are interested in the ways that AI prehends race and race data within its computational practices of skinomics.

3.1 Biomediated Bodies and the Raced Subject

Developments in quantum physics, nanotechnology, cellular and molecular biology, neuroscience and epigenetics tell us that life as we know it can no longer be read as deterministic because life has always been artificial (Colebrook 2011) and plastic (Malabou 2009) in its transmission of code and information. Patricia Clough (2008: 2) argued that our bioinformatic moment has generated the 'biomediated body' – a liminality that contemporary bioinformatic forces are directed toward 'the forging of a new body'. The biomediated body 'exposes how digital technologies, such as biomedia and new media, attach to and expand the informational substrate of bodily matter generally, and thereby mark the introduction of a "postbiological threshold" into "life itself"' (Clough 2008: 2). Biomedia involves 'digitization', whereas 'the image itself has become a process, which not only invites the user's interaction but rather requires the human body to frame the ongoing flow of information, shaping its indeterminacy into meaning' (Clough 2008: 5–6).

Biomediated bodies are positioned within diametrically opposed understandings of life, whereas, on one hand, life and bodies are evolutionary determined and hence selected, disciplined and trained (Foucault 1995); and, on the other hand, life and bodies are immanently open, modulated, and constantly exceed disciplinary enclosures (Deleuze 1992). Clough (2008: 2) locates biomediated bodies precisely within these diametric oppositions of 'life itself', and within the corresponding, and often painful, transformation from industrial capitalism toward a hyper-financialized and neoliberal force. Here, the biomediated body is a 'historically specific mode of organization of material forces, invested by capital into being'.

[2] We use the following definitions throughout: artificial intelligence is defined as the theory and development of computer systems that interact and perform human cognitive tasks (e.g., visual perception and speech recognition); and the following two features which can be discrete from, but are increasingly seen as aspects of AI, (a) algorithm is a defined list of steps for solving a problem and a computer program can be viewed as an elaborate algorithm; (b) machine learning occurs when computer systems learn from data, enabling them to make increasingly better predictions. (Luckin et al. 2016)

Clough (2008: 2) notes that the biomediated body produced through different economic transitions parallel the accompaniment of 'relations of power in the shift of governance from discipline to biopolitical control, a shift that depends on a certain [re-]deployment of racism'. We agree, and note that the continuous surplus value generated through different racisms is extracted from biomediated slave labor, fracked from the earth's strata, and continually expropriated through the neo- and re-colonization of native territories (Da Silva 2014). As Clough (2008: 18) observed, '[w]hat makes the biopolitics of the biomediated body a political economy then, is the break into biology or "life itself" by carving out various populations in order to estimate the value of their capacities to live'. Sylvia Wynter (2005: 364) described the intersections between biomediated bodies and political economy as *racism*, or 'an effect of the biocentric conception of the human' (see also Foucault 2003; Mbembé 2003).

Like ourselves, Clough (2008: 2) is ultimately interested in the liminalities produced in biomediated bodies, and specifically with how biomediated bodies are 'empirically realized and in terms of the philosophical conception of the virtual'. For our purposes, we connect Clough's ideas about the virtual to Denise Ferreira da Silva's descriptions of the virtual, namely transubstantiality, whereas

> racial knowledge transubstantiates (shifts them from the living to the formal register) what emerges in political relations into effects of efficient (scientific reason's) causality, its critical tools fail to register how the total (past, present, and future) value expropriated is in the very structures (in blood and flesh) of global capital. (da Silva 2014: 83)

Like Clough and da Silva, we believe that bioinformatics is beginning to accumulate capital from '"life itself", an abstraction which reduces life to a new unit for negotiating an equivalency between the cost of energy expenditure and its reproduction or replacement' (Clough 2008: 14).

Throughout our discussion, we note that any idea of a decolonial bioinformatics must account for its supposed scientific non-neutrality. For example, in our post-pandemic moment, imbued with the biopolitics of human capital, we note that the lives of most humans are mediated in some way by science and techno-information, but in disproportionate ways. Privileged bodies enjoy both the life-enhancing medical procedures and products (such as vaccines), and enjoy better survival rates due to improved access to information; while, unfortunately, other, sexed and racialized bodies are utilized as raw sources and labor, valued mostly for their biological (reproductive) capacities.

3.2 The Possibilities and Problems of Bioinformatics to Disaggregate Raciologies

Paul Gilroy (1998) surmised that our bioinformatic moment will have profound impact on the ways race, racism, and raciologies are understood and practiced. Gilroy speculated,

> [t]he old, modern representational economy that reproduced 'race' is today being transformed … by the scientific and technological changes that have followed the revolution in molecular biology … [I]t is possible that we shall do a better job of countering the racisms, the injustices … if we make a more consistent effort to de-nature and de-ontologize 'race' and thereby to disaggregate raciologies. (Gilroy 1998: 839)

In many ways, our chapter takes its impetus from Gilroy's (1998) ideas about the possibilities of biotechnology to de-ontologize race. However, we complicate our contemporary bioinformatic moment in two ways. First, we note the pervasive biopolitical rationalities in education around racialized eugenics and the ways contemporary advancements in bioinformatics re-raise – but also, re-trouble – discourses in education concerned with its historical and disciplinary practices of treating life as an evolutionary determined or closed system. The contemporary vernacular around optimization and enhancement is historical code particularly for racialized/non-White populations. Gilroy (1998), of course, is rightly not interested in optimizing bodies with biotechnology, but we note that educational practices and educational governance rely on these rationalities quite a bit.

For example, Rose (2007: 16) referred to the capacity to recombine the molecular body, or the recombinant body, as part of the expansion of the technologies of optimisation, in which a technology is both equipment and techniques but 'is more than this. It is an assemblage of social and human relations within which equipment and techniques are only one element.' Gulson and Webb noted that the recombinant body

> is part of a long history of optimisation connected to eugenics, and hence the idea that postgenomics is seeing a re-racialisation in molecular terms (Meloni, 2017), an occurrence in which there is a re-emergence of multiple biological underpinnings for race (Morning, 2014). This is to see that optimisation can be premised on normalisation – that is, the practice of eliminating biological differences that are considered to threaten what is deemed as 'normal life'. Making optimisation synonymous with normalisation … has led to some claims that forms of postgenomics such as epigenetics have been considered a possible science of new eugenics (Mansfield & Guthman, 2015). (Gulson and Webb 2018: 7)

The second complication that we introduce has to do, broadly, with control and agency. Above, Gilroy (1998) used the preposition 'we' to signal a certain level of human agency or human control within attempts to de-nature and de-ontologize race. We want to stress that conceptions of raciality and emerging attempts to de-nature and de-ontologize race can be generated by both humans *and* machines, in which 'algorithmic rules now generate or construct patterns from the re-assemblage of data' (Parisi 2019: 2). What is significant about machinic understandings of life, race and processes of racialization are the extensive range of applications produced by the intensification of new computing power and availability of (big) education data and (big) biological data, including the possibility of AI to apprehend these data on 'their' own.[3] This is to take seriously what others have described as an 'autopoiesis' of machinic prehension (Fazi 2019), or what Luciana Parisi (2013)

[3] Facial recognition may be the clearest evidence of how racializations and racism are re-circulated through AI (Gulson et al. forthcoming).

described as *contagion*. In other words, we condition Gilroy's hope to disaggregate raciologies with bioinformatics with the assistance of non-human actors and the autopoiesis of machinic prehensions. However, we note that any disaggregated raciology must confront how it has been historically territorialized within unequal discourses and practices of optimization, and imaginings of recombinant – and disqualified – bodies.[4]

We discuss the autopoiesis of machinic thought next, and specifically with Luciana Parisi's idea of machinic contagion.

4 Contagious Life: Dissipative Structures and the Virtual Possibilities of Disorder

Luciana Parisi (2013) argued that artificial intelligence, machine learning, and algorithms prehend data through a process of *contagion*. Parisi stated,

> algorithms prehend the formal system into which they are scripted, and also the external data inputs that they retrieve. Nevertheless, this activity of prehension does not simply amount to a reproduction of what is prehended. On the contrary, it can be described as a contagion. This is because to prehend data is to undergo an irreversible transformation defined by the way in which rules are immanent to the infinite varieties of quantities that they attempt to synthesize. (Parisi 2013: 16)

Parisi's idea of non-anthropocentric contagion signal that machinic thought, i.e., algorithms used in skinomics, require, and rely on, propositions of uncertainty and incomputability. Indeed, algorithmic prehensions are actuated within innumerable forms of incomputibilities, or what Parisi (2013: 129) discussed as 'computational entropy' (i.e., randomness). For Parisi (2013), algorithms are independent, non-human entities fully capable of speculative thought *themselves.*

Katherine Hayles (2016: 33) noted that bioinformatics are best understood as 'cognitive assemblages' distributed across human and machine cognitions. Cognitive assemblages 'attend to new situations, incorporating this knowledge into adaptive strategies, and evolving through experience to create new strategies and kinds of responses'. Hayles (2016: 32) locates her idea through the idea of *assemblage* developed by Gilles Deleuze and Félix Guattari, whereas assemblage 'carries connotations of connection, event, transformation, and becoming'. Tony Sampson (2012), again borrowing from Gilles Deleuze (and particularly Deleuze's reading of Gabriel Tarde's microsociology), similarly extends biological contagion to, what he refers to as, 'the age of networks' best understood as 'virality'. Thus, we can understand bioinformatics as a 'ceaseless modulation of information that follows the auto-transmutation of matter [e.g., epidermus] by changing its activity of selection from one moment to the next' (Parisi 2004: 133).

[4] Disqualified bodies is, of course, a major aspect of Gilroy (1998).

For our purposes, we emphasize Parisi's ideas of machinic prehensions of uncertainty, incomputability, and 'computational entropy', or randomness. These dissipative structures function as contingent practices of virtuality, and are central to understanding how and where de-ontology resides.

4.1 Contagious and Mutative Bioinformatics

Uncertainty, incomputability, and computational entropy are processes that Keith Ansell Pearson (1999: 170) argued were intrinsic to 'machinic evolution' which 'refers to the synthesis of heterogeneities and involves the formation of a "consistency". A machinic assemblage connects and convolutes the disparate in terms of potential fields and virtual elements, and crosses techno-ontological thresholds without fidelity to relations of genus or species.' Contagion, then, is understood as attempts to form consistencies across heterogeneities, material *and* virtual, but undergoes an irreversible transformation itself immanent to the heterogeneities synthesized. In this sense, contagion necessarily and irrevocably mutates, whereas 'all living systems and their boundaries are caught up in machinic assemblages that involve modes of transversal becoming' (Pearson 1999: 170).

Pearson (1999) noted that AI, algorithms, and biology do not coincide with popular conception of life as the 'body-as-organism' or as a closed and determining system. Rather, biological and machinic life operate as open systems dependent on *contagious* dynamics. Pearson stated,

> it is erroneous to view the organism as an entity entirely separate from, and evolving independent of, its environment, or to reify the environment by treating it as something given and fixed, and which, it is alleged, produces only a 'passive' model of adaptation. Organisms cannot be treated as closed systems simply subjected to external forces and determinations; rather, they have to be understood in more dynamical terms as open systems that undergo continual flux. (Pearson 1999: 146)

Contagion, then, assists in understanding that bioinformatics and its objects of practice, are 'not reducible to its particular genetic structure or composition. In other words, what are important are not the components of the system but the dynamic relations between them' (Pearson 1999: 169).

4.2 Disorder and Dissipation: Life in Death

Clough (2008: 14) noted that understanding life (biological and machinic) as open systems 'makes it possible to theorize information once again, this time in terms of open systems, where information is connected both to the movement from disorder to order and from order to disorder'. Contagious bioinformatics is expressed through dynamic relations between 'negentropic decrease of entropy' which generates a reciprocal proliferation of 'complexity or turbulence, a disordering of order can

emerge' (Clough 2008: 14). For example, Claire Colebrook (2011: 14) noted that the human eye does not just prehend sensory input, but simultaneously censors, edits, color-codes, synthesizes and selects how the non-perceived will be 'fabricated'. That is, the eye as an 'organ composed of singularities undergoes an irreversible transformation each time it actualizes pure potentialities of what it is "to see" but can only proceed efficiently with a high degree of not seeing' (Colebrook 2011: 14).

By way of vulgar analogy to educational bioinformatics, the overt focus on functional and genetic structures inherent to closed systems (e.g., ordering, synthesizing, actualizing and harmonizing) obfuscate the negentropic dynamics involved with, for example, sight. By favoring the pre-programmed or genetic, and so-called productive aspects of closed systems, education attempts to control disorder. In other words, education continually treats life as a closed system and tries to de-limit what can and cannot be prehended and hence understood or fabricated. Nevertheless, we argue, a contagious bioinformatics in education attends to the relations of differentiation, dislocation and dissolution germane to life as open systems. A contagious and decolonial bioinformatics in education would attend to disorder rather than control. It would pay close attention to attempts to manage, colonize, and control entropy, particularly in the name of educational governance practiced on the values of efficiency, choice and optimization.

Clough (2008: 14) noted that open systems of bioinformatics utilize 'dissipative structures' which 'allows for the virtual or potential emergence, that is, the deferral of entropy'. Dissipations can be understood as a loose form of decoherence – the loss of information from a system into a milieu. Importantly, dissipations and decoherence are productive, whereas loss simultaneously produces virtual conditions for energetic opportunities. For instance, Reza Negarestani (2011: 183) discussed dissipative structures as 'thanatropic regression or the compulsion of the organic to return to the inorganic state of dissolution'. What Negarestani (2011: 187) points to is how 'dissipative structures' produce the virtual through 'the traumatic scission of the organic from the inorganic provides the organism with energetic opportunities which are posited as sites and conditions for participation'. In other words, dissipative structures, decoherence, and thanatropic regressions are productive, virtually. The overt focus on life as a closed system obfuscates the virtual possibilities contained within processes of dissipation and decoherence.

Parisi (2013), Pearson (1999), Clough (2008) and Negarestani (2011) all note that dissipation, decoherence, and death (e.g., decomposition, and decay) function as sites of possibility rather than (only) as designations of finality. Moreover, dissipative structures can be appropriated by a variety of different political economies – capitalism, racism, sexism, etc. As Clough (2008: 11) observed, 'the appropriation of these complexities as the noisy condition of chance mutation and creation may be most desirable for capital accumulation'. Dissipative structures mark virtual sites of engagement, and position bioinformatics as a contagious locus of excess, proliferation, and mutations for different political economies to accumulate capital. As such, we believe there are 'dangerous' opportunities to accelerate these forms of accumulation in order to produce what Moten (2008: 187) discussed as a para-ontology,

whereas '[t]he lived experience of blackness is, among other things, a constant demand for an ontology of disorder, an ontology of dehiscence, a para-ontology'.

However, contagion, dissipation, decoherence, as practiced in open systems, are expressed disproportionately. Depending on the precariousness and vulnerability of the open system, bioinformatics are implicated in and productive of ongoing colonial and neocolonial enclosures (e.g., life and race (and sexuality), schools, prisons). Here, Sylvia Wynter's (2005) concept of *sociogeny* is helpful. Wynter (2005: 361) offered the idea that, '[m]y proposal is that we are bio-evolutionary prepared by means of language to inscript and auto-institute ourselves in this or that modality of the human, always in adaptive response to the ecological as well as to the geopolitical circumstances in which we find ourselves'.

Sociogeny provides our proposal of a contagious bioinformatics with two important ideas. For one, sociogeny identifies adaptation, ecology, and geopolitics as obvious disproportionate and unequal forces that affect life. Two, sociogeny pushes the logic of the 'immanently open' (i.e., life, bodies) beyond the bifurcating biocentric logic of raciality. For instance, sociogeny directs our attention beyond the binary oppositions of transcendence (closed systems, evolutionary substratum/DNA) and immanence (open systems, desire, infinite optimization, etc.). Sociogeny is a remarkable idea that noted, philosophically rather than scientifically, processes associated with environmental epigenetics and what is loosely discussed as processes of 'soft hereditary' (Meloni 2017). Rather than bifurcating life as either closed *or* open, sociogeny and environmental epigenetics suggest life is produced within closed *and* open systems, or 'the idea that the hereditary material is affected by the parents' or grandparents' lifetime experiences, not fixed at conception (Meloni 2017, p. 4)' (in Gulson and Webb 2018: 6).

For our purposes, sociogeny locates life firmly within the biopolitical economies of desire, produced by and productive of biocentric raciality. That is, we are mindful of the potentially contradictory desires of open systems when articulating the racial and racialized categories that have structured the contemporary composition of the bio / info / matics. Sociogeny helps us understand how open systems are opaque, indifferent, and nonhuman, but also desirous, sensed, and prehended.

5 Ontologies of Dehiscence and the Plasticities of Educational Governance

Fred Moten (2008: 187) argued that '[t]he lived experience of blackness is, among other things, a constant demand for an ontology of disorder, an ontology of dehiscence, a para-ontology'. We have argued that an ontology of disorder can be located within a bioinformatics premised on open systems, rather than on closed systems. Further, an ontology of disorder can be proliferated through the contagious and nonhuman computations and dissipative structures of AI. As a point of orientation, we might accelerate, rather than constantly regulate, our contagious bioinformatic moment in order to produce ontologies of dehiscence.

Moten's (2008) 'constant demand' for dehiscence focusses the educative moment of bioinformatics within the very conditions of excess that already exist within the para-ontologies of life premised on open systems. This excess is located doubly within machinic capacities for contagious thought, an acceleration of bioinformatic's own capital accumulation of thanatropic regressions and dissipative structures. These decidedly non-human actors nuance Gilroy's (1998) hope to 'disaggregate raciologies' with, what we believe, are largely non-anthropomorphic processes of contagion produced by non-human actors and indifferent processes of mutation and decoherence.

Another educative moment within the uses and practices of bioinformatics is to note how biopolitical discourses about 'optimization' continually swarm and shape biomediated bodies. As Clough (2008: 10) noted, the biomediated body 'is a recent complexification in bodily matter at the molecular level as its informational capacity is made more productive'. We have no doubt that the fields of bioinformatics premised on closed systems will attempt to control contagion, excess, and mutation in order to accumulate more capital, one form being the production of more useful bodies, often referred to as 'human capital' in education. As such, we understand a bioinformatics premised on closed systems as a likely return to different forms of racism. Hence, ours and others' pleas to escape education (Webb and Mikulan 2021), and in ways best suited for their particular situations, perhaps as forms of counter-conduct (Ball 2020; Davidson 2011; Foucault 2007), counter-actualization (Deleuze 1990), and/or fugitivity (Harney and Moten 2013).

The scientific and educational preference for closed systems positions bioinformatics in diametric opposition to Moten's (2013) idea of a para-ontology. We anticipate that bioinformatics premised on closed systems will employ education and educational governance as the primary means to extend the idea of a productive body, particularly within the economic processes of racialized optimization and accumulation. In other words, education's historical investments in practices of normalization will not interrupt the bioinformatic 'wet lab'. Rather, education will likely represent an invaluable site of (big) data for future biomediated productions and accumulations. More importantly, education will position itself (once again) as a complimentary site to both normalize and differentiate (i.e., contain) the mutations of a contagious bioinformatics. Thus, education will likely continue with its eugenic practices, but now through the expropriation of the virtual manifest in contagion and dissipation.

5.1 The Complimentary and Contradictory Desires of Biomediated Bodies

The biomediated body, a liminal and desirous one, is stretched between the teleologies of different closed systems of bioinformation, and cast within the contagious excesses of disproportionate and desirous open systems. Moreover, the liminalities and desires of the biomediated body are expressed through shifts in industrial

capitalism to contemporary financed ones. For example, Rose (2007: 20) noted that the liminalities of the biomediated body rest with a consumerist reorientation from normalization to customisation. He stated:

> In part, I suspect, the feeling of novelty and disquiet arises from the sense that we are moving, in the words of Adele Clark and her colleagues, 'from normalization to customization' … Pre- viously expert medical interventions were utilized in order to cure pathologies, to rectify gen- erally accepted deviations from desirable functioning or to promote biopolitical strategies through lifestyle modification. Now recipients of these interventions are consumers, making access choices on the basis of desires that can appear trivial, narcissistic, or irrational, shaped not by medical necessity but by the market and consumer culture. (Rose 2007: 20)

We would just add that the biomediated body is not simply one stretched across conflicting forms of governance, capital, desires or even conflicting ideas of information and 'life itself'. Rather, bioinformatics is an exceptional site of contradiction that invites bodies to invest in themselves through, and even with, these contradictions. In other words, we might not place normalization and customization as distinct poles, but rather, as complimentary *and* contradictory desires, whereas it is easy to understand how customization can be normalized, and normalization differentiated.

Today, the 'customized' educational subject is no longer an 'individual' with an assumed 'potential' waiting to be trained through disciplinary schooling. Rather, '[i]ndividuals have become "dividuals," and masses, samples, data, markets, or "banks"' – redolent of the contemporary biomediated body (Deleuze 1992: 5). For Deleuze, desire is what marks control societies 'because they express those social forms capable of generating them and using them' (Deleuze 1992: 6). In this sense, bioinformatics produce desiring subjects, and in concert with discipline, 'biopolitics turns power's grasp from the individual subject to "life itself"' (Clough 2008: 18).

Once the biomediated body is understood as a locus of complimentary *and* contradictory desires, then, we believe it is easier to understand how racialized bodies are continually placed within constant and disproportionate forms of racism. Hence, 'a constant demand for an ontology of disorder' can be seen as a strategic site for blackness that attempts to recognize how racism is derived from closed biocentric systems of life, and simultaneously one that circumscribes the contagions, excesses, and mutations of open systems. 'An ontology of disorder' can be produced, we argue, through complimentary *and* contradictory desires of optimization, customization, and, when speaking of education governance, normalization.

Next, we discuss how bioinformatics functions as a desiring machine. We note how ideas of open systems, particularly notions of biological plasticity, are still circumscribed by the kinds of racisms noted by Sylvia Wynters and her ideas of sociogeny.

5.2 *The Plastic Fantasies of Open Systems: Contagion as Excess Raciology*

As we've discussed, the prevalent image of life that operates today is premised on a biocentric image of a particular human organism. It is enclosed, self-determining and elevated by a double movement of expropriation. On the one hand, the enclosure of White bodies continues to be produced by distinctive ways of coding, looking, measuring, classifying, dissecting, and evaluating Black and Brown bodies. Bioinformatics, on the other hand, manufactured in scientific knowledge procedures, produce physical, axiological and cognitive self-determinacy of whiteness as an effect of, and cause for, universal reason, – exemplified in this chapter through Kant's racism and Nussbaum's appropriation of universal reasoning as the basis for educational practice.

And, while modernist and disciplinary education is organized and modelled on this particular paradigm of biocentric, disciplinary or organismic 'life' (i.e., self-actualized and self-determined, vital), this same paradigm is conditioned on something that might be called artificial, indeterminate, or contagious. It is within these dissipative and virtual processes that a contingent counter-actualization of racialized bodies can be located. For example, in her reading of infinite indeterminacy and malleability of all life, Malabou (2015: 43) argued that the idea of *plasticity* has radically altered how (and if) material can be represented outside of itself (symbolically or 'transcendentally'):

> …if we can affirm that plasticity inhabits the biological, that it opens, within organic life, a supplement of indeterminacy, a void, a floating entity, it is then possible to claim that material life is not dependent in its dynamic upon a transcendental symbolic economy; that on the contrary, biological life creates or produces its own symbolization. (Malabou 2015: 43)

For Malabou (2015: 43), '[p]lasticity is in a way genetically programmed to develop and to operate without program, plan, determinism, schedule, design, or preschematization'. As such, 'existence reveals itself as plasticity, as the very material of presence, as marble is the material of sculpture. It is capable of receiving any kind of form, but it also has the power to give form to itself.' (Malabou 2015: 81)

Plasticity can be understood as a problemata that does not determine solutions. In fact, plasticity is always indifferent to solutions. On one hand, this indifference to solutions and functions (optimizations, augmentations, enhancements) signals a certain force of contagion, because plasticity, just as dissipation, ingresses its own irreversible transformations. However, as Jayna Brown argued in *Being Cellular, Race, The Inhuman and Plasticity of Life,*

> [o]ptimistic fantasies about the plasticity of life in contemporary speculative thought ignore the history of racial eugenics and its investment in these same ideas to its peril. It reminds us that scholarly enterprise can never be free of the contingencies that shape our understandings of life itself. Remembering how a plasticity of life was imagined and scientifically practiced through race and ability is key as scholars go forward in the project of decentering the human. A trust in scientific knowledge must be interrogated, and the 'we'

> of new materialist thinking situated historically. Scholars must remember not to assume a universally shared positioning in relation to the material world. (Brown 2015a, b: 327)

Similarly, Zakyyah Iman Jackson in *Becoming Human* conditions ideas of plasticity to acknowledge how anti-blackness lies at the root of most colonial conceptualizations of human forms. Jackson (2020: 73) argues that becoming 'any kind of form' is an optimization that is 'embedded in and conditioned by an anti-black imaginary' and particularly of an afterlife of slavery. Instead of affirming such a potential for optimization, Jackson (2020: 73) argues that plasticity 'concerns the way potential can be turned against itself by bonds of power'.

As an alternative to Malabou, Jackson's (2020: 72) plasticity is 'neither the thing-in-itself not an immanent ontology of the real but representational or paradigmatic: an a posteriori virtual model of a dynamic, motile mode of antiblack arrangement'. Jackson (2020: 72–73) concludes that 'ontologizing plasticization has been constituent to a mode of unfreedom and the history of antiblackness'. For our purposes, we suggest that folding the virtuality of optimization against itself can be conceived as excess contagion because of its own irreversible transformation of plastic potentiality. Thus, Jackson's notion of 'decentering the human' can be, we suggest, aided with the assistance of contagious machines.

Next, we end by discussing some of the implications of a contagious bioinformatics, particularly in relation to ideas of decoloniality and alternative approaches to studies of educational control. We stress some of the ethical considerations brought about from a contagious bioinformatics designed to de-ontologize race.

6 Excess Contagion: Virtuality, (Im)Possibles and a Decoloniality of Bioinformatics

We are two White academics writing from within a White university, situated on stolen indigenous lands. We are implicated in the political and affective dimension of systemic racism, and perpetuate it each time we conduct research, teach, and write from within its enclosures. This chapter is a speculative proposal, perhaps even a naïve one, that uses the disarticulations and refusals of a contagious bioinformatics to rethink, problematize, perhaps even subvert, raciology and educational control. Our speculations and problematizations are designed to imagine new modes of being and becoming – modes that account for, and proliferate, contagious and erratic encounters with dissipative virtual intensities. As such, this chapter has been written '*and* risked in the name of "impossibles"; future educational worlds that converge and diverge according to their own manners of composition' (Mikulan 2022).

Our argument stitches together somewhat disparate ideas about de-ontologizing race by accelerating, rather than regulating, bioinformatics. In no way is our argument designed to speak for anybody, and, in addition, we are uncomfortable thinking ours as a signpost about being and becoming an 'ally'. Rather, we have strung

together some 'impossible' ideas in order to generate a different thought, an alternative rationale, perhaps even a logic of refusal and subversion to the governing practices of raciology, raciality and education. As such, our chapter can be conceived as a kind of 'ex-colonization' of particular ideas and practices in order to accelerate a de-colonialization of educational governance and bioinformatics.

For example, Mikulan and Rudder (2020: 615) suggested that neo-vitalist materialist approaches to ontology and life must consider that 'racism is vitalist in the active sense because it begins with bodies' (as bounded organisms are always autopoetic and self-proximate). They also noted that 'vitalism is racist' because it 'distributes and discriminates racialized bodies according to their function as parts in a whole'. Speculations from/with bioinformatic (im)possibles, in contrast to molecular biopolitics, would be an orientation for educational thought that no longer begins with the image of a living, active, body imagined as a recombinant student that is to be managed and optimized. Rather, bioinformatic (im)possibles now present education with new problems of virtual, dissipative forces of de/composition that are indifferent to those of the reproductive human and the productive organism (and, of course, the persistent and disproportionate governance and control paid to the reproductive functions of females).

Our argument locates bioinformatics as a specific non-human machine that already proliferates contagion, randomness, and dissipative errors intrinsic to its calculating operations. This is the ontological supposition of Luciana Parisi's (2013) notion of contagion. Our argument rests in understanding that the redeeming project of an educational bioinformatics lies in its decoloniality, and particularly a decolonization directed to exceed enclosures (e.g., closed systems, 'racial purity', schools). This excess, we argue, is always already located within the non-human or non-anthropomorphized systems of life and information treated as open, rather than understood as closed. The converse of this statement, of course, is that education and its governance are designed entirely to control this excess.

If there is an element of human agency in a decolonial bioinformatics it is, we argue, to accelerate and proliferate these non-human systems and processes. Another locus of human intervention within a decolonial bioinformatics is to refuse attempts to 'fix', 'correct', or 'humanize' contagion and dissipative excess. Our gambit locates education as the likely and premier site to attempt to humanize and control bioinformatic contagion. Further, we believe education will try to re-inscribe contagion, error, and randomness in ways that are congruent with the humanistic, vital, and patently racist values of today – and importantly – yesterday.

As a result, we recognize and fully acknowledge that our 'impossibles' are not a straightforward politic because we believe that education governance (e.g., policy) will likely try to harness the excess of decolonial bioinformatics in ways that continue to multiply and control populations. As such, a decoloniality of bioinformatics should account for the dissipative structures and thanatropic regressions of open systems, and accelerate machinic contagions and virtuality released from these reproductive functions. What Moten (2013) discussed as an ontology of disorder, then, is oriented towards proliferating disequilibrium, and dehisence, and is

'dangerously' contingent, dissident, indeterminate, incalculable, uncertain, and unbinding.

Our decolonial bioinformatics follows Colebrook's (2011) reading of Deleuze that it if the self-efficient human organism were to be 'radically recalibrated' in the future, it is possible to live outside the confines of closed systems and develop injunctions to biopolitical and educational control. As such, our ideas about a decolonial bioinformatics conditions images of a people yet to come by insisting that it is ethically irresponsible to continuously tear and split the biopolitical. Infinite varieties of impersonal quantities and immanent qualities that dissipate and decompose are unequally arranged and disproportionately experienced (e.g., Black/White; male/female). A decolonial bioinformatics is cognizant that any politics of dehisence will likely bifurcate ontologies into subjective, productive enclosures on one hand, and objective, subhuman and lazy forms on the other. *What is at stake are relations of being and death, wherein racialized de- and re-compositions reside within closed pasts of displacement and death, and within so-called 'hopeful', open and vitalist futures that will ceaselessly split blackness in unequal ways*.

Our decolonial bioinformatics suggests that after being irreversibly transformed in the continual process of colonial *ontologizing plasticization*, racial singularities (conceptual, spatio-temporal, gestural), once released from a particular grammar of raciality endure virtually as excess contagion. A decolonial bioinformatics is no longer tied to Black corporeal existence only, but transubstantiated into something else (da Silva 2014). Da Silva (2014: 93–94) argued that virtuality can be understood through the idea of transubstantiality when she noted that 'transubstantiality, finally, becomes a possibility' when there is a 'break through the formal lines of space inscribed by our categories (of body, of species, of genus)'.

Excess contagion, born from the dissipative structures and thanatropic regressions of open systems, mark virtual sites of engagement and endure as virtual intensities. Excess contagion is a productive force of (im)possibles – potentialities to become re-augmented, re-optimized and re-invested in new, different, and possibly mutative forms of life. Our speculative proposition for bioinformatics that disarticulates/refuses biocentric raciality in order to imagine new modes of being and becoming agrees with what Mikulan (2022) noted were an ethics of refusal. This ethics of refusal 'attends to the structural deformations that are maintained by the epistemic praxis of erasure and dissimulation so prevalent in higher education (and schooling in general), which continue to insist on engaging with the presupposed and proper *possibles* for social change'.

If excess contagion (expressed virtually as dissipation and transubstantiality) is understood to be that which informs bioinformatic practices and outputs, we note that this excess can be thought of as virtuality because its composition is dissipated beyond any single desire. The event of dissipation/entropy/death inherent to contagion no longer indicates a moment of 'going beyond', or when death and dissipation are understood as external and extrinsic to the finality of matter from the outside. Rather, death, dissolution, and thanatropic regressions involve the productive processes of virtuality and transubstantiality (molecular into cellular; conceptual into

digital). Importantly, contagion indicates a repetition, an instauration of a life with no deterministic arrival, return or conclusion. In the words of Deleuze (2005: 28), '[t]he life of the individual gives way to an impersonal and yet singular life that releases a pure event freed from the accidents of internal and external life, that is, from the subjectivity and objectivity of what happens'.

Like Agamben (1998) earlier, we also advocate for more philosophical understandings of life. Moreover, we believe that analyses of education policy and governance attend to how dissipative forces operate within our contagious and bioinformatic moment. We simply do not believe that bioinformatics can be separated from educational control. In fact, bioinformatics is its product. Nevertheless, the indifferent forces that both philosophical and education policy studies should find new ways to account for those that compose errant life, death, decomposition, dissolution, and mutation. Contemporary educational analyses that attend to errant life would, we believe, require new scales against which we juxtapose the non-organismic opacity of a singular life, confronted, for example, by planetary scales already responsive to future impossibles through transubstantiation. In other words, we advocate for analyses of educational control that search out a new ethics of scale, or even analyses of educational policy that un- or de- scale education's predilection for closed, vitalist, and humanistic scales (e.g., human ethics). Scale, of course, is itself a biocentric tool and method that measures, narrates, cuts and fetishizes that which it has already predetermined (life-death, Black-White, male-female, past-future, human-nonhuman, artificial-non artificial, organic-computational, etc.).[5]

The remaining questions, for us, relate to educational control. For example, to what extent can education proliferate contagion and dehiscence (as discussed herein)? What forms of life are educated in contagion, rather than those educated through reproduction and vitalist control? Will studies in educational governance examine errant life, death, decomposition, dissipation, dissolution, and mutation, and in ways that are congruent with escaping education rather than reforming or improving it? Or, will studies in education policy continue to examine overt and 'productive' relationships, reproducing vitalist habits in studies of control, power, and force?

Educational control is entirely dependent on anthropomorphic and human scales. As such, the most likely outcome of our bioinformatic moment is that education and education governance will simply co-opt dissipative forces in order to widen its own limits. This co-optive tactic will likely try to regulate contagion, dissipation, and errant life in order to optimize current biopolitical and historical raciologies. Of course, it is entirely possible that it may do both. If 'a people yet to come' can be actualized, we believe that they will do so through concerted efforts to escape education, rather than endless efforts to try and reform education, or through governmental commissions designed to regulate technology.

[5] Ideas about 'posthumanism' contain some of the clearest demarcations of how scale remains largely anthropomorphized and biocentric. See, for instance, Braidotti (2013).

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