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Critical Relationality: Queer, Indigenous, and Multispecies Belonging Beyond Settler Sex & Nature

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FROM BITS TO BODIES: PERFECT HUMANS, BIOINFORMATIC VISUALIZATIONS, AND CRITICAL RELATIONALITY

JENNIFER A. HAMILTON

***Abstract**: In December 2014, computational biologist Lior Pachter posted the results of his "tongue in cheek" in silico genome experiment on his personal blog, where he declared his discovery that "the perfect human is Puerto Rican." In this article, I analyze the "perfect human" experiment. I argue that despite the use of 21st-century, cutting-edge technology in computing and genomics, Pachter's experiment and his use of visualization can be usefully juxtaposed with earlier modes of visualizing heredity, namely the development of composite portraiture in the late-19th century and late-20th century technologies of "morphing." I temper the celebration of Pachter's creation of a "mixed race" perfect human in silico with a challenge to its ostensibly progressive stance. I instead suggest that it must be understood in the broader context of eugenic hauntings and contemporary tensions around questions of sex, sexuality, race, nation, and indigeneity. I argue that the scientific, specifically genomic, stories that we tell, can be productively read in light of critiques of biogenetic kinship and the naturalization of heterosexual love. I conclude by arguing that the perfect human experiment makes a particular kind of argument about what it means to be human and perfect and what constitutes legitimate and cognizable modes of relationality.*

***Résumé**: En décembre 2014 le biologiste informaticien Lior Pachter a annoncé ironiquement les résultats de son expérience virtuelle sur le génôme dans son blog personnel, dans lequel il déclare sa découverte que 'l'humain parfait est portoricain.' Dans cet article, j'analyse l'expérience de 'l'humain parfait.' J'avance qu'en dépit de l'emploi de la technologie la plus avancée du XXIe siècle en matière d'informatique et d'étude du génome, l'expérience de Pachter et son utilisation de la visualisation peuvent être utilement juxtaposées à des modes antérieurs de visualisation de l'hérédité, spécifiquement de la portraiture composite dans les techniques de 'morphisme' de la fin du XIXe et du début du XXe siècles. Je tempère la célébration de la création virtuelle de Pachter d'une "race mixte" d'humains parfaits en remettant en cause sa position ostensiblement progressive. Je suggère qu'elle doit plutôt être comprise dans le contexte plus large des obsessions eugéniques et des tensions contemporaines autour des questions de sexe, de sexualité, de nation et d'indigénéité. J'avance que les récits scientifiques, spécialement génomiques, que nous racontons peuvent être lus de façon productive à la lumière des critiques de la parenté biogénétique et de la naturalisation de l'amour hétérosexuel. Je conclue en suggérant que l'expérience sur l'humain parfait représente un argument particulier sur ce que signifie être humain et parfait et sur ce qui constitue des modes de relationalité légitimes et perceptibles.*

> *In the U.S. race has always been dependent on the visual.*
> *- Evelyn Hammonds, "New Technologies of Race" (1997)*

> *In the United States, race immediately evokes the grammars of purity and mixing, compounding and differentiating, segregating and bonding, lynching and marrying. Race, like nature and sex, is replete with all the rituals of guilt and innocence in the stories of nation, family, and species.*
> *-Donna Haraway, Modest_Witness@Second_Millenium.FemaleMan Meets_OncoMouse (1997)*

In December 2014, University of California, Berkeley computational biologist Lior Pachter posted the results of his "tongue in cheek" *in silico* genome experiment on his personal blog, where he declared his discovery that "the perfect human is Puerto Rican" (Pachter). Pachter applied computer modeling and statistical analysis to genetic code to produce his results. The results of Pachter's experiment, particularly his claim to have located the "perfect human," exploded on social media—160,000 shares in one day—and provoked significant discussion, both serious and humorous. The post also caused discomfort among some mainstream genomic scientists, including those who collected the blood samples that provided some of the data for this thought experiment (Oleksyk and Martinez Cruzado). Such scientists expressed concern that the public had missed Pachter's "sarcastic…tongue-in-cheek tone that ridiculed perfect-human arguments" and instead took the "experiment" seriously (Oleksyk and Martinez Cruzado; see also Irizarry).

While Pachter ultimately disavowed the existence of a "perfect human," a goal he describes as "a misleading undertaking," he nevertheless proposed that such a being, were they to come into being, would not be of "pure" genetic stock but would rather be "admixed," bringing together "good genes" from pre-colonial, pre-contact populations—defined as European, African, and Indigenous American. Pachter suggested that the embodiment of the "perfect human," conjured in his *in silico* experiment, might be Yuiza, a legendary 16th century Taíno woman: "The nearest neighbor to the 'perfect human' is…a female who is…Puerto Rican. One might imagine that such a person already existed, maybe Yuiza, the only female Taino Cacique (chief) in Puerto Rico's history"

(Pachter). To make this point visually, Pachter attached a portrait of Yuiza done by contemporary Puerto Rican artist, Samuel Lind, an image that circulated (and continues to circulate) widely in the news and social media (Figure 1).

Figure 1: Detail from Lind's *Yuiza* (2008)

The claim that "the perfect human is Puerto Rican" was celebrated throughout both social and mainstream media, in the mainland United States and in Puerto Rico, in English and in Spanish. While Pachter imagined this perfect creature as embodied in the figure of Yuiza, many others in the media suggested Jennifer Lopez, with Ricky Martin as her male counterpart, was the embodiment of Puerto Rican perfection: "Los puertorriqueños de hoy en día, sin embargo, han señalado a Jennifer López y Ricky Martin como pruebas de la perfección Boricua" ["Today's Puerto Ricans, however, have singled out Jennifer Lopez and Ricky Martin as proofs of Boricua perfection."] (JClar) (see Figure 2).[1]

Figure 2: Still from music video, "Adrenalina," Wisin featuring Jennifer Lopez and Ricky Martin, 2014

Yet the claim that the "perfect human" might be Yuiza (or even Jennifer Lopez for that matter) is not as straightforward as it might at first seem. The affective embodiment of the bits of data that constitute the perfect human *in silico*—bits stored in large databases as zeros and ones—in a legendary figure like Yuiza requires a complicated and labour-intensive process of visualization. Such a process is deeply rooted in cultural imaginaries about sex, race, sexuality, kinship, and nation. As the epigraphs from Hammonds and Haraway remind us, racial economies in the United States elsewhere rely heavily on technologies of the visual for their "sense-making" capacity, and the larger "grammars"—"of purity and mixing, compounding and differentiating, segregating and bonding, lynching and marrying" (Haraway 213)—are central logics that enable the movement from bits to bodies, from genetic code to the figure of what I call *Yuiza in silico*.

In his experiment, Pachter relies on a series of what feminist scholar Elizabeth Lloyd calls "pre-theoretical assumptions," those assumptions that must be present in order for a scientific story to make sense (Lloyd). In her discussion of explanations of female sexuality in evolutionary biology, Lloyd argues that such explanations "exemplify how social beliefs and social agendas can influence very basic biological explanations of fundamental physiological processes" (Lloyd 139). She

suggests that "social assumptions and prior commitments of…scientists play a major role in the practice of science itself, at many levels—experimental design, data collections, predictions, hypothesis formulation, and the evaluation of explanations" (Lloyd 139). In my analysis, I argue that such social assumptions and prior commitments are worthy of serious study and excavation because they reveal the deep and problematic investments that contemporary genomic sciences both have inherited and continue to reproduce: namely, sexualized and racialized notions of purity and hybridity; eugenic tropes of health and fitness; and the naturalization of heteronormativity. These tropes provide a connective node between Pachter's experiment and the larger questions of critical relationality that are the focus of this special issue of *Imaginations*.

The figure of *Yuiza in silico* must be understood as a *racialsexual formation,*[2] a conceptual framework that insists not only that race, sex, and sexuality are intersectional, socially produced categories (Collins and Bilge; see also Omi and Winant), but also that the conceptual and practical development of what science has labeled sexual dimorphism is itself inextricable from emergent concepts of race. As Sally Markowitz reminds us, sexual dimorphism itself is always already racialized, emerging as it does from nineteenth century evolutionary theories: "[T]he category of sex/gender difference…has been saturated with racial meanings for centuries and not always in ways that are easy to discern" (Markowitz 389). According to Markowitz, the two-sex model that emerges in the 18th century and is reproduced in contemporary genomics (see also Richardson) is not just central to gender ideology, but also makes a "complex contribution to racial ideology as well" (Markowitz 394). While the "naturalness" of the categories of race is contested even in the genomic sciences, categories of sex and sexuality are often left as natural and obvious and as unconnected to race, despite longstanding and elaborate feminist critiques (see Hammonds; Haraway; Carter). Thus, the idea that the "perfect human" is a Puerto Rican woman, embodied in the image of a Taíno woman, Yuiza, is an example of *racialsexual formations* and a key dimension of Pachter's claim.

This paper has two main sections. In the first, I argue that despite the use of 21st-century, cutting-edge technology in computing and ge-

nomics, Pachter's experiment and his use of visualization can be usefully juxtaposed with earlier modes of *visualizing heredity*, namely Francis Galton's development of composite portraiture in the late-19th century and late-20th century technologies of "morphing," famously represented in *Time Magazine's* composite image of "The New Face of America," also called SimEve. In my analysis of *Yuiza in silico*, I temper the celebration of Pachter's creation of a "mixed race" perfect human *in silico* with a challenge to its ostensibly progressive stance. I instead suggest that *Yuiza in silico* must be understood in the broader context of eugenic hauntings and contemporary tensions around questions of sex, sexuality, and race. I suggest that what links these visual artifacts—19th-century composite portraiture, SimEve, and *Yuiza in silico*—across time and space is a concern with embodying statistical data in ways that make a potent kind of visual argument about heredity and its relationship to race, sex, sexuality, kinship, and nation. I argue that visualizations of admixture must be problematized through an excavation of the historical and political context of "race mixing" in order to challenge naturalized heteronormative evolutionary narratives while simultaneously making visible the sexual violence of colonization and imperialism often effaced in such visualizations.

In the second part of the paper, I further explore what feminist scholar Venla Oikkonen calls "the entanglement of the informational and embodied in genetic discourses of human difference" (Oikkonen 749) in the context of critical relationality, an emergent interdisciplinary field of inquiry that puts questions of sexuality, kinship, and relatedness into critical conversation with settler colonialism. I argue that the scientific, specifically genomic, stories that we tell, can be productively read in light of critiques of biogenetic kinship and the naturalization of heterosexual love. The celebrated existence of the "perfect human" as a Puerto Rican woman—a mixed-race woman, embodied in the image of an Indigenous foremother—simultaneously works to reinforce the naturalness of heterosexuality and also forecloses apprehension of other critical modes of relationality that are central to the contemporary politics of indigeneity. I conclude by arguing that the perfect human experiment, its visualization through Lind's portrait and its dissemination through social media, makes a particular kind of argument about what it means to be the perfect human and what constitutes legitimate

and cognizable modes of relationality. More specifically, I highlight how the erasure of gendered colonial violence in these scientific narratives is central for understanding contemporary politics and claims to self-determination for Indigenous peoples in the United States, in Puerto Rico, and indeed elsewhere.

PART I: EUGENIC HAUNTINGS IN ANTI-RACIST GENOMICS?

Before moving on to a specific discussion of Pachter's experiment, a brief exploration of his motivation is in order. Pachter described his attempt to locate the perfect human *in silico* as "a thought experiment…dedicated to James Watson on the occasion of his unbirthday" (Pachter). Watson, along with Francis Crick, is credited with discovering the double-helix structure of DNA in 1953 for which he was later awarded the Nobel Prize. He was then a key figure in driving the initial mapping of the human genome in the 1990s. Watson, however, is also notorious for making "provocative comments" in public, including his 2007 remark to the UK daily, *The Times*, claiming that genetics demonstrated that Black people were less intelligent that white people, a remark that ended in his forced resignation as chancellor of Cold Spring Harbor Laboratory later that year (Milmo).

Lest you think that Pachter's "thought experiment" is simply another iteration of Watson's notorious claims about the reality and primacy of genetic race—as claims to the "perfect human" might evoke—consider Pachter's rather extensive introductory disavowal of Watson. Pachter describes meeting Watson at the Cold Spring Harbor Laboratory and outlines his discomfort with Watson's "spewing [of] racist and misogynistic hate" (Pachter). Using words like "creepy" and "disturbing," Pachter works to distance his own ideas from Watson's, including the latter's longstanding interest in building a better human (Milmo). The implication of Pachter's experiment, of course, is that there is no such thing as a "perfect human," and even if there were, she would not be of "pure" genetic stock like Watson might imagine, but would rather be "admixed," bringing together "good genes" from pre-colonial populations in a mixed race or *mestizaje* (mixed-race) embodiment. In this way, Pachter positions himself and his thought experiment in the realm of what STS scholars Catherine Bliss and Jenny Reardon have

called the discourse of "anti-racist genomics," which eschews both earlier eugenic formulations of genetic purity and any notion of racial hierarchy (see also Fullwiley).

Despite its disdain both of hierarchy and claims to racial purity, the discourse of anti-racist genomics nevertheless insists on the existence of somewhat stable, population-level categories of human genetic variation—usually articulated in terms of continental populations such as African, European, Amerindian, and Asian—and argues that such categories are importantly linked to questions of health and wellness in human groups (see Bustamante et al.). Genomics, in this anti-racist vein, is positioned as part of larger progressive social movements as an important corrective for things ranging from white supremacy (i.e. genomics challenges it) to population-level health disparities (i.e. genomics is central to any solution) (see Bliss; Reardon).

Pachter's insistence on the robustness and "perfection" of mixed-race populations espouses this kind of anti-racist genomic formulation, and he explicitly frames his experiment as a counter to Watson's outmoded, eugenicist, and racist stance. Pachter and other contemporary genomicists are deeply invested in distinguishing their own work and the larger discipline from its earlier associations with eugenics; Pachter formulates his experiment and his of embodiment of *Yuiza in silico* as a counter to such associations. As feminist STS scholar Banu Subramaniam argues eugenic hauntings are always present in contemporary genomics:

> The ghosts live on in almost all aspects of current biological practice. Learning to see them is not just about seeing the ghosts, seeing the history, the political and cultural legacy of the field, but about laying bare the epistemological and methodological apparatuses that have framed our seeing for more than a century. (Subramaniam 22)

Thus, part of the work of this paper is about using visualization in genomics in the service of this larger project of learning to see such ghosts, especially in their hauntings of anti-racist claims around the "perfect human," claims that leave intact racial and sexual economies

forged in colonization and empire and further reinforce naturalized readings of heteronormativity and sexual reproduction.

In his article "Data, Code, and Discourses of Difference in Genomics," communications scholar Peter Chow-White begins his discussion with reference to James Watson's now infamous 2007 claims. Yet, unlike Pachter's disavowal, Chow-White warns against characterizing Watson's claims as simply idiosyncratic, outmoded, and as representative of an older and thoroughly discredited pseudoscience. Rather, Chow-White argues that current ideas about race in genomics "are linked to larger social transformations in the information society where shifting formations of race are converging in old and new ways with developments and innovations in digital culture and information technologies" (Chow-White 220). Another task of this paper, then, is to make such convergences more apparent and to link these "shifting formations of race" to affective practices of bioinformatic visualization through an analysis of how statistical data has been visualized and its reliance on particular narratives and tropes.

Visualizing Heredity: Composite Portraiture, SimEve, and *Yuiza in silico*

In this section, I begin with a brief discussion of Francis Galton's development of composite portraiture in order to make the point that the visualization of statistical data has a long history, one deeply linked to notions of heredity and relationality. I then juxtapose Pachter's visualization of *Yuiza in silico* with the 1993 *Time Magazine* cover of "The New Face of America,"—also called SimEve by feminist scholars Donna Haraway and Evelyn Hammonds—a computer-generated image of a woman who "does not exist—except metaphysically" and is rather "the product of a computer process called morphing" (Gaines 2). Building on Hammonds' and Haraway's earlier analyses of SimEve, I conclude with an analysis of Pachter's embodiment of *Yuiza in silico* through Lind's portrait in order to provide a context for a larger discussion of critical relationality in the following section.

A. Composite Portraiture

In 1878, "father of eugenics" Francis Galton published the first of a series of papers about a new visualization technology he had developed in collaboration with colleague Herbert Spencer called "compos-

ite portraits." Composite portraiture was a photographic technique that sought to create representations of "types"—e.g., familial, criminal, and consumptive—by isolating phenotypic traits from individuals thought to represent the group (Figure 3).[3] Using the then relatively new technology of photography, Galton combined multiple images on a single photographic plate "to obtain with mechanical precision a generalised picture; one that represents no man in particular, but portrays an imaginary figure possessing the average features of any given group of men" (Galton, "Composite Portraits" 97). Galton produced numerous composite portraits over a period of years; he was particularly interested in using statistical methods such as averages to probe the hereditary dynamics of family resemblance, criminality, and illness. This discussion of Galton's composite portraits makes apparent how, even prior to any robust scientific concept of genes or the identification of the double-helix structure of DNA, scientists used what we now call phenotypic traits as a way to capture underlying "units of heredity" (contemporarily called genotype).

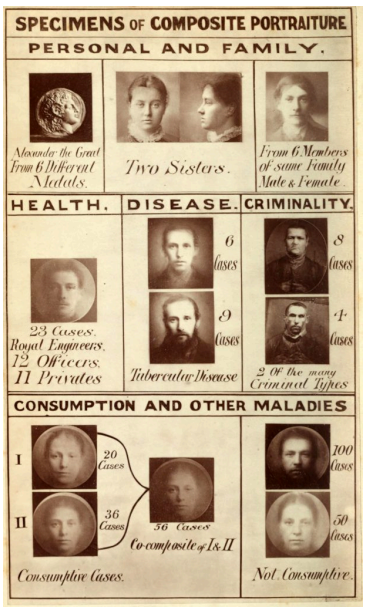

Figure 3, *Specimens of Composite Portraiture*, Sir Francis Galton (1882)

Art historian David Green makes the point that Galton's most intensive experimentation with photography occurs between 1877 and 1884, the same period during which he developed key "methods of analysis and statistical techniques designed to measure the incidence of inherited characteristics which were to have a substantial bearing upon all of his later work and that of others within the eugenics movement" (Green 14). Indeed, Green argues that Galton's photography, specifically his composite portraits, "developed out of a specific need to trace and define the manifestations of innate and hereditary differences of human faculties within physiognomical characteristics" (Green 14; see also Sekula). Photographer and art critic Allan Sekula points to the famous 1883 portrait of "The Jewish Type" (Figure 4) as one that demonstrated Galton's belief in "the reality of distinct racial types." He further argues that technique of composite portraiture "amounted to an essentialist physical anthropology of race" (Sekula 51).

Figure 4: The Jewish Type, 1883

I evoke Galton's practice of composite portraiture here to make the point that attempts to visualize hereditary traits as a way to characterize variation across human groups have a long history in the natural and social sciences; further, I want to place Pachter's experiment in vi-

sualizing statistical data, especially in terms of hybridity, in that visual historical context. It is perhaps ironic that Pachter's experiment, created in the service of disavowing the overtly racist and misogynistic position of James Watson and forging a different inclusive and anti-racist future for genomic research (one celebrating the "hybrid vigor" (Bivins) of racial mixture), should be haunted by the "father of eugenics," Galton. But, as Subramaniam reminds us, perhaps not: it is these hauntings of technologies such as composite portraiture that I want to carry through into subsequent analyses of *SimEve* and *Yuiza in silico*.

B. SimEve

The opening epigraphs of this article are both from 1997 works by Evelyn Hammonds and Donna Haraway, respectively. In different pieces, Hammonds and Haraway discuss the now famous 1993 *Time* magazine special issue on immigration and the computer-generated composite portrait of "The New Face of America" (what they both call SimEve) that graces the cover (Figure 5).

Figure 5: SimEve, or The New Face of America, 1993

In order "to dramatize the impact of interethnic marriage, which has increased dramatically in the U.S. during the latest wave of immigration," *Time Magazine* "turned to morphing to create the kind of offspring that might result from seven men and seven women of various ethnic and racial backgrounds" (Gaines 2) (Figure 6). The figure of SimEve was created using the computer software Morph 2.0, which "enabled TIME to pinpoint key facial features on the photos of the 14 people of various racial and ethnic backgrounds chosen for the chart. Electronic dots defined head size, skin color, hair color and texture, eyebrows, the contours of the lips, nose and eyes, even laugh lines around the mouth" ("Rebirth of a Nation").

The portrait of SimEve is similar to Galton's composite portraiture in that it blends multiple images to produce a novel one, and also produces a photo not of a particular individual but of a type. The technology of "morphing" provides the means to "Rebirth of the Nation, Computer-Style, to a 'new face of America.'" This new face is exotic, and while light-skinned, she appears racially mixed, stressing "the enticing glamor of ethnic diversity" while simultaneously establishing "itself as a retort to the racism of a founding film like *Birth of a Nation*" (Gubar 33-34). Like Pachter's framing of his "perfect human" experiment as counter to Watson's eugenic stance, *Time Magazine*'s figure of SimEve celebrates race-mixing as a nationalist "rebirth," one that, counter to D.W. Griffith's 1915 film, purportedly challenges deep-seated anxieties about miscegenation. Yet Hammonds locates morphing "at the center of an old debate about miscegenation and citizenship in the United States" (Hammonds 109) and reminds us of the larger context of sexual violence evoked by the image of SimEve:

> This is truly the drama of miscegenation in cyberspace. The history of white men crossing racial boundaries to have sexual relations with African, Asian, Mexican and Native-American women - and then refusing to acknowledge their offspring in order to reserve the right to determine how whiteness would be defined as a characteristic of citizenship- is simultaneously implied and disavowed. (Hammonds 120)

Figure 6, "Rebirth of a Nation, Computer-Style"

Like Galton's *Specimens*, the *Time Magazine* cover is a form of composite portraiture. While a technological novelty back in 1993, SimEve shares conceptual and visual antecedents with earlier forms of scientific experimentation and representation, conceptual and visual antecedents reproduced in Pachter's use of Samuel Lind's *Yuiza* to embody his *in silico* "perfect human." These images traffic in "the grammars of purity and mixing" that undergird sexual and racial representations of the nation, wherein "bits and bytes replace the flesh and blood that provoked the guilt, hatred and violence of our country's history of racial domination" (Hammonds 120).

C. From Bits to Bodies: Yuiza in silico

It is worth spending some time with Pachter's thought experiment and tracing the specific ways in which he came to the conclusion that the "perfect human is Puerto Rican," a claim that on its surface seems progressive simply because it includes people often marginalized or excluded from conceptions of both humanity and perfection and "celebrates" the beauty of women of colour. How exactly does Pachter operationalize an experiment looking for a "perfect human" and how does he come to conclusion that "the perfect human is Puerto Rican," more specifically a Puerto Rican woman? Pachter uses bioinformatics, an emergent interdisciplinary field that basically that uses tools from statistics and computer science to organize and interpret biological data. In their blog post about the experiment, fellow geneticists Oleksyk and Martinez Cruzado provide the following overview:

> In what he called a "thought experiment," Pachter looked at all the mutations in the database, noting the ones with beneficial and disadvantageous effects. His argument: the person with the most "good" alleles and the least "bad" alleles would be the "perfect human." It just happened that the sample closest to this arbitrary constructed ideal came from a Puerto Rican woman. (Oleksyk and Martinez Cruzado)

Pachter's *in silico* work on this experiment takes place in a "dry lab," and he performed a bioinformatic analysis on already existing datasets, constructing his "perfect human" by analyzing a series of small mutations called "SNPs." He then applied this analysis to genotypes from individual donors who were part of a recent genetic variation project, the 1000 Genomes Project.

SNP (pronounced "snip") is an acronym for "single nucleotide polymorphism," a small genetic mutation that may be associated with population-level genomic differences such as ancestry or disease or other phenotypic traits such as the consistency of ear wax. Pachter accessed the SNPs he used in his experiment from a database called SNPedia. Created by geneticist Greg Lennon and computer programmer Michael Cariaso, SNPedia has been online since 2006 (Cariaso and Lennon). It shares "information about the effects of variations in DNA,

citing peer-reviewed scientific publications" and offers users the opportunity "to create a personal report linking your DNA variations to the information published about them" (*SNPedia*).

Pachter created his *in silico* "perfect human" by isolating all of the "good" SNPs (almost 5000 in total in 2014)[4] from the database. He then performed principal components analysis (PCA), comparing the SNP-based "perfect human" *in silico* with an existing dataset of 1092 individual genotypes from the 1000 Genomes Project[5] (Figure 7): "Add the 'perfect human' to a panel of genotyped individuals from across a variety of populations and perform PCA to reveal the location and population of origin of the individual" (Pachter).

snp_id	perfect	HG00096	HG00097	HG00099	HG00100	HG00101	HG00102
HG00103	HG00104	HG00106	HG00108	HG00109	HG00110	HG00111	HG00112
HG00113	HG00114	HG00116	HG00117	HG00118	HG00119	HG00120	HG00121
HG00122	HG00123	HG00124	HG00125	HG00126	HG00127	HG00128	HG00129
HG00130	HG00131	HG00133	HG00134	HG00135	HG00136	HG00137	HG00138
HG00139	HG00140	HG00141	HG00142	HG00143	HG00146	HG00148	HG00149
HG00150	HG00151	HG00152	HG00154	HG00155	HG00156	HG00158	HG00159
HG00160	HG00171	HG00173	HG00174	HG00176	HG00177	HG00178	HG00179
HG00180	HG00182	HG00183	HG00185	HG00186	HG00187	HG00188	HG00189
HG00190	HG00231	HG00232	HG00233	HG00234	HG00235	HG00236	HG00237
HG00238	HG00239	HG00240	HG00242	HG00243	HG00244	HG00245	HG00246
HG00247	HG00249	HG00250	HG00251	HG00252	HG00253	HG00254	HG00255
HG00256	HG00257	HG00258	HG00259	HG00260	HG00261	HG00262	HG00263
HG00264	HG00265	HG00266	HG00267	HG00268	HG00269	HG00270	HG00271
HG00272	HG00273	HG00274	HG00275	HG00276	HG00277	HG00278	HG00280
HG00281	HG00282	HG00284	HG00285	HG00306	HG00309	HG00310	HG00311
HG00312	HG00313	HG00315	HG00318	HG00319	HG00320	HG00321	HG00323
HG00324	HG00325	HG00326	HG00327	HG00328	HG00329	HG00330	HG00331
HG00332	HG00334	HG00335	HG00336	HG00337	HG00338	HG00339	HG00341
HG00342	HG00343	HG00344	HG00345	HG00346	HG00349	HG00350	HG00351
HG00353	HG00355	HG00356	HG00357	HG00358	HG00359	HG00360	HG00361
HG00362	HG00364	HG00366	HG00367	HG00369	HG00372	HG00373	HG00375
HG00376	HG00377	HG00378	HG00381	HG00382	HG00383	HG00384	HG00403
HG00404	HG00406	HG00407	HG00418	HG00419	HG00421	HG00422	HG00427
HG00428	HG00436	HG00437	HG00442	HG00443	HG00445	HG00446	HG00448
HG00449	HG00451	HG00452	HG00457	HG00458	HG00463	HG00464	HG00472
HG00473	HG00475	HG00476	HG00478	HG00479	HG00500	HG00501	HG00512
HG00513	HG00524	HG00525	HG00530	HG00531	HG00533	HG00534	HG00536
HG00537	HG00542	HG00543	HG00553	HG00554	HG00556	HG00557	HG00559
HG00560	HG00565	HG00566	HG00577	HG00578	HG00580	HG00581	HG00583
HG00584	HG00589	HG00590	HG00592	HG00593	HG00595	HG00596	HG00607
HG00608	HG00610	HG00611	HG00613	HG00614	HG00619	HG00620	HG00625
HG00626	HG00628	HG00629	HG00634	HG00635	HG00637	HG00638	HG00640
HG00641	HG00650	HG00651	HG00653	HG00654	HG00656	HG00657	HG00662
HG00663	HG00671	HG00672	HG00683	HG00684	HG00689	HG00690	HG00692
HG00693	HG00698	HG00699	HG00701	HG00702	HG00704	HG00705	HG00707
HG00708	HG00731	HG00732	HG00734	HG00736	HG00737	HG00740	HG01047

Figure 7: Dataset of individual genotypes from 1000 Genomes including "perfect human" and HG00737, created by Lior Pachter

PCA, an early 20th-century statistical technique, now a mainstay of contemporary data analysis, is designed to provide "a roadmap for how to reduce a complex data set to a lower dimension to reveal the sometimes hidden, simplified structures that often underlie it" (Schlens). The 1092 individual genotypes, already collected and organized as representative of large-scale population groups (African, Amerindian, European, and Asian), were plotted on a graph and the genotype closest to the "perfect human" *in silico*—the genetic code from an individual identified as HG00737, a female donor to the "Puerto Ricans in Puerto Rico" collection (Figure 8).

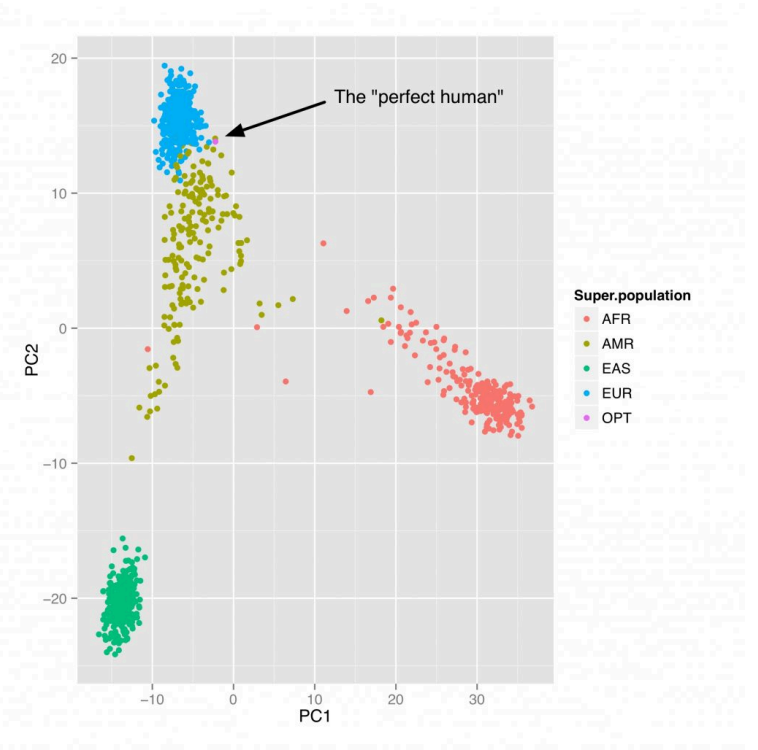

Figure 8: "Perfect Human" Principal Components Analysis, 2014 (Pachter)

Of course, the experiment was not based on any DNA from Yuiza, a legendary, possibly mythical, figure, represented on Pachter's blog in portrait form by Puerto Rican artist Samuel Lind; nor, we can safely assume, did the anonymous blood sample from which the data derived come from Jennifer Lopez.[6] Rather, Pachter's experiment relied on data generated from the 1000 Genomes sample population, "Puerto Ricans in Puerto Rico" or "PUR." More specifically, according to Pachter, "[t]he nearest neighbor to the 'perfect human' is HG00737" (citation), the identification number of an anonymous female donor who self-identified as Puerto Rican at the time of collection.[7]

I want now to further contextualize the next steps of Pachter's "perfect human" experiment through a discussion of the visualization of scientific—in this case, bioinformatic—data in order to draw attention to the larger tropes of race, sex, sexuality, and nation that shape Pachter's interpretation of his data as well as to draw attention to the ghosts that Subramaniam describes. As many STS scholars have compellingly demonstrated, careful attention to the conceptual frameworks and experimental apparatus of scientific practice is necessary to excavate the underlying frameworks and conventions that shape scientific inquiry:

> [I]n looking at how ideas about race, nation, and belonging are brought to bear on genetics in contemporary society, we should not overlook the material forms that scientific inquiry takes: the types of evidence scientists choose, the ideas about credibility and counterfeit that factor into these choices, and the mechanics of how evidence is converted into scientific models and conclusions. (Kohli-Laven 200)

To emphasize the point that the "perfect human" of his experiment is a Puerto Rican woman, Pachter speculates: "One might imagine that such a person already existed, maybe Yuiza, the only female Taino Cacique (chief) in Puerto Rico's history" (Pachter). Through the visual transformation from genetic code (Figure 7) to PCA (Figure 8) to Yuiza (Figure 1), Pachter's experiment transforms HG00737—the genetic code of a 21st-first century Puerto Rican woman about whom we know almost nothing—to the speculative figure of *Yuiza in silico.*

Sociologist Adrian Mackenzie makes the point that in bioinformatics "a living body figures…as a somewhat abstract relational entity, potentially open to many different determinations" (Mackenzie 317). Thus, the kinds of choices, the particular determinations, that Pachter makes in embodying *Yuiza in silico* can be productively studied through an exploration of the kinds of *pretheoretical assumptions* that undergird the experiment: namely, eugenic tropes of health and fitness represented by the idea of "good" alleles (mutations); longstanding genomic preoccupation with purity and hybridity; and the naturalization of reproduction and heteronormative sexuality through a romanticization of "hybridity."

While Pachter uses neither the photographic techniques deployed by composite portraiture nor the software that enables "morphing," he nevertheless uses another modality of visualization to "embody" his *in silico* perfect human. The use of Lind's portrait of Yuiza does important sense-making work, shifting the visualization of code from zeroes and ones (Figure 7) to an embodied mythical-historical figure that does the work of translating bits of data into a recognizable figure, Yuiza (Figure 1).

In his discussion of DNA portraiture, communications scholar Drew Ayers argues that "the representational power" of this visualization technology relies on the assumption "that DNA, conceived of as an informational pattern (a code), has the power to function as a synecdoche for the materiality of the lived body" (Ayers 314). Lind's portrait of *Yuiza in silico* provides much needed visual power that makes this synecdochal relationship evident, especially in terms of moving from bodies to bits and back to bodies. The "perfect human" body that provides the initial blood sample (that becomes the cell line HG00737 that becomes the code that provides the basis for Pachter's experiment) disappears and is replaced by the figure of Yuiza.

There is some slippage between Pachter's visualization of *Yuiza in silico* and the contemporary Puerto Rican female donor only known as HG00737. Yuiza, a famous figure in Puerto Rico, is the quintessential representation of the Taíno, the Indigenous peoples who encountered the Spanish on their first expedition to the island of Boricua (the Taíno name for PR) in the 16th century.

Historical details about Yuiza are scant, although her legend circulates widely in Puerto Rican folklore and in popular discourse. In particular, her relationship with Pedro Mejías, variously called a "mulatto conquistador" and free black man (*liberto*) and part of Ponce de Léon's expedition, is a foundational national story in the island. Yuiza is ultimately murdered at the hands of other Taínos who see her relationship with Mejías as a betrayal. In her 2014 book, *Puerto Rican Folktales*, Lisa Sánchez González names Yuiza (Yuisa) and Pedro Mejías as "the great-great-great-grandparents of the Puerto Rican nation" (81).[8] Although many have written that Yuiza's relationship or marriage to Mejías and her conversion to Catholicism were strategic, rooted in an attempt to mitigate the enslavement and murder of her people at the hands of the Spanish, still others suggest that she was compelled into such relations either by force or coercion. Yet González's version is told, rather triumphantly, through the trope of heterosexual romantic love, one that is often explicitly or tacitly present in genomic narratives about race-mixing, especially around the genomics of *mestizaje*.

Mestizaje is very basically a concept connoting racial mixture. It is one that is common throughout the Iberian-colonized Americas, although it has meant different things at different times. It is also one that is being renegotiated and reworked in light of emergent genomics programs throughout Latin America (see Wade et al.; Gibbon et al.). Yuiza is a key symbol in Puerto Rican national narratives, especially in terms of being representative of one of the *tres razas* ("three races"). What Carmen Lugo-Lugo calls "the racial trinity creed" shapes Puerto Rican identity, in terms of the popular understanding "that the racial origins of the modern-day Puerto Rican is a harmonized and binding alchemy of races that no longer exist as independent entities on the island" (Lugo-Lugo 107). Despite this appeal to a universal, harmonized Puerto Rican identity, the politics of race and indigeneity in Puerto Rico are complex (see J. L. González; Rodríguez-Silva; Duany; Castanha). Carmen Lugo-Lugo uses the term *mulataje* to emphasize the centrality of African and European mixture to Puerto Rican identity (see also Buscaglia-Salgado). Finally, the question of Indigenous "extinction" in Puerto Rico and elsewhere in the Caribbean is another organizational axis for understanding questions of racial hybridity. The claim that all Indigenous peoples in what is now Puerto Rico had died by the mid-

dle of the 16th century as the result of Spanish conquest is widespread but also contested by contemporary peoples who self-identity as Taíno, and genetics has become a key way through which indigeneity is explored (see Benn Torres). Sociologist Gabriel Haslip-Viera challenges what he terms as the "neo-Taíno" movement while other scholars such as Maximilian Forte and Tony Castanha dispute what they call "the myth of indigenous extinction" in the Caribbean (see Forte; Castanha). The animation of *Mestiza Eve* as the Taíno cacique, Yuiza, also articulates with the contemporary politics of indigeneity in the Caribbean, especially the appeal of having Indigenous ancestors.

Brief attention to the politics of racial hybridity and indigeneity allows us to contextualize Pachter's experiment, especially in terms of the role of race, sex, and nation in the kind of visual sense-making used by Pachter. In Pachter's visualization, Yuiza is clearly understood as Taíno, as Indigenous, and thus as existing prior to the "race mixing" that emerges with the conquest of the Americas by the Spanish and the trafficking of enslaved Africans in the Transatlantic slave trade. Yet Pachter's use of Yuiza's portrait is clearly intended to embody the genetic code that comes from the body of donor HG00737, a contemporary Puerto Rican woman assumed to be representative of a Puerto Rican-inflected form of *mulataje*, as a descendant of Spanish, Indigenous, and African peoples. Further, in contrast to Lisa González's narrative, Pedro Mejía's "contribution" to the nation, as a descendant of European *and* African peoples disappears from Pachter's account of *Yuiza in silico* as the perfect human. The racial "slippage" that embodies donor HG00737 as a mythical Taíno woman, meant to personify the beauty and vigor of the hybrid itself, trades in anti-Blackness that is also reproduced in the PCA image that locates the pink dot of the perfect human far away from the orange clusters representing African ancestry (Figure 8).

Pachter's vision of hybridity in the "perfect human" experiment follows what anthropologist Jean Muteba Rahier calls the tendency among North American and European scholars "towards a somewhat naïve enthusiasm for the end of white supremacy and all other forms of racism, segregation, and intolerance" (Rahier 40). Pachter's discussion also intersects with the larger racial politics of the mainland United States, a racial politics shaped by the concept of hypodescent—more

familiarly known as "the one-drop rule"—wherein any African ancestry makes someone Black. In Pachter's analysis, the Blackness essential to *mulataje* "drops out," enabling the figure of *Yuiza in silico* to be simultaneously racially hybrid *and* not Black. What links these different ideas of race and hybridity across the ideologies of U.S. hypodescent and Puerto Rican *mulataje* is precisely the organizing racial logics of anti-Blackness. This anti-Blackness enables the story of the "Perfect Human is Puerto Rican" to be culturally legible in both contexts.

Pachter's embodiment of *Yuiza in silico* also relies on longstanding tropes of the (colonized) nation as woman (see Chatterjee). Yuiza is beautiful, fertile, and "births" the Puerto Rican nation. Pachter moves quickly from discussing the "perfect human" at the level of species to animating the "perfect woman," a configuration heavily reliant on *racialsexual formations* such as the sexual desirability of mixed-race women.

Regardless of whether or not Yuiza is an Indigenous ancestor or a kind of *Mestiza Eve*, central to the story of the mixed-race "perfect human" evoked by Pachter is the ongoing erasure of sexual colonial violence. As Latin American studies scholar Edna Acosta-Belén argues, the Puerto Rican history of *mestizaje* is intimately linked to coercive and exploitative encounters between Spanish colonizers and Indigenous and African women:

> During those early years in the history of Puerto Rico as a colony of Spain, the sexual exploitation of Indian women by the conquistadores and settlers was commonplace....In the years after the Spanish occupation of Puerto Rico, many Spaniards entered into illegitimate unions with Indian and slave women; miscegenation and concubinage were widespread realities of Puerto Rican colonial society. (Acosta-Belén 2)

The absence of any reference to, or discussion about, the sexual violence of colonization performs important work in Pachter's experiment. His analysis transforms ones and zeroes into a visually legible woman who embodies the potential of mixed-race unions in terms of their benefit to the human species as a whole. This is not simply the

prioritization of histories rooted in genomic science, but also the continuing naturalization and celebration of biogenetic kinship and heterosexual reproduction at the expense of any understanding of colonial sexual violence. *Yuiza in silico* becomes a kind of *Mestiza Eve*, the great-great-great-grandmother of a beautifully mixed-race nation, although there is no mention by Pachter of Yuiza's legendary counterpart, the mixed-race Mejías (or any other male figure). The sexual violence that marked these colonial encounters is not only effaced but also justified as a satisfactory end result. In other words, we might say that while such gendered violence is unfortunate, its outcomes have benefitted humanity through the beauty and hybrid vigor of *mestizaje*.

Pachter's interpretation of his experimental data relies on nationalist narratives framed in terms of settler-colonial modes of kinship, heterosexual reproduction, and romantic love. In addition to reflecting the longstanding genetic interest in race-mixing, his data analysis is refracted through a cursory knowledge of Puerto Rican folklore, stories of *mestizaje,* and deeply raced and gendered ideas of Puerto Rican women. In what follows, I locate Pachter's "perfect human" experiment in the "durable preoccupations" (Pollock) of hybridity and purity that characterize genomics past and present and connect these to cultural narratives about sexual desirability. I then discuss Pachter's visualization of *Yuiza in silico* by putting it into conversation with a larger literature on kinship and critical relationality.

PART II: *DURABLE PREOCCUPATIONS: SEXUALITY, HYBRIDITY, AND PURITY*

> So, what happens is that you go to places like Rio de Janeiro, and you walk on the beach, and you take skin color as a correlate—there is a continuum which goes from the very, very dark African lineages to the very, very light skin lineages and everybody in between. And, to tell you the truth, these are very beautiful people. They are very attractive and certainly have no aversion to falling in love and making offspring. (Stephen O'Brien cited in Bliss 104)

In another of his serial controversies, James Watson gave a guest lecture at the University of California, Berkeley in 2000. While speaking about the potential relationship between happiness and genes, Watson declared a positive link between "sex and sun," more specifically a link between libido and skin colour, and he asserted that people with darker skin (more melanin) have stronger sex drives than their lighter-skinned counterparts. Briefly invoking a then-recent University of Arizona study that found a correlation between the injection of synthetic melanin and sexual arousal (Ugwu et al.), Watson went on to conclude, "That's why you have Latin lovers. You've never heard of an English lover. Only an English patient" (Brown).

Again, it would be tempting to dismiss Watson simply as an aging scientist increasingly out of step with modern population genetics—a reflexive and progressive science that eschews the hierarchical plotting of human groups on an evolutionary scale and instead celebrates anti-racist possibilities in the genomic sciences. Thus, while Watson's juxtaposition of "Latin lovers" and "English patients" relies on tired clichés and unproven scientific data, it also evokes a pervasive cultural investment in biologized—specifically geneticized—narratives of race, nation, sex, and sexuality, ones articulated as anti-racist formations that continue to undergird population genetics in its various iterations including Pachter's figure of *Yuiza in silico*.

As the introductory epigraph from geneticist Stephen O'Brien suggests, contemporary genome scientists are invested in celebratory interpretations of "race-mixing" (and its link to hybrid vigor) and often unproblematically link the sexual reproduction of mixed-race offspring to romantic love. Such celebratory interpretations, though, are always haunted by their corollaries: racial purity and racial degeneration (see Hammonds and Herzig). As Haraway reminds us, the mainland United States and Puerto Rico are both societies "consumed by ideas of racial purity and racial denial" and are thus "also replete with fascination with racial mixing and racial difference" (Haraway 214). Feminist historian Laura Briggs points to the historical (and ongoing) centrality of Puerto Rico as a site of U.S.-based scientific and social scientific research, an island "test tube" wherein "Puerto Rican difference has been produced and located in women's sexuality and reproduction"

(Briggs 2). The seeming celebratory claim that the "perfect human in Puerto Rican" must be seen in this larger context.

Critical Relationality

This special issue of *Imaginations* focuses on analyses "that document, provoke, or imagine relations between humans, and between humans and nonhumans that go beyond and trouble normative categories of 'nature,' 'sex,' and 'love.'" In their discussions of SimEve, both Haraway and Hammonds refer to the *Time* editor's column where he describes the reaction of several of his (male) employees to the image produced by Morph 2.0:

> Little did we know what we had wrought. As onlookers watched the image of our new Eve begin to appear on the computer screen, several staff members promptly fell in love. Said one: "It really breaks my heart that she doesn't exist." We sympathize with our lovelorn colleagues, but even technology has its limits. (Gaines 2)

The physical attractiveness and sexual appeal of figures like SimEve and *Yuiza in silico* is not accidental. They are both speculative figures, animated by heteronormative fantasies of (white) men falling in love with imaginary (non-white, albeit light-skinned) women. These fantasies are purposively distanced from sexual violence and racial domination. Yet, as Hammonds argues in her analysis of SimEve, "Hierarchies of domination have not disappeared as female reproduction is replaced by a masculine technophilic reproduction because stereotypical racial typologies remain in place" (Hammonds 120). Critical relationality illuminates how scientific imaginaries—especially in visual form, like Pachter's—naturalize and reinforce deeply cultural notions of kinship as a straightforward biogenetic expression of sexual dimorphism and of heterosexual reproduction (see Yanagisako and Collier) that are part of a larger apparatus that forecloses other possibilities of being in the world. Native studies scholars have productively put settler-colonial studies in conversation with queer theory (see Smith; Scott Lauria) to refuse any understanding of the intimate sphere of reproduction that insists on a decoupling from "the scope and shape" of the political (Rifkin). Pachter's experiment is problematic not only because it trades

in racialized and sexualized stereotypes but also because it naturalizes "love" and heterosexual reproduction in a way that simultaneously denies imperial and colonial violence, particularly against Indigenous and African women, *and* celebrates the offspring of such "unions" as naturally healthier and more beautiful. What are the implications of such a claim?

In *When Did Indians Become Straight?*, literary scholar Mark Rifkin draws attention to how notions of civilization (and its implied opposite, savagery) are deeply linked to heteronormative ideas of reproductive kinship. Rifkin points to "an imperial imaginary that provides the organizing framework in which heterosexuality signifies" (Rifkin 5). It is such "an imperial imaginary" that organizes the kind of work that provides the kind of sense-making backdrop to the "perfect human" experiment. The implication here is that the kind of imaginary of Yuiza, of Pedro Mejías, as the great-great-great-grandparents of the Puerto Rican nation, encapsulates indigeneity and race-mixing in a heteronormative framework that naturalizes colonial violence in the figure of Yuiza as *Mestiza Eve*, accessible to our imaginations through the science of genomics. In other words, the celebrated existence of the "perfect human" as a Puerto Rican woman simultaneously works to reinforce the naturalness of heterosexuality and also forecloses apprehension of other critical modes of relationality that are central to the contemporary politics of indigeneity (see TallBear; Simpson).

Rifkin contends that other modes of relationality have existed and continue to exist among Indigenous communities. He argues for attention to "a more multivalent history of heteronormativity in which alternative configurations of home, family, and political collectivity are represented as endangering the state and in which conjugal domesticity provides the condition of possibility for intelligibility within U.S. institutions" (Rifkin 5). Thus, discourses of sexuality are not the proper domain of the private, but rather of the public and indeed of the nation.

Native studies scholars and others have also reminded us that relationality is always part of a larger politics of survival. The celebration of so-called race-mixing, of hybridity (again, whose corollary is always purity) as anti-racist, as a counter to earlier, outmoded eugenic formations (embodied here by Watson), leaves intact the putative centrality of het-

erosexual reproduction and erases the sexual violence of colonization while simultaneously foreclosing other modes of critical relationality that might open up different kinds of politics.

CONCLUSION

It is not accidental that Haraway's analysis of SimEve leads to her famous "PostScript™" in *Modest_Witness* wherein she challenges the unquestioned pre-theoretical assumptions that continue to shape genomic investigations, especially those rooted in the search for human difference:

> I am sick to death of bonding through kinship and "the family"... It is time to theorize an "unfamiliar" unconscious, a different primal scene, where everything does not stem from the dramas of identity and reproduction. Ties through blood—including blood recast in the coin of genes and information—have been bloody enough already. I believe that there will be no racial or sexual peace, no livable nature, until we learn to produce humanity through something more and less than kinship. (Haraway 265)

Pachter's "perfect human" thought experiment moves from the seemingly sterile dry lab, *in silico* environment, to being personified in the lush portraiture of Lind and reproduced through social media. Lind's Yuiza becomes the embodiment of Pachter's *in silico*, bioinformatics experiment, a celebration both of anti-racist genomics and of the hybrid vigor (and beauty) of Puerto Ricans. Yet Pachter's figure of *Yuiza in silico* is precisely "blood recast in the coin of genes and information," relying both on earlier visual technologies of statistical embodiment and on the durable preoccupations that continue to shape contemporary genomics, despite its anti-racist framing. The main critique in this paper is that such ideas are presented as natural and obvious, both in terms of the kind of cultural sense that they make and the appeal to a particular ordering of the natural that reproduces heteronormative evolutionary narratives while simultaneously denying the sexual violence of colonization and imperialism.

Part of the larger work of my analysis of *Yuiza in silico* is to make apparent how the putatively "intimate" relations that constitute the foundational act of what makes genomics make sense (heterosexual reproduction) must be seen as a larger part of processes of colonialism and imperialism; where blood and other units of heredity are intimately linked to access to rights and resources, to the dispossession of territory, and, most importantly for this discussion, the foreclosure of other relational modalities beyond what we might call kinship.

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NOTES

1. The story of the "perfect human" experiment was covered extensively in the mainland United States, in Puerto Rico, and elsewhere in the Caribbean and Europe. For instance, a quick Google search for "humano perfecto" and "Jennifer Lopez" in July 2018 returned more than 2,500 results. The same search in English returned more than 28,000.↩

2. This concept is based on collaborative research I am currently conducting with my colleagues, Banu Subramaniam and Angela Willey.↩

3. My thanks to Amanda Reyes for introducing me to Galton's composite portraits, and for her suggestion that I explore them in the context of Pachter's experiment.↩

4. SNPedia is updated continually. As of March 2017, SNPedia contained nearly 100,000 SNPs (almost double the 50,000+ at the time of Pachter's experiment in December 2014). It is important to note that the presence of new SNPs would likely give a very different result if the experiment were repeated; thus, *Yuiza in silico* is an artifact of a particular moment in time and space.↩

5. The 1000 Genomes Project (2008-2015) was an international collaboration that collected samples from populations from across the world in order to map human genetic variation.↩

6. Because of the protocols for collecting the PUR samples in The 1000 Genomes Project, we know that HG00737 had at least one biogenetic child 18 years or older in 2010.↩

7. A self-identified healthy Puerto Rican woman over the age of 18 donated an anonymized blood sample as part of The 1000 Genomes Project. After collection, the sample was sent to the Coriell Institute for Biomedical Research in New Jersey where it was converted into an immortalized cell line, labeled "HG00737," and now forms part of the "PUR-Puerto Ricans in Puerto Rico" collection. The cell line is stored and reproduced at Coriell and is available for purchase by authorized researchers. The HG00737 sample was sequenced—determining the order of nucleotides in a strand of DNA—and the sequence data was then released into the public domain through a series of genome browsers.↩

8. It is important to note that the traditional story of Yuiza and Pedro Mejías has her murdered by her people before any offspring are produced. In her 2014 volume, González fantasizes that Yuiza and Mejías are married for more than 20 years and produce six children.↩