

HUMANITIES

three pieces

DEFYING GRAVITY: A DECOLONIZATION OF THE MIND

Aleela Taylor

The following is an excerpt from a longer piece. For full text, please visit www.honorsjournal.com

INTRODUCTION

Sitting on the couch beside my host cousin Maya.

My first homestay in South Africa.

Maya brushes her hand down my arm. "Do you like your skin?" she asks innocently, as she peers down at her own beautiful brown skin. I look down at the dispersed freckles lain across the arm that she touched, "I do," I reply. Her gaze still intent on her own skin. "I do because there is no other way that I can be, and no one else can be me. Do you like your skin?" Maya looks up apprehensively. I smile and imitate the gentle brush on her arm, "You're lucky Maya, you know? Your skin is beautiful. Not everyone can have skin like yours. It is beautiful and it is powerful." She said nothing, but embraced herself with a full-toothed smile. And it occurred to me that she, in the eight years of her life, had probably internalized the ever-present racism still plaguing the country and the world.

In present day South Africa, legally, apartheid has been over as of 1994. However, for some of the people of color living here not much has changed.

[...]

For the purposes of this paper, I interviewed four people of color, two women and two men, living in Cape Town. I looked at how race informed their conceptions of beauty in self and others, and how these notions of race and beauty further informed performance of self in society. Under the guidance of Qiniso van Damme, I explore perceptions of beauty amongst four university students.

I study the persistent relevance of

race, especially in the post-apartheid context. With my four participants, I attempted to study physical beauty, but quickly learned that the embodiment of beauty is more about inner beauty and its manifestation in the physical body. Through the month-long research project, I look at the perceptions of self in my participants, all of whom seem to reject notions of performativity for the sake of others. They focus on self-love, acceptance, and individuality as the reasons for their own performance of beauty. By the time you, the reader, reach the end of this paper, the hope is that you will have gathered an in-depth understanding of the "embodied subjectivities" amidst contending discourses of beauty (Glapka & Majali, 2017). The aim is to establish a better picture of what physical beauty looks and feels like in Cape Town for people of color and to establish a better understanding of how the objectification of Black bodies has been manifested within the city of Cape Town. I hope that one comes to see the persistent relevance of race, especially in the post-apartheid context.

[...]

THE GOOD STUFF IS IN THE INSIDE

[...]

When asked about what beauty looked like, each of my participants came to the same conclusion: that beauty is not that which one can see, but in essence, what one can feel—what is projected from one's soul.

"Beauty is about the person's energy

... their aura...it's not necessarily about the physical being, but someone's spirit. " (Nina, personal communication, 13 April 2017)

"Whenever a person is comfortable in their own skin... a person that deals with their imperfections and has self-acceptance; comfort in their container (*gestures to whole body*)—their entity." (Kendrick, personal communication, 13 April 2017)

"There's not one ideal form of beauty... it is more about confidence...radiance—a sense of power is beautiful." (Janelle, personal communication, 17 April 2017)

"Beauty is when one's self-love exuberates outwards...when it is clear that someone loves themselves wholly...which therefore projects outwardly—manifesting itself into how one takes care of themselves [or physical beauty]." (Jermaine, personal communication, 26 April 2017)

[...]

Through my research, it became clear that the Black Consciousness Movement played a key role not only in the discussion about self-love, but also in the practical implementation of it. Each of my participants expressed that their knowledge of the movement helped them come into their own self-acceptance, which is a daily, and continually changing process. Inner beauty, self-love, and individuality are all interrelated with identity, especially racial identity. I questioned my participants on whether they thought race informed conceptions of beauty. Nina argued that her own self-love and beauty came from exposure not only to the Black Consciousness Movement, but also to other university students similar to her. She said that her circle is made of Black people, especially Black women, that they exude power and beauty.

Kendrick argued that "Blacks have always, and are still sometimes seen as something negative...[and that] each generation of Blacks is told that they are ugly—unworthy of the label beautiful because the white man has always been seen as the 'Holy Grail' of beauty" (Kendrick,

personal communication, 20 April 2017). Flashing a proud smile, Kendrick stated that "you are never done learning about being Black—being beautiful" (Kendrick, personal communication, 20 April 2017).

Janelle, who self-identifies as "mixed" but white passing, told me that growing up, people would always assume that she was white, and she accepted that, unsure of whether it was her "place" to claim the other side of her identity with which she was unfamiliar. She said that it wasn't until university that she began her reclamation of her Blackness. Her self-determination was tied to her self-acceptance as a white-passing person of color. Janelle said that race impacts the ways one sees oneself because society sees race, and therefore sees one not as they are, but as they can be classified. "If you look some type of way, then you are that way because that is how society sees you, and therefore how you see yourself" (Janelle, personal communication, 21 April 2017). Tying this to what Kendrick said, the conclusion can be drawn that if society sees you as a simplification of your skin color and you see yourself that way as well, and society tells you that your skin is the opposite of that which exemplifies beauty, then you will think that you are ugly if you are Black. So, the rise of self-love and acceptance can be seen as a rejection to society's reductionist view of beauty.

[...]

CONCLUSION: YOU SEE ME AND YOU SEE BLACK

The subjective value of beauty comes in various forms. There is a duality between inner and outer beauty. Through my research, it became clear to me that beauty starts on the inside and therefore projects outwardly, as each of my participants resolved. When asked if he believed he was beautiful, Jermaine, like the rest of my participants, confirmed his inner beauty, which consequently meant that his outer beauty was also present. Jermaine argued that "you start to believe in your outer beauty if you believe in your inner

beauty" (Jermaine, personal communication, 26 April 2017).

Jermaine spoke about the emergence of inner beauty as the end of comparisons outside of one's self. He said that even though he eliminated the desire to compare himself to others, he recognized that "there are complexities of being human," saying that "one always exists in a physical space" (Jermaine, personal communication, 26 April 2017). This was an enlightened insight. As he said, "existing in a physical space" means that one will always be recognized within their physical reality. People will always see the physicality of a person, whether or not that individual rejects corporeal beauty and replaces it with inner beauty. Therein lies the paradox, which explains Kendrick's description of his friends as attractive, meanwhile contending that it is inner beauty that counts.

I inquired about how Jermaine came into loving himself, and he surmised that the root of his unhappiness arose from his constant comparisons to others. He said that "[inner beauty begins with] understanding that you are the only person that you have competition with" (Jermaine, personal communication, 26 April 2017). Regarding role models to whom he often compared himself, he professed that in "replicating role models you lose yourself, molding to bits and pieces of other people...I noticed that I was some caricature of someone else" (Jermaine, personal communication, 26 April 2017). This is quite a developed idea, which is representative of the other participants as well, based on the information that they shared with me. Janelle said that her perceptions of her own self-worth were lower than the people to whom she was comparing herself, arguing that if her sense of self-worth were greater, she wouldn't be comparing herself in the first place (Janelle, personal communication, 27 April 2017).

The media plays a key role in the development of beauty standards. Jermaine argued that "we are socialized and conditioned for instant gratification"—an idea I had not considered before in relation to

beauty (Jermaine, personal communication, 26 April 2017). The rise of information, consumerism, and capitalism has shaped how people view themselves and others by way of materialism. Regarding gratification, Jermaine contended that it was "...not only the gratification for one's self, but also a gratification of others" (Jermaine, personal communication, 26 April 2017). He argued that being the object of desire is a source of gratification facilitated by social media in particular, which gives people the opportunity to be whoever they want. This gratification can be found in the validation of others. Jermaine called this a "façade," saying that this "temporary dress" upon one's self facilitates reinvention, but in that reinvention, people forget who they are—"escapism." Jermaine described this as "forcing the outwards inwards" (Jermaine, personal communication, 26 April 2017).

When asked how he performs his beauty, Jermaine said that he "must stay true to himself, and his feelings...[and] that by recognizing that an individual changes daily" he is able to perform his inner beauty outwardly (Jermaine, personal communication, 26 April 2017). This idea of truthful beauty again addresses the duality between assimilation and authenticity, but in a nuanced sense. The authenticity of which Jermaine speaks is an authenticity of self, as opposed to authenticity in the eyes of others.

In studying people of color, I was curious about how race informed their performativity, perceptions of self-worth and social status, and self-love. With each of my participants, it became clear that beauty with all of its subjectivities has strong ties to desirability. Tate (2007) recognized this, in people of color, as melancholia, as her subjects felt that beauty was something outside of their realm. On conceptions of self, Jermaine explained that skin color and aesthetic values are interlinked. He said that "you must perceive [my skin color] some way...whether it is desirable to you or not is subjective...my physical presence is a negative one, both in history and even now.... You see me and you see Black"

(Jermaine, personal communication, 26 April 2017).

This decompartmentalized view of skin color and desirability is interesting because it is wrapped up in every aspect of life. As Nina said, "We all want to be loved," but no one can love you better than you love yourself. When one has fully come to terms with their own self-love, they become beautiful. Nina, Janelle, Kendrick, and Jermaine have all taught me about their interpretation of beauty as the manifestation of inner beauty projected outwards. This inner beauty is not something tangible, but rather something immeasurable. It comes from self-love. The embracing of one's self therefore creates an aura of beauty.

I am not my skin, but my skin is me. No one else can have it, nor can I have anyone else's. I am a mix of Black, Choctaw, Greek, French, Irish, Scottish, and Dutch—and I am beautiful.

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MARRIED LIFE WILL NOT BRING ME HAPPINESS: RELIGIOUS RENUNCIATION AS AN ALTERNATIVE TO MARRIAGE IN HINDU INDIA

Lauren A. Trujillo

The following is an excerpt from a longer piece. For full text, please visit www.honorsjournal.com

INTRODUCTION

All [*sadhus*] enter through a ritual process [*sannyasa*] which emphasizes the disjunction between ordinary life and a life oriented toward spiritual liberation, and all signify a major change in ritual status. For women, the change in identity and status following initiation is particularly dramatic, since unlike men, women are unequivocally identified with householdership, home, and family. The society into which a woman enters differs radically from the society in which she lived as a householder.

This quote from Lynn Teskey Denton describes the profound difference between being a *sadhu* (Hindu ascetic) and being a *grhin* (householder) in Hindu Indian society. The quote also points out that a woman's choice to become a *sadhu* is a radical one that involves rejecting the role of *grhini* (female householder), the dominant life paradigm expected of women. Very few Indian Hindu women choose to become *sadhus* and, because their numbers are small, there has been minimal scholarship written about them. These women, however, are important for understanding both a woman's place as a householder as well as understanding the way that religion in general and *sannyasa* (renunciation) in particular can subvert the traditional patriarchal power structures present in traditional Hindu Indian society. The purpose of this thesis is to explore the reasons Hindu Indian women would not want to marry or stay married and the way that renunciation can allow women agency and power over their own lives that they would not otherwise have

as householders.¹

[...]

CHAPTER I: THE DIFFICULTIES OF MARRIED LIFE IN SOME TRADITIONAL HINDU FAMILIES AND A LACK OF OPTIONS: WHY WOMEN TURN TO SANNYASA

[...]

Ethnographers studying both male and female *sadhus* ask common questions to learn the life stories of their informants. One typical question is something along the lines of, "Why did you choose *sannyasa*?" Male *sadhus* and female *sadhus* tend to have very different answers to this question. A majority of male *sadhus* state a religious reason; specifically, the desire to achieve *moksha* in this lifetime.

[...]

Conversely, female *sadhus* almost always cite social reasons for renunciation. The social reasons female *sadhus* cite, however, are different from those of men because they almost always involve marriage in some way. Female *sadhus* state that they took *sannyasa* because they did not want to marry, because they did not want to continue living with their husbands, because they were unsuitable for marriage, or because they were no longer married because they had either been widowed or their husbands had abandoned them.

[...]

¹ Lynn Teskey Denton, *Female Ascetics in Hinduism* (Albany: State University of New York Press, 2004), 105.

CHAPTER II: THE FREEDOM OF SANNYASA: WHAT BECOMING A SADHU HAS TO OFFER WOMEN

[...]

As those in urban areas have become less bound to traditional Hindu norms, it has become acceptable for women to be highly educated, take well-paying, secure employment, and live on their own. This is not an option, however, for rural, poor women who have little to no money or education on which to fall back. Indeed, for these women reared in highly traditional, rural areas, there are very few other options besides marriage. As Harlan and Courtright explain:

"[R]ural women are expected to marry, to bear children, to aid in household production, and to become mothers-in-law. Given the lack of alternatives, women benefit by adhering to the norms defined by the male-dominated society.²"

Although most women do choose to adhere to this norm of becoming a wife and mother, there is one other option for rural women and that is to take *sannyasa*. All but the most orthodox Brahminical sects of Hindu renouncers and adherents accept that women can become *sadhus*.³ A widespread *laukik* (popular, in contrast to orthodox) belief in the Hindu philosophy of *Advaita* (non-duality) makes this possible. *Advaita* promises the possibility of transcending all dualities and distinctions, so that the soul (*atma*) can merge with *Brahman* (the all-encompassing spirit of which the entire universe is made). *Advaita* philosophy "proclaims absolute freedom of the Spirit including the transcendence of all finite human institutions."⁴ Ironically, *Advaita* is an orthodox theory espoused in classical Brahminical

2 Lindsey Harlan and Paul B. Courtright, *From the Margins of Hindu Marriage: Essays on Gender, Religion, and Culture* (New York: Oxford University Press, 1995), 99.

3 These orthodox sects hold the *Dharmasastric* viewpoint (that is, one taken from the orthodox Brahmin Hindu text the *Dharmasastras*) that women are inherently sinful due to their pollution from childbirth and menstruation. This impurity makes it impossible for women to be able to reach *moksha* in this lifetime and therefore they are unfit for *sannyasa*. From this view, the way for women to reach *moksha* is to continue to accrue good *karma* and go through multiple rebirths until they can be reborn as high-caste men. Denton, *Female Ascetics in Hinduism*, 6.

4 Meena Khandelwal, *Women in Ochre Robes: Gendering Hindu Renunciation* (New York: University of New York Press, 2004), 44.

Hindu texts, and yet, within this idea is the ability to transcend the very strict gender and class hierarchies that Brahmins have attempted to keep in place. Most laypeople as well as many male *sadhus*, including many of those who consider themselves orthodox and high-caste, believe in the idea that male and female are categories that only apply to the physical body and are able to be transcended. These people believe that men and women can both be initiated into *sannyasa* and try to achieve *moksha* in this lifetime.⁵

[...]

This section will address the question of what advantages renunciation offers to women over the life of a householder. While Hausner, DeNapoli, Khandelwal, and Sinclair-Brull have focused on the many similarities between the life of a female householder and female *sadhu*, I will argue that there are also many differences between the life of a female *sadhu* and the life of a female householder, and these differences give renunciation benefits over householdership. These benefits include agency, freedom, a chance to have an education, a chance to earn respect and power, and a chance to escape a life of poverty—all things that likely would not have been possible for most rural, poor, low-caste householder women.

First, and most generally, *sannyasa* gives women a level of agency that they would not otherwise have had as householders.

[...]

One example of the agency *sannyasa* provides women is the celibacy that largely characterizes Hindu renunciation. Men basically control householder women's sexuality, as I argued earlier, by constant surveillance and restricting women's activities and movements in order to ensure there is no sexual activity outside of marriage for their daughters or wives. The chastity of wives and daughters is one of the main ways a family can maintain or increase its honor or

5 Denton, *Female Ascetics in Hinduism*, 7.

prestige. Maintaining daughters' virginity leads to better marriage matches, which in turn can make the family more powerful and a family whose women are unquestionably chaste will gain honor in the community. In this way, women's sexual activity or lack thereof is used to cultivate power for men, who are the main beneficiaries of increased familial honor and power.

[...]

Instead of cultivating power for men, a female renouncer can cultivate spiritual power for herself through celibacy. Sexual activity is said to drain power, in the form of *tapas* (the inner heat created by religious practice), from a person. Being celibate, as well as other spiritual practices such as singing *bhajans*, reciting *mantras*, meditating, and serving others (*seva*), allows women to build *tapas*.⁶ Hindus believe that this heat, when accumulated, is used to destroy impurity, bringing a *sadhu* closer and closer to the purest state of merging her *atma* with Brahma, thus achieving *moksha*.⁷ As one builds up *tapas*, it is believed he or she can gain spiritual powers, such as the ability to speak to the gods or goddesses, have prescient visions, and even control another person's thoughts or actions.

[...]

Second, women have much more freedom as renouncers than they otherwise likely would have had as married women. This is one of the reasons that renunciation is thought to be inappropriate to women in the traditional, orthodox texts such as the *Dharmashastra* literature. As Khandelwal notes, "That renunciation implied freedom and independence would in itself render it inappropriate for women."⁸ One of the ways this freedom manifests itself is that female renouncers' travel and movements are much less restricted.

⁶ Antoinette E. DeNapoli, "Leave Everything and Sing to God: The Performance of Devotional Asceticism by Female Sadhus of Rajasthan." (Doctoral Dissertation: Emory University, 2009), 406.

⁷ Sondra L. Hausner, *Wandering with Sadhus: Ascetics in the Hindu Himalayas* (Indianapolis: Indiana University Press, 2007), 172.

⁸ Khandelwal, *Women in Ochre Robes*, 37.

Indeed, it is believed that there should be a phase in a renouncer's spiritual journey where a *sadhu* must travel extensively, usually for many years with very few possessions, visiting various pilgrimage sites. The point of this is so that the *sadhu* learns detachment to both places and objects, as well as to not get too comfortable in one place. This is typically done when a renouncer is younger, as that is when one's physical body can stand to move around a lot and travel long distances.⁹

[...]

Third, women who renounce have the chance to receive an education that they likely would not have been able to receive as householders. As I mentioned in the last section, women who want an education often take *sannyasa* so they are able to attain an education. Very few women from rural areas have the opportunity to receive an extensive education, as they are kept home because of fears of a ruined reputation or that the girl will then be unhappy in a marriage where she must be submissive to her husband and in-laws. Therefore, *sannyasa* is often the only possible way for a girl from a traditional family to receive an education. This education can be either formal, through an established school or university, or informal, through one's *guru* or others in the person's *sadhu* lineage.

[...]

A fourth reason becoming a *sadhu* has an advantage over the life of a householder for women is that female *sadhus* are often greatly respected as compared to *grhinis*. While householder women are considered lower than men in basically every respect, female *sadhus* are considered both spiritually adept and powerful. According to the Hindu notion of *purusartha* (the goal to which a person devotes his or her life), renunciation is considered the highest end or goal (*artha*) to which a human being (*purusa*) can devote himself or

⁹ Hausner, *Wandering with Sadhus*, 101-103.

herself.¹⁰ Because of this, female *sadhus*, although they lead unconventional lives, "are highly respected by ordinary and even conservative people as sources of spiritual power and everyday morality."¹¹ By becoming a renouncer, a woman acquires a previously unattainable social and ritual status. This is because the woman is now formally considered under the tutelage of a *guru* and will later be able to initiate and teach her own disciples if she so chooses.

[...]

Fifth, female *sadhus* are able to hold much more power than they would have as rural, poor, low-caste householders. Indeed, female householders have little power in their lives over their households or even their own bodies. In contrast, female *sadhus* have power over both people and property. First, some female *sadhus* run their own ashrams or *mandirs*. Running one of these establishments is an opportunity to control a large amount of property, money, and people. For instance, Shiv Puri, a female *sadhu* informant of DeNapoli's, heads a large ashram outside of the city of Udaipur. She stays at the ashram for six months of the year and the rest of the time she travels to Bombay, where she visits devotees and collects donations for her ashram. When DeNapoli met her, Shiv Puri was in the process of having a larger ashram constructed to accommodate all the guests who wished to visit her site. This female *sadhu* was in charge of budgeting and paying for all of the construction of the new building, as well as interacting with the male contractor to dictate what amenities she wanted for the new ashram.¹²

[...]

Choosing to renounce often also allows a woman to become more powerful within her

¹⁰ Denton, *Female Ascetics in Hinduism*, 3.

¹¹ Khandelwal, *Women in Ochre Robes*, 6.

¹² DeNapoli, "Leave Everything and Sing to God," 137. Denton also notes that some women who join well-established *sadhu* orders can become economically powerful as a *mahantini*, the abbess or prioress of an ashram. Denton, *Female Ascetics in Hinduism*, 53.

own family. Although becoming a *sadhu* is often believed to be a renunciation of all previous relationships, including family and friends, many *female* *sadhus* retain relationships with their families. In this way, becoming a *sadhu* allows a woman to essentially subvert the usual power imbalance between men and women in Indian Hindu society, as she becomes the member of the family her relatives respect the most. For example, Shiv Puri, an informant of DeNapoli's, has altered her relationship with her son so that she is now his *guru* and he, along with his wife and children, are her *chelas* (householder followers or disciples). He is the caretaker for the large ashram she heads as well, so she is also his boss in a secular sense.¹³

[...]

In conclusion, renunciation allows women to respectably operate outside of the traditional Hindu role of wife and mother. It is clear that *sannyasa* offers a variety of real benefits to women over householdership, including agency, independence, power, respect, education, and improved living conditions. Women who choose to take *sannyasa* are able to lead lives that allow them to determine their own actions and garner authority and respect on their own terms, instead of through the men they are connected to. It is for these reasons that female *sadhus* who choose *sannyasa* over marriage are, as Shiv Puri, DeNapoli's informant states, "much happier because of it."¹⁴

CONCLUSION

[...]

Although female *sadhus* make up a very small minority of Hindu Indian women in general, I agree with Khandelwal's argument that their importance far outweighs their number in the population.¹⁵ Female *sadhus* allow us to see that householdership is not the only option for rural Hindu women. In doing so, we can gain a better understanding of the way in which even what seems like a very

¹³ DeNapoli, "Leave Everything and Sing to God," 137.

¹⁴ DeNapoli, "Leave Everything and Sing to God," 140.

¹⁵ Khandelwal, *Women in Ochre Robes*, 45.

rigid gender hierarchy has some flexibility in it to allow women more than one life possibility. This is also a way of “destabilizing Western truth claims” that Hindu Indian women do not have choice in their lives.¹⁶ This work as well as those of DeNapoli, Sinclair-Brull, Denton, Khandelwal, and Hausner go at least a small way in showing that poor, rural Hindu women in India do have some choices in their lives and that these women can, and do, lead lives of independence and power.

[...]

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¹⁶ Ruth Behar and Deborah A. Gordon, eds. *Women Writing Culture* (Los Angeles: University of California Press, 1995), 353.

HOW ETHICAL IS GENETICALLY EDITING OUR BABIES?

A RESPONSE TO ALLEN BUCHANAN'S COUNTING PRINCIPLES

Kimberly Abels

The following is an excerpt from a longer piece. For full text, please visit www.honorsjournal.com

Valentine's Day: a day filled with chocolates, roses, and romance. But in 2017 there was a groundbreaking release of new information that could affect lovebirds everywhere. February 14, 2017 marked the day the National Academies of Sciences and Medicine (NASM) gave tentative approval for the research of editing single-gene disorders. Picture this: a world where a couple who knows they both have the gene for cystic fibrosis (CF) can ensure their child is born disease-free. Because CF is controlled by a single, recessive gene, under normal conditions, there is a 25% chance their child will be born with CF (Cystic Fibrosis Foundation). Compounding this, there is a 50% chance that their child may not have the disease but will still have the gene for it, which they could pass on to their own children (Cystic Fibrosis Foundation). The child, or the child's child, will constantly cough up phlegm because the body cannot remove it from the lungs (Cystic Fibrosis Foundation). NASM's response resulted from advances in a particular gene editing technique, CRISPR-Cas9 (National Academy of Sciences, 2017). With more research, this technology can make gene editing a reality (National Academy of Sciences, 2017). In short, NASM stated that gene editing is beneficial for those who have single-gene diseases, such as CF; however, they issue caution for advancing research in editing diseases caused by many genes (such as schizophrenia) and editing the germline (National Academy of Sciences,

2017). Despite their hesitations, NASM does recognize some cases where germline editing would be beneficial, such as parents with a copy of the CF disease gene (National Academy of Sciences, 2017). In short, they conclude that "although heritable germline genome editing trials must be approached with caution...caution does not mean prohibition" (National Academy of Sciences, 2017).

Caution, not prohibition, is the same approach Allen Buchanan uses in "Playing God, Responsibly," a chapter in his 2011 book, *Better than Human*. Buchanan is a philosophy professor at Duke University and King's College, London. He has a particular interest in biomedical ethics, having served as staff philosopher for the 1983 President's Commission on Medical Ethics, as well as serving on the Advisory Council from 1996-2000 for the National Human Genome Research Institute. He also has a fellowship at Hastings Center, which is a bioethics research institution. In the "Playing God, Responsibly" chapter, he creates a set of guidelines which he believes promote an ethical approach to genome modifications. The system Buchanan proposes acts as a set of risk-reducing principles, or "counting principles" (Buchanan, 2012). Buchanan explains, "the idea is that the more of them that are satisfied and the more fully each of them is satisfied, the more confident we should be that we've covered the bases in trying to reduce the risk of bad unintended consequences" (Buchanan, 2012).

The counting principles, listed below, are a set of seven guidelines “intended for a very specific task: reducing the risk of unintended bad biological consequences in the case of genetic enhancements” (Buchanan, 2012), which is NASM’s number-one concern:

1) Edited genes should be “downstream” in their developmental role since editing “upstream” genes will more likely result in unintended changes to the organism.

2) Editing the gene will not make someone “better” than the “best” person with that trait. For example, we would not want to genetically alter someone to give them an IQ of 240 because nobody has this IQ range.

3) The modifications must stay within the original person, and any potential negative effects should not be passed onto future generations.

4) The effects from the editing must stay “compartmentalized” within the person and not spread to other parts of the body.

5) The effects of the editing must be reversible, meaning the effects of the change can be stopped if harmful to the person.

6) Editing the gene should not change the “basic design or shape” of the person.

7) If editing will remove a trait, the gene that causes the specific trait must be known, as well as that gene’s role throughout the entire body.

Buchanan’s background in philosophy and genetics help him develop a seemingly sound set of counting principles. But when analyzed through a biologist’s eye, his rudimentary knowledge of biological processes discredits many of his risk-reduction guidelines. This paper will address three biological concepts that invalidate Buchanan’s approach: gene-environment interaction, complex gene-gene interaction, and biological “fail-safes.”

GENE EDITING BACKGROUND

Currently, research methods use gene editing techniques. Not only do scientists perform gene editing on bacterial and rodent cells, this editing is also in clinical application stages for human

somatic cells. Because somatic cells are specific to an individual and play no role in carrying genetic information for reproduction, these edits are not heritable. This research focuses on treatment and prevention of disease and excludes any possibility for “enhancement,” or increasing any traits past natural human ability levels, such as physical strength. The main difference between somatic cell editing and germline editing is that with germline editing, the edits are heritable. The immediate offspring, and the offspring of the offspring, and so on, all have the potential of inheriting these edits. If these edits result in negative unintended effects, these effects would not only affect the original person but also all their successive generations. Germline editing also differs from editing the embryo. Once the embryo begins development, it is its own entity of somatic cells. Edits to the embryo do not affect the embryo’s germline, so any changes will not be inherited by any future offspring.

On the other hand, many from NASM believe germline editing is “ethically inviolable” (National Academy of Sciences, 2017). Something that is ethically inviolable is deemed to never be broken or infringed upon. They believe that due to ethical concerns, germline editing should not happen, under any circumstances. NASM believes this because germline editing is heritable, unlike somatic cell or embryo editing. Because of the “passing down” of these genes that will occur, and because scientists do not know the long-term effects of germline editing, one can see why NASM hesitates with permitting these procedures. Although the NASM report in 2017 focuses on the ethicality behind CRISPR-Cas9 modifications, it is important to apply this logic of thinking to all potential gene editing techniques.

[...]

UNDERSTANDING COMPLEX GENE-GENE INTERACTIONS

Despite what many learn in their biology classes, there are no true “upstream” and

"downstream" genes.

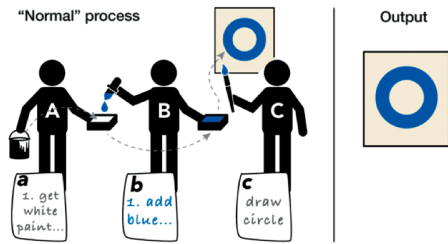
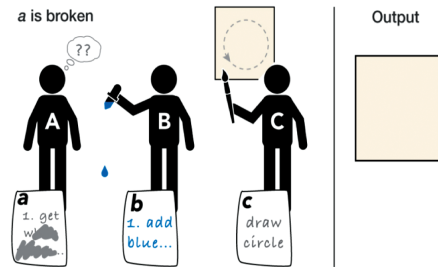


Figure 1: The interaction between genes A, B, and C.

Genes with epistatic relationships typically encode proteins (or gene-products) that work together in a biological process. In this example, three "genes" work together to produce the phenotype (or physical characteristic) of a blue circle. Even though each gene (A, B, and C) may have its own function, they also work in correlation with one another to produce a product through epistasis. (Figure adapted from University of Utah)

When analyzing Buchanan's arguments, "upstream" and "downstream" genes refer to where in the specific pathway the gene product plays a role. Considering Figure 1, gene A (get white paint...) is "upstream" of gene B (add blue...) because once "get white paint" happens, "add blue" happens (University of Utah). Gene B (add blue...) is considered "downstream" of gene A (get white paint), but gene B is "upstream" of gene C (draw circle) (University of Utah). An "upstream" gene affects (typically through activation or inactivation) a gene that is "downstream" of it in the biological pathway. However, the terms "upstream" and "downstream" are purely relative.



This version of a is epistatic to b and c it hides their output.

Figure 2: The elimination of an epistatic gene affects the rest of the genes in the relationship.

In this example, the broken gene A is epistatic

to genes B and C. The concept of epistasis is exemplified by the lack of final gene product (or the blue circle). The true function of epistasis is the "hiding" of the directions given by another gene. Because there is no paint provided by gene A, gene B cannot add blue to it (even though that is B's function and B is functional), and C cannot create the circle because there is no paint (even though the circle drawing is C's function and C is functional). (Figure adapted from University of Utah)

Many "upstream" and "downstream" genes interact with one other in a relationship known as epistasis. To best understand this concept, see Figure 1 (University of Utah). However, just because genes work together to produce a final product does not mean they are necessarily epistatic to one another. Another image from the Genetic Science Learning Center at the University of Utah (Figure 2) better illustrates epistatic effects and how changing one gene may result in the elimination of a phenotype (University of Utah).

Considering epistasis as an example of complex gene-gene interaction, Buchanan's counting principle one is no longer possible. This principle states that edited genes should be "downstream" since editing "upstream" genes more likely will result in unintended changes (Buchanan, 2012). However, genes do not necessarily function in this fashion. Most genes do not work in a way that is strictly "gene A is upstream of gene B, and gene B produces a protein that has no other 'downstream' effects." If the protein is the end-product of gene B, it may be the end-result of that gene product, but often a protein regulates functions of other proteins. In the epistasis example, if someone thought that gene A (get white paint) was purely downstream (it affected no other genes), the elimination of it would affect the expression of the trait (blue circle) (University of Utah). If this epistatic relationship was unknown, there would be unintended changes (the elimination of the phenotype) produced by editing this seemingly-"downstream" gene. More than likely, this unintended change would be the case, according to Evan Snitkin's publication about epistatic interactions leading to different phenotypes. He explains "little

is known about how cell-scale genetic interaction networks vary across multiple phenotypes” (Snitkin, 2011). Because these “cell-scale genetic interactions networks” are unknown, we can assume that the true role of epistasis in phenotype development is also unknown (Snitkin, 2011). Also utilizing the painting example, if gene B (add blue) was determined to produce a disease, a parent would want the gene changed to encode for a non-fatal color. However, there would still be unintended changes of phenotype (University of Utah). In this case of figure 3, if they changed gene B from coding for blue to coding for red, the phenotype of the circle would still be present; however, the coloring would have changed from blue to red. Although red may be a known non-disease phenotype, changing it and not knowing the exact phenotypic downstream effects violates Buchanan’s first counting principle.

Not only do genes work together in creating different phenotypes, they also work together throughout the body. This concept is again best represented by Hox genes. However, the functioning of Hox genes contradicts Buchanan’s counting principle four. This principle states that the effects from editing must stay “compartmentalized” within the person and not spread to other parts of the body (Buchanan, 2012). Although some genes function in this manner, the principle does not consider genes that affect the entire body, not just one “compartment” (such as the digestive tract or the brain). These “cross-compartment” gene relationships are best exemplified in the development of mice. Although they are not humans, mice are considered a model organism, meaning that their results from testing mimic the results of testing that would occur on humans (for experiments we cannot perform on humans due to ethicality reasons). *MHox* in mice regulates the growth of arm bones (Cretkos et al., 2008). When this gene is removed, mice begin to develop normally, but because they cannot grow forelimbs, they die a few weeks into development (Cretkos et al., 2008). This extreme example highlights

the function of genes in different parts of the body. Although the *MHox* gene does not affect life-sustaining organs (such as the heart and brain), its removal not only affects bone growth, but affects the life of the mouse overall.

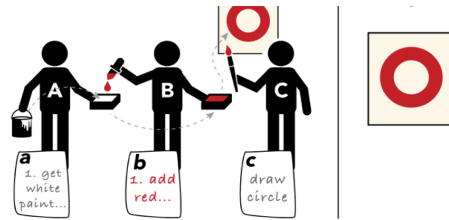


Figure 3: The editing of an epistatic gene affects the end phenotype. I

In this example, gene A is epistatic to gene B and gene B is epistatic to gene C. The concept of epistasis is exemplified by the change of final gene product (or the blue circle). Because gene B adds red instead of blue to the paint and C still creates the circle, but the circle is red instead of blue because of the change in one gene (gene B). (Figure adapted from University of Utah)

Through the analysis of “upstream” and “downstream” genes, epistasis, and “cross-compartment” gene interactions, one begins to understand the complexity behind gene functioning. Although basic biology explains gene interactions simplistically, they ignore the same elements of gene interactions that Buchanan does. Some, but not all, genes work in a true “upstream” and “downstream” relationship; however, most do not function in this manner. Complex gene pathways and epistasis discredit Buchanan’s counting principle one, as gene interactions often mean that one seemingly “downstream” gene may actually not be and could result in unintended phenotypic effects. These interactions also mean that the genes do not always function in only one compartment of the body, discrediting Buchanan’s principle four, as it would be hard for the intervention’s effects to stay compartmentalized.

[...]

MOVING FORWARD WITH CAUTION

As seemingly plausible as Buchanan’s principles may be, they do not hold up

once closely scrutinized. Considering the growing field of genetics and genetic engineering throughout the last decade, there is a possibility that these problems were not known information in 2011. But until we have a full understanding of germline editing, genes and their associated functions, along with what traits are controlled by which genes, we must proceed with caution. However, there are diseases that are controlled by one gene: Mendelian diseases. Because the diseased gene is known and well understood for many Mendelian diseases, germline editing for these traits is something we could continue pursuing. As gene editing technologies become more advanced, there is a probability that diseases like CF and HD could be "cut out" of the genome.

But until we fully understand more complex traits, we should dismiss Buchanan's guidelines and revert to the Precautionary Principle (Buchanan, 2012). Our knowledge is relatively uncertain regarding the effects of germline editing, and we cannot make probable assertions about the risks of gene editing in situations other than editing Mendelian diseases. We are in the same principle of uncertainty that Buchanan believes warrants the precautionary principle (Buchanan, 2012). The Precautionary Principle, put simply, is the principle of reducing risks—not doing something because it has the potential to cause serious harm (Buchanan, 2012). Once we learn more about gene-environment interaction, complex gene-gene interactions, and biological fail-safes, we can take on Buchanan's counting principles. Until then, it is important and necessary to proceed towards gene editing with caution.

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