

# The Pioneer Research Journal

*An International Collection of  
Undergraduate-Level Research*

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## A Study of Yoko Ono as a Fluxus and Woman Artist

Yao Lin

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### Abstract

This research looks at the art of Yoko Ono. The goal is to present Ono as one of the most important artistic figures in the history of modern art, without biases based on race or gender. The artist's widely known marriage with John Lennon in 1969 triggered many misogynist and racist attacks against her, and has overshadowed most of her artistic achievements and influence. Despite pressure from her male counterparts and Western society, Ono was one of few female artists in 1960s' Fluxus movement, and one of first few Asian artists in the United States. Both of her Fluxus and female identities are evident in most of her art, including Grapefruit, Cut Piece, and Sky Piece For Jesus Christ, all of which the research paper discusses and analyzes in the context to the cultural and social norms of the time. The paper concludes with a comparison and contrast between Ono and Yayoi Kusama, and emphasizes the significance of Ono as a Fluxus and female artist in modern America.

"Don't be scared, don't be scared to love... Don't be shy, don't be shy to tell, you may lose the chance to tell, don't be shy."<sup>1</sup>

In the seventies, Yoko Ono dreamed of having a solo art show; yet at the time, it was almost impossible for a museum like MoMA to hold a show just for a woman, and especially for a nonwhite woman. Yet she dreamed, and she did a "MoMA show" on her own. In the poster advertising her unauthorized 1971 MoMA show, the artist held up a plastic board with a printed letter "F" before "Art," making it "the Museum of Modern FArt," as an attack on the museum's negligence of women artists - but a playful one. In the show, Ono claimed to release a bottle of flies into the city of New York, and what she asked of the visitors was to track down the flies in the enormous busy world outside the exhibition. Her request demanded the audience to look at everything closely in everyday life - street signs, coffee mugs, a piece of cake left on a dinner table, or even trash cans - and this piece of

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<sup>1</sup> Yoko Ono, prod., "Don't Be Scared," *Milk and Honey*, by Yoko Ono, compact disc.

instruction was like a light-hearted joke, but an ambitious one too, which blurred the line between art and life.<sup>2</sup>

In 2015, *Yoko Ono: One Woman Show*, an art exhibition devoted to Ono as an artist, was finally held in the Museum of Modern Art, 44 years after her daring and ambitious joke in 1971. It was not until 1982, 11 years after Ono's unauthorized MoMA show, that the art museum had its first woman solo show, featuring Louise Bourgeois.<sup>3</sup> Appreciating and emphasizing a woman's artistic intelligence and effort alone, once unimaginable for the majority, has since become a reality; such appreciation for women artists was again realized in Ono's solo MoMA show. Ono, on the other hand, was finally revealed as a "historically important, groundbreaking and influential artist" by Mr. Klaus Biesenbach, the director and chief curator of MoMA. He explained that MoMA wanted to unearth Ono's artistic accomplishment, which was once overshadowed by her fame as John Lennon's wife.<sup>4</sup>

Like her unauthorized MoMA solo show in 1971, Ono is an artist who can be described in many different ways. Her philosophy, which was anti-sexist, anti-racist and anti-art, was a rebellion against the mainstream concepts of gender, race and art. She was also one of the founders of the Fluxus movement, along with George Maciunas, Allan Kaprow, Alison Knowles and many others. Fluxus sought to make art approachable, blur the boundaries between art and life, and obscure the lines between artists and their audience. Ono was a lively embodiment of Fluxus ideas, but the fact that she was a woman and Japanese hindered her progress in creating art.<sup>5</sup> While it was difficult for white men like George Maciunas and John Cage to perform their conceptual "anti-art" art in front of an audience who only perceived art as something requiring skills and high aesthetic standards, the situation was even tougher for Asian women like Ono in the largely sexist and racist contemporary Western society. Furthermore, many art historians speculate that Ono's art career was brutally interrupted by her romantic relationship with Lennon, which made her a main suspect in the disbanding of the Beatles and a victim of race- and sex-oriented attacks. Ono's anti-sexist and anti-racist art entails such life experiences; fortunately, she has never quit making art despite gunshots and cannons of criticism.

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<sup>2</sup> Blake Gopnik, "Yoko Ono and MoMA, Together at Last," *The New York Times*, last modified May 6, 2015, accessed July 8, 2018, <https://www.nytimes.com/2015/05/10/arts/design/yoko-onos-1971-moma-show-finally-opens.html>.

<sup>3</sup> "Louise Bourgeois." MoMA. Accessed July 8, 2018. <https://www.moma.org/calendar/exhibitions/2243>.

<sup>4</sup> Blake Gopnik, "Yoko Ono and MoMA, Together at Last," *The New York Times*, last modified May 6, 2015, accessed July 8, 2018, <https://www.nytimes.com/2015/05/10/arts/design/yoko-onos-1971-moma-show-finally-opens.html>.

<sup>5</sup> Tracy DiTolla, "Fluxus Overview and Analysis," *The Art Story*, last modified 2018, accessed July 8, 2018, <https://www.theartstory.org/movement-fluxus.htm>.



In this paper, I will discuss Yoko Ono as an artist from the perspectives of Fluxus and feminist art by analyzing some of her artworks, comparing her to other contemporary artists and integrating her contemporary cultural background. The first part of the paper, “Fluxus and Ono,” will introduce the Fluxus movement, in which Ono served an important role, and discuss the key ideas which heavily influenced her art. Part two of the paper, “Feminism and Domesticity in Ono’s Art,” is built on the Fluxus affirmative attitude toward art and life, which is previously discussed in part one; this section, which includes the main argument of the paper, will closely examine womanhood, motherhood and domesticity as presented in Ono’s art and finally illustrate the importance of her feminism. Finally, I will conclude the paper by contrasting Ono with another Japanese artist, Yayoi Kusama.

## 1. Fluxus And Ono

When discussing Ono’s art, one should not ignore how heavily the Fluxus movement has influenced her work. Fluxus was a loosely constructed organization of artists; although the Fluxus artists were located around the globe, their activity was most evident in New York. The concept of “fluxus” was first introduced by George Maciunas in 1961. He favored the term because the multiple meanings of the word “flux”— “flow,” “change,” “fuse” and “excrete”— happened to coincide with the art concepts he embraced.<sup>6</sup> As he states in his *Fluxus Manifesto*, the movement aimed to “purge the world of bourgeois sickness... of dead art, imitation, artificial art,” to “promote living art, anti-art ... by all people, not only critics, dilettantes, and professionals.” He also claimed that artists were to “fuse the cadres of cultural, social [and] political revolutionaries.”<sup>7</sup> In other words, Fluxus artists intended to create art that everyone in the society— regardless of their social or educational background— could participate in, and to merge art with life. In this way, Fluxus art became a shared bond between different parties, including the artists who created art and the audience who both perceived and participated in art.<sup>8</sup>

Maciunas insisted that unlike previous avant-garde art movements, Fluxus did not have much to do with the “negation, critique and deconstruction” of both Futurism and Dada; rather, the movement was more lighthearted and playful.<sup>9</sup> Indeed, most Fluxus art involved performances and interactions between artists/art and

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<sup>6</sup> Roger Rothman. “Fluxus, or the Work of Art in the Age of Information.” *symploke* 23 (2015): 309-325. <https://muse.jhu.edu/> (accessed July 7, 2018).

<sup>7</sup> George Maciunas, *Fluxus Manifesto*, 1963, offset lithograph, The Museum of Modern Art, New York, NY.

<sup>8</sup> Rothman, 322.

<sup>9</sup> Rothman, 310.

audience. Some of them were actual games, like Ono's *White Chess Set*.<sup>10</sup> The absurd works of the American composer John Cage, a close friend of Ono's, served as a solid philosophical foundation for Fluxus. Cage's works rejected the tendency to criticize and annihilate of Dadaist works— an avant-garde movement that was an objection largely against World War I— but attempted to create “a new sensitivity, ...of accident, of vanishings, of nothing.”<sup>11</sup> Although such descriptions might make Cage seem suspiciously nihilistic, he and Fluxus were really giving birth to the “humor and collectivity” of art rather than negatively critiquing contemporary society like Dada.<sup>12</sup>

The light-hearted artistic attitude and positive quality unique to Fluxus can be observed in Ono's unauthorized MoMA solo show in 1971, as described in the introduction, and throughout her artistic career. Ono's *Ceiling Painting, or Yes Painting*, was another fine representation of Fluxus art, emphasizing both the participation of viewers and the movement's optimistic and cheerful attitude towards life. Her artwork consisted of three parts: a ladder, the word “yes” written on a paper and framed beneath glass, and a hanging magnifying glass attached to the ceiling.<sup>13</sup> Members of the audience were asked to climb up the ladder to the top, hold up the magnifying glass and look for the small “yes.” As a participant moved up and stood at the top of the ladder, he or she would unavoidably feel an endurable amount of anxiety, due to the fear of fall-ing. Ono's intention was to invite viewers to accept their vulnerability and trust the artist and the artwork itself. The “yes”— which would be conceived by the participants when standing atop the ladder with uneasiness — is indeed a “comforting and humorous”<sup>14</sup> message which affirms the audience's voluntary participation, for it is already the process and action of bravely accepting and believing.<sup>15</sup> Such humor and positivity presented in Ono's art and other Fluxus works were much different than what the majority would expect from avant-garde art; most contemporary art, according to Lennon who attended Ono's 1966 Indica Gallery show in London, “was all negative.”<sup>16</sup>

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<sup>10</sup> Rothman, 312, 322.

<sup>11</sup> Rothman, 310.

<sup>12</sup> Rothman, 311.

<sup>13</sup> “Ceiling Painting, Yes Painting,” Guggenheim Bilbao, accessed July 8, 2018, <http://yokoono.guggenheim-bilbao.eus/en/artworks/ceiling-painting-yes-painting.html>.

<sup>14</sup> Elizabeth Ann Lindau. ““Mother Superior”: Maternity and Creativity in the Work of Yoko Ono.” *Women and Music: A Journal of Gender and Culture* 20 (2016): 57-76. <https://muse.jhu.edu/> (accessed July 8, 2018).

<sup>15</sup> Rothman, 322.

<sup>16</sup> Sheff and Golson, *the Playboy Interviews*, 87.



**Figure 1.** Yoko Ono's "Sky Piece for Jesus Christ" performed during the exhibition "Half-A-Wind Show A Retrospective" at the Louisiana Museum of Modern Art, Humlebæk, Denmark. Bjarke Ørsted.

In Ono's *Sky Piece to Jesus Christ*, which was first performed in 1965, Ono and her assistants wrapped the performing orchestra with white gauze after their prelude. According to Ono, the piece was a contrast between the permanent sky and human life, in which the latter is always changing but the former stays the same forever.<sup>17</sup> Even though this work seems to show the audience how small we, as humans, are in contrast to the sky, Ono is actually implying the immense strength and potential of life despite its minuteness, as the orchestra still struggles to play after being wrapped in gauze. The action of wrapping for Ono is a metaphoric action for restraining organic life, as well as a mirror showing the inner freedom and infinite possibilities inside each human.

"Life is too complex, you know, and I try to clear it," the artist once said about her intention behind *Sky Piece*.<sup>18</sup> The complexity of life is a uniform message conveyed in Ono's artworks, yet despite her acknowledgement that life is complicated, the message is always positive and encouraging the viewers to take an optimistic attitude toward life. In this way, Ono deliberately crosses the line— which was once concrete and impassable— between life and art, and actualizes the Fluxus idea of "art is life" and of positivity.

## 2. Feminism And Domesticity In Ono's Art

Ono's art is not sentimental as her critics charged it to be. Despite the intimate relationships between Ono's art, Fluxus, and New York's avant-garde, Ono and other female artists were often criticized by their male counterparts for being too "emotional."<sup>19</sup>

<sup>17</sup> Gabriella Daris, "Yoko Ono's 'Sky Piece to Jesus Christ' in Lyon," Blouinartinfo, last modified March 10, 2016, accessed July 8, 2018, <http://www.blouinartinfo.com/news/story/1351960/yoko-onos-sky-piece-to-jesus-christ-in-lyon>.

<sup>18</sup> Daris.

<sup>19</sup> Lindau, 67.

Sentimentality seemed to be a dominant element in contemporary female art. Ono communicates the vulnerability of women, especially that of an Eastern female like her, through her art; nevertheless, she also reveals the power of womanhood and motherhood.

*Cut Piece*, one of Ono's most famous works, was first performed on July 20th, 1964 at Yamaichi Concert Hall, Kyoto. The piece was later staged in Tokyo, London, New York and in 2003, in Paris. During the performance, the well-dressed artist sat on stage with a pair of scissors in front of her and invited the audience to step on stage and cut a piece of cloth off her. In the recording of her performance at Carnegie Hall in 1965<sup>20</sup>, the audience went up to her and cut off pieces of her clothes— sometimes boldly large, sometimes carefully diminutive — while the artist remained motionless and silent.<sup>21</sup> The simple interactions between the artist and audience enabled the latter to participate in creating artworks as artists do, narrowing the distance between the crowd and art. As a piece of instruction, Ono's *Cut Piece* further put the audience in the spotlight:

...Performer sits on stage with a pair of scissors in front of him. It is announced that members of the audience may come on stage – one at a time – to cut a small piece of the performer's clothing to take with them. Performer remains motionless throughout the piece. Piece ends at the performer's option. Second version for audience: It is announced that members of the audience may cut each other's clothing. The audience may cut as long as they wish.<sup>22</sup>



**Figure 2.** Yoko Ono's "*Cut Piece*", 1964

<sup>20</sup> As explained in an email response from Kathleen Sabogal, the assistant director of archives at Carnegie Hall, Ono had two major performance events at the recital hall; one was from 1961 to 1962, the other from 1964 to 1965. Ono performed *Cut Piece* at the latter as a solo artist for the entire event. Both events were organized by Norman J. Seaman, the recital hall's manager at the time.

<sup>21</sup> *Cut Piece*, performed by Yoko Ono, directed by Albert Maysles and David Maysles, 1965.

<sup>22</sup> Kevin Concannon, "Yoko Ono's CUT PIECE : From Text to Performance and Back Again," *A Journal of Performance and Art*, September 2008, [Page #], accessed July 8, 2018, <http://imaginepeace.com/archives/2680>.

Although cutting seemed to be a simple action, many among the audience were too afraid to go up to the artist and make the cut. Carolee Schneemann, another female Fluxus artist, attended one of Ono's *Cut Piece* performances. According to her, the performance was frightening, for it frankly showcased Ono's female "vulnerability, and [the] unpredictability of the audience" as well as the aggressiveness, hostility, and danger enacted upon females in the male-dominated society.<sup>23</sup> Ono wanted the audience not only to feel like a participant in art, but also a perpetrator in the victimization of women, and especially, powerless oriental women.<sup>24</sup> Ono's performance, Fluxus and the two World Wars all contributed to a broadening of women's roles, before which in worst cases, women were only perceived as domestic housewives, submissive mistresses and even worse, sex objects. For a woman who came from the East like Ono, the situation was more threatening, with the added layer of racism. Asian women were suppressed in their own countries, such as Japan and China, where women had no authority whatsoever, domestically or socially. They were not better off in the West, either, where they were often reduced to one of the Eastern female stereotypes. In this way, Ono's *Cut Piece* daringly criticized the objectification of women and indicated that every member of society — represented by the audience — could be the perpetrator. Furthermore, the artist added another layer of meaning to the performance/instruction art work by making it gender non-specific. Perhaps Ono wanted to make males experience what women have been through; or maybe she also perceived males as victims of gender stereotypes and over-emphasized masculinity.

Although Ono underscored the victimization and objectification of women in *Cut Piece*, she did not approve of female powerlessness in her art. Instead, she presented females as empowered by both womanhood and motherhood. After marrying Lennon, Ono received endless criticism for her possible participation in dissolving the most successful band in the world. The denunciation she experienced was indeed a byproduct of the greatly sexist rock and roll music industry. Many well-known music pieces of the genre have exemplified rebellions against obedience and domesticity, which, in many cases, were what femininity represented. Females were either portrayed as domestic burdens or indicated as sexual objects in much of rock music.<sup>25</sup> In many early Beatles songs, for example, females were

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<sup>23</sup> Moderated by Midori Yoshimoto, Featuring Alison Knowles, Carolee Schneemann, Sara Seagull, Barbara Moore, Transcribed by Brynn Wein Shiovitz, Edited by Midori Yoshimoto & Alex Pittman (2009). An evening with Fluxus women: a roundtable discussion, *Women & Performance: a journal of feminist theory*, 19:3, 369-389, DOI: 10.1080/07407700903399524

<sup>24</sup> Gwendolyn Audrey Foster (2010) Self-Stylization and Performativity in the Work of Yoko Ono, Yayoi Kusama and Mariko Mori, *Quarterly Review of Film and Video*, 27:4, 267-275, DOI: 10.1080/10509200802350307

<sup>25</sup> Caroline Hartman, "Girly Boys and Boyish Girls: Gender Role in Rock and Roll Music," accessed July 8, 2018, <https://dialogues.rutgers.edu/journals/152-girly-boys-and-boyish-girls-gender-roles-in-rock-and-roll-music/file>.

shown to “lock up” males in “chains of love,”<sup>26</sup> or to entertain boys by “telling things [they] want to know,”<sup>27</sup> as if female existence could not be independent from male dominance. “Moms Don’t Rock” was an essay written by Norma Cortes which identified a prevalent anti-feminist notion in the world of rock music; the essay explained that in most contemporary associations of mothers, the female guardians were thought to be preventing teenagers from attending music concerts, and were thus a symbol to rebel against.<sup>28</sup> Although rock and roll music was revolutionary in terms of music and politics, its existence was not novel in terms of gender; it was a musical form that continued to emphasize masculinity and oppress femininity.

It seemed almost a shame then to be a female, especially for those woman rock singers who were forced into early retirement due to motherhood, such as Moe Tucker and Patti Smith. Ono, on the contrary, took great pride in her womanhood and motherhood, even though she did not celebrate her motherhood in a traditional way. She highly appreciated women’s ability to become pregnant, yet she rejected the burden of childcare that usually fell on females. Ono’s nearly infamous screaming showcased in her music collaboration with Lennon and the Plastic Ono Band was an example of the womanhood and motherhood in her art. According to the artist, the unforgettable screaming was inspired by her childhood and teenage experience in Japan, those of hearing women screaming when in labor or receiving abortions.<sup>29</sup> She figured that screaming was a significant sign of great maternal power, a rebellious force that was often suppressed and overlooked in a society controlled by men; yet the screaming not only gave power to mothers, but also life to infants, regardless of gender. To Ono, male-dominant society was undeniably dependent on women’s ability to give birth, but the power of femininity and maternity was neglected by men for the most part: every ruling king, every disobedient rock superstar— every man in society— all had times when they were entirely dependent on their mothers. Ono’s screaming, which was often considered displeasing, was an alarming and clever way of reminding the listeners of the importance of females, mothers and their enormous maternal capability.

While she demonstrated that women gained power from their ability to physically bear children, Ono dismissed childcare as a part of the maternal duty. Instead, she considered caring for children both a restraint on the children’s growth and a burden to mothers. When she was pregnant with her and Lennon’s first child, she demanded the former Beatle to become the househusband who would take care of their son Sean after he was born; Ono, on the other hand, would continue to create art and become the financial manager of the

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<sup>26</sup> Gerry Goffin and Carole King, lyricists, “Chains,” performed by The Beatles, on *Please Please Me*, performed by The Beatles, 1963, compact disc.

<sup>27</sup> “Ask Me Why,” performed by The Beatles, lyrics by John Lennon and Paul McCartney, recorded November 26, 1962, on *Please Please Me*, 1963, compact disc.

<sup>28</sup> Lindau, 61.

<sup>29</sup> Lindau, 69.

household.<sup>30</sup> The Ono-Lennon relationship, then, was a complete reverse of American parents in the 1950s: a housewife mother who took care of kids and did domestic chores, and a businessman father who worked and had control over the family's financial arrangement. That Ono's domestic role was equal, or even superior to Lennon's is evidential in her art, and proven by her husband many times. Lennon once explained that he nicknamed Ono "Mother,"<sup>31</sup> in spite the fact that Ono was only 9 years older than Lennon. The name showed the domestic relationship between the two which was unique and revolutionary when comparing to other contemporary couples.

Although Ono rejected childcare as one of her maternal responsibilities, she did not reject all possible definitions of female domesticity at once. Her first self-publication, *Grapefruit*, is a collection of poetic instructions which sometimes touch upon themes of melodious femininity and ambiguous domesticity. In "Room Piece" of *Grapefruit*, Ono asks the audience to "take the sound of the room breathing" at five distinct times during the day and to "bottle the smell of the room."<sup>32</sup> A "room" was a domain of women and housewives, not to mention that the instructions required staying in a room for five different hours while recording the room. Here, Ono displayed a sense of hidden beauty in the domestic environment—the feminine domain—and femininity, without advocating oppressive domesticity. It might seem to some that she was advocating for domesticity, yet she was in fact rendering domesticity to show the beauty of womanhood and motherhood by inviting her readers of both genders to experience what contemporary females did and felt. In "Tunafish Sandwich Piece," her instruction is to "make one tunafish sandwich and eat."<sup>33</sup>



*Figure 3. A first edition copy of "Grapefruit," photograph, MoMA.*

<sup>30</sup> Lindau, 65.

<sup>31</sup> Lindau, 63.

<sup>32</sup> Ono, "Room Piece" in *Grapefruit*, 1964.

<sup>33</sup> Ono, "Tuna Sandwich Piece" in *Grapefruit*, 1964.

Yet before the whole process of making and eating the sandwich, she proposed imagining a pleasant landscape of one thousand suns shining in the sky, and finally melting away and disappearing from view. Ono asked her readers to accommodate such rituals of appreciating the beauty of life with moments in their daily lives; to her, those contemporary women—especially domestic mothers—knew how to celebrate the beauty of daily life the best, because mothers always made sandwiches for the rest of the family. Whether the artist was consciously combining the Fluxus idea of “art as life” and domesticity—which was not only for females, but for male audience, too—it was an invitation to experience life and art together in trivial daily rituals, and her art was a thank-you note sent to all women around the world who sacrificed their time in the domestic realm. While many of her contemporaries considered criticizing and attacking femininity and domesticity as a way of rebelling against the socially constructed stereotypes of females, Ono took a different route and emphasized her gratefulness to her female companions and mothers. Rather than simply denying womanhood and domesticity, the artist noticed the importance of both feminine traits and the complexity behind the oppression placed upon women, just like she once said:

...I understood that was the kind of thing women were being asked to do - to just accommodate. But at the same time there's a certain dignity and courage in allowing yourself to be in that position. And that's how all women survived then.<sup>34</sup>

Indeed, featuring the dignity and courage of womanhood and motherhood, Ono's art was an authentic revelation of the contemporary feminine life.

### **3. Conclusion**

Yayoi Kusama, a Japanese artist who arrived in New York City presumably around the same time as Ono, was treated differently by the majority than was Ono. While Ono received bitter dismissals from Beatles fans and critics, Kusama was much more favored by the public. In spite of Ono's possible role in disbanding the Beatles or accelerating the process of their break-up, there are many other possibilities behind the critiques against her. Kusama's art is visually pleasing, with vivid use of colors and large or small dots that one will inevitably associate with the Japanese concept of “kawaii,” or “cuteness.” Her works can be perceived directly without struggles in understanding, for hers was mostly an art of visuals. In this way, Kusama's largely or narrowly scaled and psychedelic paintings fulfill the public's expectation of women artists, which was to be superficial, beautiful, and cute. Ono's art is almost the complete opposite of Kusama's art; her art is conceptual and

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<sup>34</sup> Andrea K. Scott, “Yoko Goes Solo,” *The New Yorker*, last modified May 18, 2015, accessed July 8, 2018, <https://www.newyorker.com/culture/culture-desk/yoko-goes-solo>.

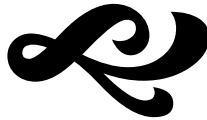


intellectual, and understanding requires much of the audience's time and effort. On the surface, Ono's art was rather mysterious and pointless, difficult to interpret and understand; yet after careful analysis, it is full of her messages, varying from the complexity in life and praises of human life, to her gratitude for other women and mothers. Although Ono emphasizes womanhood and motherhood in most of her artworks, she and her art do not fulfill the public expectation for women to be submissive, obedient and "kawaii." She is a woman artist and an independent individual who can well survive without her husbands, including Lennon. Perhaps the male dominant society was afraid that a woman could be as intelligent and strong as Ono. What Ono did was not only creating art, but also fighting against the anti-feminist social norms. Her art is more than a personification of the Fluxus art concepts, of womanhood and motherhood, but a Fluxus woman artist's rebellion against a sexist society.

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# Reducing Oncogenic Behavior of MLL Fusion Proteins by Inhibiting Combinations of Genes Necessary for Leukemia Proliferation

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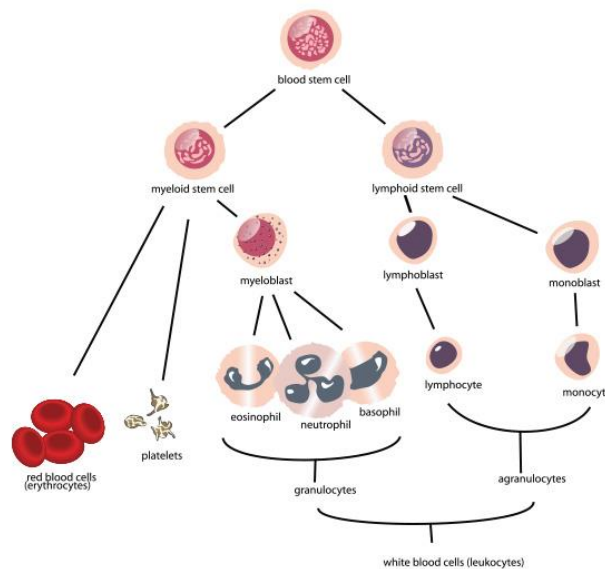
## Abstract

Mixed lineage leukemia (MLL) is an acute cancer that indicates the presence of both lymphoid and myeloid lineages in hematopoietic differentiation. MLL has a particularly poor prognosis in infants, with a “5 year event free” survival rate of 27% in patients with a primarily lymphoid lineage and 45% in patients with a primarily myeloid lineage, with particular translocations of the MLL gene with less common fusion partners to be as low as 11% (Rubnitz, Balgobind). This research paper focuses on current and past pharmaceutical interests in drug therapy to inhibit the MLL gene’s epigenetically controlled transcription, proposing further examination to both the repression of the Dot1 domain in combination with that of the SETD2 gene, and the inhibition of repressible domains on both MLL1 and MLL2 genes in order to prevent the abnormal regulation of hematopoiesis and development of mixed lineage leukemia.

## Background

Leukemia is the cancer of the blood and blood-forming organs; it begins in the blood-forming cells of the bone marrow when the DNA of these cells becomes mutated, resulting in a leukemia cell that replicates itself (Davis). While a healthy cell is able to replace itself in the bone marrow, abnormal cells continue to occupy space, overcrowding native cells and spilling out into the bloodstream. Demographically, leukemia as a whole disease affects more men than women and more Caucasians than African Americans (Mayo Clinic). However, there are several categories of Leukemia, and they are classified separately dependent on whether the leukemia is chronic, meaning most of the affected cells are mature like white blood cells, or acute, meaning most of the abnormal cells are similar to stem cells (American Society of Clinical Oncology). Acute leukemias generally

progress far more rapidly than its chronic counterpart, and has the lowest survival rates in age categories both under and over 50 years old (Stoppler). Leukemia is further classified by the bone marrow the cancer starts in—myeloid leukemia begins in the myeloid cells, which further differentiate to be white blood cells, red blood cells, or platelet-making cells, while lymphocytic leukemia begins in the lymphatic cells that become lymphocytes, a specific type of white blood cell involved in the lymphatic system (Nordqvist).



**Figure 1.** Hematopoietic stem cell differentiation showing myeloid and lymphoid lineages (Scott, et al).

## Diagnosis of Leukemia

Several tests examining the cell numbers and types in the blood and bone marrow are used to further diagnose the specific subset of leukemia in a patient. Cells are counted and sorted based on their specific surface markers. These surface markers traditionally include surface membrane immunoglobulin or receptors for erythrocytes defining either B or T lymphocytes (Thiel). However, particular monoclonal antibodies have also been developed that determine even the separate intermediate stages of white blood cell differentiation. Cloned cells of lymphoid lineage or other particular abnormal combinations of these surface level cellular makers are able to identify the subtype of leukemia (Wolach & Stone). In the case of mixed lineage leukemia, when immunophenotyping was performed with fluorescent activated cell sorting, it was frequently observed that the cell surface markers were from both the lymphoid and myeloid lineages (Wolach & Stone). In some cases, the cancer's lineage completely shifted from one lineage to another, or relapsed as the other lineage (Thiel).

### **Mixed Lineage Leukemia Background and Demographics**

Mixed-lineage leukemia, an aggressive blood cancer seen mostly in infants and children, is categorized by its “mixed lineage,” or translocation of chromosomes (Slaney). A piece of chromosome 11 forms a fusion gene with another chromosome, creating a distinct gene expression profile compared to those of patients with acute lymphoblastic leukemia (ALL) or acute myeloid leukemia (AML), the two major subtypes of acute leukemia that patients with MLL most often have (Balgobind). While expressing cell markers from more than one lineage and exhibiting characteristics from both lymphoid and myeloid cell lines, affected individuals tend to preserve characteristics indicative of a single dominant lineage (Rubnitz et al). This leukemia was first noted in acute leukemia patients, and correlates to a poorer prognosis, especially in the case of infants, who maintain a survival rate of less than 50% (Muntean and Hess). They often do not respond to standard therapies for acute leukemia and relapse at a faster rate post-chemotherapy, and cure rates remain stagnant. Translocations affecting the MLL gene at chromosome 11q23 “may be seen in as many as 80% of infants presenting with acute leukemia in the first 6 months of life” (Stoppler and Balentine). While the infant is between 6 months and 12 months of age, the frequency of MLL development from a 11q23 translocation reduces, but remains significant, overall reducing as age increases (Slany). In adult patients, MLL can be found in roughly 3% to 10% of patients diagnosed with lymphoid, indeterminate, or myeloid acute leukemias (Stoppler and Balentine). The mixed lineage leukemia gene codes for enzymes that are essential to the transcriptional and epigenetic regulation of HOX genes, fundamental to development including the differentiation of hematopoietic stem cells and their progenitor divisions (Muntean).

### **Mechanisms of Epigenetics in Mixed Lineage Leukemia**

Epigenetics, including methylation in enzymes transcribed by the MLL gene, can change which genes are transcribed and expressed based on how condensed DNA is wrapped around histones. Every human cell contains the entire genome in its nucleus, and epigenetic tags aid in controlling DNA expression, stability, and integrity, allowing the cell to differentiate and carry out its specific function (Slany). DNA methylation patterns are sustained by methyltransferase enzymes, and occur at the cytosine bases of DNA, where methyltransferases convert them to 5-methylcytosine (Philips). Methylation has also been linked to gene expression, as greater methylation in gene promoters are associated with low or blocked transcription (Philips). Another epigenetic factor, the acetylation of histones, occurs when acetyl functional groups are introduced to the amino acid lysine on the tail of the histone, and it is associated with the increase of transcription factors to DNA through structural changes (Sterner). Transcriptional epigenetic factors alone are linked together; protein complexes binding to methylated DNA also interact with those that bind to

de-acetylated histones, creating a concurrent process in which the methylation of DNA causes the deacetylation of nearby histones (Philips). Histone lysine methylation, which can negatively or positively affect gene transcription, occurs when methyl groups are transferred to amino acids that compose histone proteins and has also been closely associated with methylation (Chen). In mixed lineage leukemia, epigenetic tags and the chromatin-modifying enzyme H3 lysine methyltransferase aid in regulating HOX genes, which are highly conserved evolutionarily, and play a major role in early development and cell differentiation (Seifert, Anne, et al). The HOXA and HOXB4 clusters are directly involved in hematopoiesis and “its transition from embryonic to adult program” (Seifert, Anne, et al).

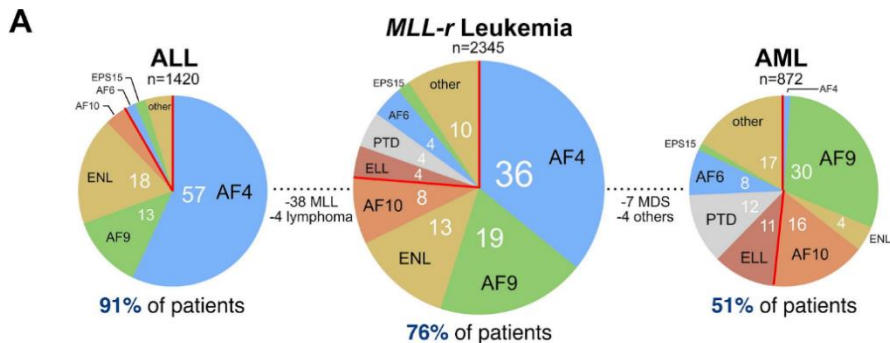
In humans, an H3K4 methylation is observed at the HOX gene cluster although it is normally confined to distinct sites. Humans have at least ten of these specific methylations, of which six (MLL1, MLL2, MLL3, MLL4, SET1A and SET1B) are both associated with the MLL family and contain the SET protein domain (Malik and Bhaumik). This SET-domain methyltransferase includes all of the proteins that are familiar to methylate histone on lysine (Dilon). The MLL family’s regulation of HOX genes is crucial, as its incorrect regulation has been linked to leukemia through the rearrangements in the MLL1 gene, also called the Lysine K Methyltransferase 2A gene, or KMT2A (Malik and Bhaumik).

Additionally, the MLL family regulates genes aside from the HOX clusters such as p27 and p18 (Milne, et al). In cases of MLL1 gene deletion, HOXA genes are misregulated, whereas deletion of MLL2 results in the loss of control over HOXB2 and HOXB5, and MLL3’s deletion results in widespread apoptosis (Malik and Bhaumik). This shows that MLL1, MLL2, and MLL3 do not have duplicate functions in gene regulation.

### **Fusion Genes in Mixed Lineage Leukemia**

The MLL gene is known for becoming a fusion gene by breaking apart incorrectly and fusing to several other genes, or fusion partners, thus causing cancerous growth through proteins that regulate target genes involved in the development of cellular blood components from stem cells incorrectly (Winters and Bernt). The disease is identified by the fusion proteins encoded by the translocations affecting 11q23 (Winters and Bernt). The gene translocation pairs the amino-terminus of the MLL histone methyltransferase with many different fusion partners that destroy the normal function of histone-modifying enzymes and replace it with irregular behavior and gene regulation influenced by the fusion partner (Daigle, et al). In most instances, the wildtype methyltransferase domain is replaced with genetic sequences originating from AF4, AF9, AF10, and ENL, which possess intrinsic regulatory function within the nucleus and enable atypical involvement of molecular transcription machinery to target MLL genes (Liedtke and Cleary). The remaining 59 fusion partners were identified mainly in individual patients (Daigle, et al).

The resulting fusion proteins coded by these rearranged genes are abnormal transcriptional regulators that gain control over the wildtype MLL gene's regulatory targets, including the HOX homeobox genes. Since these fusion partners do not share a similar structure when looking at the proteins, it can be concluded that the different properties of regulation are provided by the fusion partners themselves (Marschalek). Overall, regardless of the MLL rearrangement and fusion partner, a disruption of the MLL protein is seen in a region preventing protein-protein interaction (Marschalek).



**Figure 2.** Fusion partners for MLL leukemia gene in patients with MLL-rearranged leukemia, ALL leukemia, and AML leukemia (Steinhilber and Marschalek). Some of the most common fusion partners include MLL-AF4, AF9, ENL and AF10; these fusion partners are combinations of either X-MLL (reciprocal alleles), or MLL-X alleles. These multiple and completely different fusion alleles manifest as the same leukemia phenotypes, ALL, AML, and MLL leukemia.

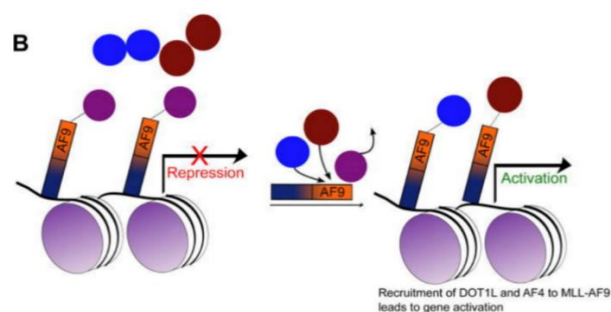
## Treatments

Standard treatments for MLL include chemotherapy cocktails dependant on the classifications of the patient's leukemia. Patients with mixed lineage leukemia are treated with chemotherapy drugs for acute lymphoid or myeloid leukemia, usually depending on which lineage they express more dominantly (National Cancer Institute). For acute myeloid leukemia, a drug cocktail by the name of ADE is the only drug combination listed in approved drugs from the FDA And National Cancer Institute that is currently being used (National Cancer Institute). It contains the chemicals Cytarabine, Daunorubicin Hydrochloride, and Etoposide Phosphate, and cocktails for acute lymphoid leukemia contain similar drugs (National Cancer Institute). However, these chemotherapy treatments are targeted towards acute leukemias, and often stop working for patients with MLL, as the cell lineages are a mixture of both myeloid and lymphoid, and are variable to change during treatment (Muntean). Furthermore, they decrease the patient's quality of life and have attached risks such as tumor lysis syndrome, in which intracellular contents are discharged into the bloodstream, creating high levels of uric acid, blood urea nitrogen, potassium, and

phosphorus (Namendys-Silva, et al). This leaves the only treatment option that is currently used to be allogeneic transplantation of hematopoietic stem cells, which replaces cancerous bone marrow with healthy blood-producing bone marrow. With its high fatality rate in infants and lack of stable treatments, there is an urgency for targeted drug therapy that have the ability to inhibit specific vulnerabilities, or repressible domains, in leukemia cells. With the repression of these cells, the epigenetic changes that occur on behalf of the mutated chromatin-modifying enzymes to parts of the genome regulated by the MLL gene can be stopped along with the impairment of cancer cells.

### Previous Drug Therapies Repressing the SET Domain and Dot1

The protein encoded by the MLL gene has several “conserved functional domains,” including the SET domain, which is engaged in methyltransferase activity and capable of modifying chromatin in a manner associated with epigenetic transcriptional regulation (Human Gene Database). The MLL gene has many such repressible domains, including “DNA binding AT hooks, a cysteine rich CXXC domain with homology to DNA methyltransferases, plant homeodomain (PHD) finger motifs, a Bromo domain (BD), a transactivation domain (TAD), a nuclear receptor interaction motif (NR box), a WDR5 interaction or *Win* motif, and a C-terminal SET domain” (Cosgrove). In the past, researchers have focused their efforts towards developing drug therapies that inhibit methyltransferase activity through the SET domain, a repressible domain on the multiprotein complex that engages in epigenetic regulation, which the MLL fusion gene codes for (Winters and Bernt). The SET domain includes all but one protein involved in the methylation of histones on lysine, and the exception is Dot1, which then shifted focus onto the Dot1 family.



**Figure 3.** Seen in the molecular interactions between Dot1 protein (blue circles)/AF4 (red circles) and the MLL-AF9 gene, the default state of repression is changed to activation, ultimately leading to the epigenetic activation of other genes through methylation (Ballabio and Milne).

The Dot1 protein, or histone H3K9 methyltransferase, shows promise of inhibition through drug therapy as it interacts with several of the MLL gene’s fusion partners



(Cosgrove). Derivations from AF4, AF9, AF10, and ENL fusion partners have been found to have interactions with Dot1 through complexes promoting transcriptional elongation, by phosphorylating the repeat carboxyl-terminal of RNA Polymerase II (Chang, et al). Dot1 was originally identified as a potential target because it disrupted the process of telomere silencing and has been heavily conserved evolutionarily, suggesting its crucial role in chromatin and gene regulation (Marschalek). In one study, the inactivation of the Dot1 domain was examined in hematopoietic cells in which different MLL oncoproteins were inserted with a vector (Chang, et al). As the MLL gene possesses numerous fusion partners in a mutation rearrangement that determine a significant portion of functional properties, the three major classes (fusion partners from cytoplasm containing dimerization domains, fusion partners with bonafide transcription factors and coactivators, and proteins that enable the P-TEFb elongation complex) were all examined when considering oncogenes to immortalize cells and test the inhibition of Dot1 (Chang, et al). In MLL-AF9-immortalized cells, the loss of Dot1 had a significant decrease in viable cancer cell colonies (Chang et al).

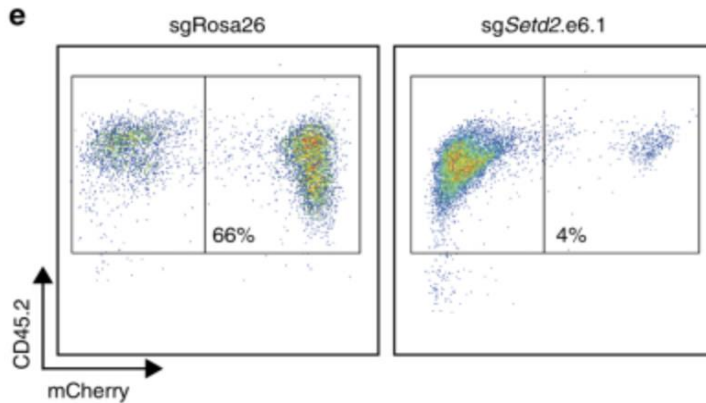
Dot1 ablation also removes histone H3 lysine 79 methylation, a chromatin-modifying enzyme that functions as a regulator of normal gene expression in humans that is involved in the immortalization of cancer cells in the bone marrow from translocations of the gene; the loss of Dot1 also triggered apoptosis in MLL-AF9, MLL-GAS7, and MLL-AFX (Chang, et al). As observed, histone methyltransferase Dot1 is required for the initial development and maintenance of cancer cells caused by a rearrangement in the MLL gene, according to genetic and molecule inhibitor studies observed in cell lines and biochemical enzyme inhibition assays, driving clinical studies inhibiting Dot1.

In one particular phase-one clinical study where Pinometostat, a Dot1 inhibitor developed by Epizyme, was used in accordance with multi-agent chemotherapy in pediatric patients, it was concluded that “pinometostat has an acceptable safety profile” and pharmacodynamic studies showed that Dot1 inhibition was observed in leukemic blasts (Shukla and Wetmore, et al). In about 40% of patients, transient reductions in bone marrow leukemic blasts was observed, but these reductions were not stable nor significant enough to pursue an immediate treatment in MLL patients; however, further studies involving the Dot1 inhibitor were validated (Shukla and Wetmore, et al). In trials with adults, the clinical activity of Pinometostat were categorized as “modest” (Stein et al).

### **SETD2 and Dot1 Inhibition**

While Dot1 inhibitors may not show promise on their own, their inhibition in conjunction with SETD2 may show stronger results. Through the examination of the protein-protein interactions between “seven distantly related MLL-fusion proteins,” a lysine methyltransferase by the name of SETD2 has been identified through functional investigation as having a specific role across the examined fusions (Skucha, et al). While certain molecular pathways have been understood, consistent mechanisms in all

MLL-fusions have not had a focus so far. Several studies have identified a relationship between the fusion partner's molecular function and the mechanics of the formation of leukemia; factors that have a role in the oncogenic properties include epigenetic modulators, signaling proteins, transcription factors, and the wildtype MLL protein (Slany, Skucha, et al). The SETD2 gene is involved in the differentiation of acute myeloid leukemia cells and resists senescence, or deterioration by age, which can cause additional DNA damage (Skucha, et al).



**Figure 4.** The methyltransferase activity of SETD2 is necessary for the full oncogenic effects of MLL-leukemia. In this graph of flow cytometry plots, mCherry (red fluorescent protein) is plotted against the anti-mouse CD45.2 antibody in cells expressing a control synthetic RNA, sgRosa26, and cells expressing mutations in the SETD2 domain. The control showed a significant contribution to MLL-leukemia in vivo, whereas the expression of SETD2-mutated genes in cells that developed MLL-leukemia was much lower, at 4% (Skucha, et al). The takeaway is that SETD2 expression is essential to the development of MLL-leukemia, and inhibiting or knocking out SETD2 will show similar reductions of leukemia in cells in-vivo.

Its expression was higher in acute myeloid leukemia samples compared to normal hematopoietic stem cells, progenitor stem cells, and myeloid cells (Skucha, et al). In human AML cell samples from patients, a strong decrease in cancerous cells was observed with MLL-AF9 and MLL-LASP fusion genes with the inhibition of SETD2; thus, SETD2 is strongly suggested as a requirement for the oncogenic growth of MLL-fusion proteins, and the inhibition of the SETD2 gene can result in DNA damage and senescence in leukemia cells (Skucha, et al).

Layering the studies of leukemia cell proliferation requiring both Dot1 H3K79 methyltransferase and SETD2, it was found that the inhibition of both proteins were cooperative. The loss of SETD2 resulted in hypersensitivity to the Dot1 inhibitor, causing DNA damage in addition to an impairment in the chromatin binding of MLL-fusion proteins (Skucha, et al). Altogether, the loss of SETD2 combined with the inhibition of the

methyltransferase Dot1 through drug therapy results in “DNA damage, growth arrest, differentiation, and apoptosis,” demonstrating a dependence on SETD2 in the development of mixed lineage leukemia and greater promise in inhibiting both of these proteins together (Skucha, et al).

### **Targeting the MLL2 Gene Instead of the MLL1 Gene**

The cancers that develop as a result of MLL gene translocations have encouraged drug therapy, although previous protein domain inhibitors have struggled to show meaningful clinical results. A pivotal 2017 study using mouse models has examined target genes to inhibit as a whole, and has concluded that MLL2, not MLL1, is the more pertinent target (University of Colorado Anschutz Medical Campus). The MLL1 and MLL2 genes are both involved in the epigenetic regulation of the HOX genes, among others, and both code for lysine methyltransferases. The MLL2 gene is the “closest paralog,” or a gene related by duplication to the MLL1 gene, although paralogs may have their own function through evolution (Mouse Genome Database). The MLL2 gene serves as an instruction base for lysine-specific methyltransferase 2D enzyme, which is found in several tissues and organs (Colorado Anschutz Medical Campus).

In a 2017 study, researchers compared leukemia induced in a mouse model with an MLL1-knockout genome to leukemia in the model with its genome intact and found no differences in the cancer’s development despite the loss of the MLL1 gene. In the comparison of the regular genome to a model with MLL2 knocked out, a 40% reduction was seen in the development of leukemia in mice with the missing MLL2 gene, implying that the protein complexes encoded by MLL2 were crucial for the development of mixed lineage leukemia (Chen, et al). More interestingly, when both MLL1 and MLL2 genes were knocked out together, there was a 90% reduction in leukemia in the mouse models, signifying interconnected general pathways of gene expression in the MLL-fusion gene protein complexes (Chen, et al). It was found that in solely MLL2 knockout, 177 genes were deregulated, whereas when both genes were knocked out, a total of 444 genes were deregulated, stopping the development of mixed lineage leukemia (Colorado Anschutz Medical Campus). The conclusion that MLL2, and not MLL1, is more appropriate to use as a target for drug therapy and killing cancer cells, a shift of perspective from the focus of drug research into the MLL gene as a result of the lack of demonstrated clinical benefit; in addition, MLL2 has a smaller role in adult gene expression and development, alluding to fewer risks compared to inhibiting MLL1 (Colorado Anschutz Medical Campus).

Adding onto this interconnectivity, in many instances, when one allele has a mutation or forms a fusion gene, the MLL gene’s remaining wildtype allele is retained, and contributes to the development of leukemia through the regulation of genes, although the extent to which this occurs is not definable (Rao). Research has shown that in the formation of a fusion gene, there are times at which only one of the two copies of the gene is altered,

and wildtype MLL genes were working with the fusion genes to cause cancer (Chen, et al). However, with MLL2 deletion, the MLL-AF9 fusion transformed cells had a lower survival rate, even more so when the original MLL gene was deleted, as each protein is regulating separate pathways at some point, suggesting that the inhibition of MLL2 is more important in drug therapy, especially when paired with the suppression of MLL (Chen, et al).

## **Conclusion**

Mixed lineage leukemia is known for its poor prognosis rates, some as low as 11% in infants and increasing with age. New combinations and types of targeted drug therapy must be developed to reduce rates of leukemia development due to epigenetic regulation. In the case of rearrangements or fusion genes in the MLL1 gene, the fusion-protein complex that is encoded by the MLL gene goes on to influence gene transcription modification of chromatin through its binding to target promoters, altering chromatin signatures through DNA methylation and histone acetylation. The regulation of target HOX genes involved in the development of the blood's cellular components, or hematopoiesis, causes cancerous growth that results in mixed-lineage leukemia. T In the past, drug-therapy has aimed at repressing protein domains on the MLL1 gene to keep chromatin-modifying enzymes from being produced, although these inhibitors have shown little promise in isolated clinical trials. After the comparison of knocking out MLL and MLL2 genes in mouse models in a pivotal experiment, scientists' next steps should be to apply past domain-repressing techniques to the MLL2 gene.

Consequently, a greater focus must be applied to the research of drug therapy that can inhibit protein complexes and gene regulators from the MLL2 gene, even though the this gene as a whole seems to have a smaller function in the body compared to the MLL gene's involvement in the hematopoietic stem cells of bone marrow. It is clear that both multiprotein complex transcription factors encoded by MLL and MLL2 genes must be inhibited in concurrence. In regards to the MLL1 gene, deletion of SETD2 and using Dot1 inhibitor molecules together creates damage to DNA and chromatin binding functionalities of MLL-fusion proteins, which disallows the leukemia-causing epigenetic regulation of genes by the methyltransferases and growth of cancer. If these therapeutic targets are inhibited in addition to the repression of protein domains in the MLL2 gene such as the SET domain, the combination of both MLL1 and MLL2 protein complexes deregulating HOX and other genes that lead to the development of leukemia may reduce leukemia in similar ratios compared to the knockout-genome mouse models, a significant improvement to current survival rates.

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## How do Perturbation-Based Interventions Help Reactive Balance Control in Stroke Survivors?

Abigail Romero

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### **Abstract**

Thus far, no single systematic review as comprehensively both novel and traditional therapy methods. In addition, no study has jointly looked at the mechanisms within the central and peripheral nervous systems that explore why rehabilitation interventions may be effective in increasing reactive balance in those who have suffered from stroke. This extensive search of the current scientific literature aims at providing an insight into these two gaps literature. Foremost, a thorough review was conducted to determine which physical interventions or perhaps series of exercises yields the greatest increase in reactive balance. Equally as important, this study looked into understanding the factors behind what makes rehabilitation interventions effective from a neurologic and physiologic standpoint in order to better design future exercises for the post-stroke demographic. Mechanisms involving the CNS and peripheral nervous system (PNS) dx will also be studied to understand the efficacy of exercises that succeed in producing an increase in reactive balance.

The research question that was posed in this extensive review of the literature was: How do perturbation-based interventions help reactive balance control in stroke survivors? This review proposes that perturbation-based interventions take advantage of the neuroplasticity of certain areas in the central nervous system, such as the right cerebral hemisphere for the majority of individuals, and the SMA. Most perturbation-based interventions were administered within a period of six weeks, and progress was assessed up to a year after discharge. The repetitive nature of the sessions led to learned fall-prevention strategies in patients, as well as an indication that CNS mechanisms may have been changed as a result of these interventions. It can also be inferred that much like isokinetic

strength training, the repeated sessions (including booster sessions) of PBT may have led to some strengthening of the lower limbs, although this is yet to be founded by literature.

## **1. Introduction**

A stroke, or cerebrovascular accident (CVA), is a phenomenon within the central nervous system that occurs when neurons become oxygen-starved, resulting in the death of cells. The two primary variants of a stroke are ischemic and hemorrhagic. An ischemic stroke occurs when the blood supply to certain parts of the brain are impeded due to blockage, causally leading to necrosis. In a hemorrhagic stroke, a blood cell is ruptured causing excessive bleeding in the surrounding brain tissue, in turn generating pressure and swelling to the extent of cell death. Both types of stroke can become fatal, with the ischemic stroke being the more prevalent of the two, accounting for strokes in 87% of the cases (National Stroke Association). In the United States alone, close to 800,000 people are affected by stroke (Quanhe et. al. 2017), and globally, 15 million suffer from stroke, of which 10 million either die or face permanent disability (The Internet Stroke Center). Although in recent years, stroke death rates have been on the decline (Quanhe et. al., 2017), stroke still remains the fifth leading cause of death in Americans, and the first leading cause of disability (American Stroke Association), costing the United States \$34 billion per annum (Centers for Disease Control and Prevention).

Due to the damaging nature of stroke, many who have suffered from one also suffer from long-term disability. This can include muscle weakness, paralysis, memory loss, and vision impairment. People post-stroke tend to suffer from motor changes, resulting in problems with ambulation, a higher risk of falls, and especially a reduction in balance capabilities (American Stroke Association). This higher risk of falls, and reduced ability to recover from them, contributes to falls being a large cause in further disability in the stroke population (Salot et. al., 2016). A number of studies have examined reactive balance, or automatic balance responses to perturbations, and how this aspect of balance can be improved in the post-stroke population through interventive exercise. Reactive balance is a key component in the mechanisms surrounding how stroke survivors react to falls. Much of the research surrounding balance, namely that of reactive balance and interventions specific to improving reactive balance, employ external perturbations via a moving platform or treadmill-type device intended to mimic unexpected perturbation. To give a brief overview, a review of the literature will be conducted in order to further examine the benefits of perturbation-based exercises compared to traditional exercise in the post-stroke population.

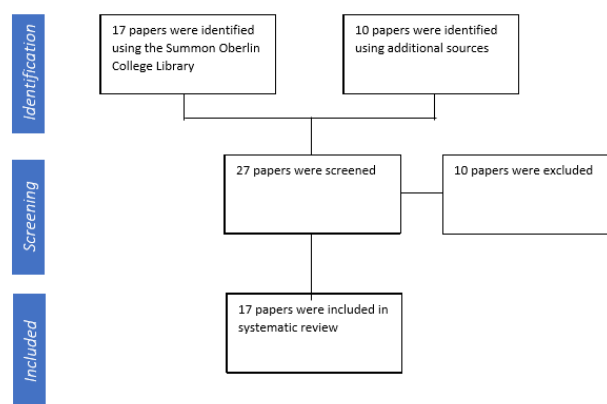
Thus far, no single systematic review has comprehensively studied the efficacy of perturbation-based exercises compared to both novel and traditional therapy methods. In addition, no study has jointly looked at the mechanisms within the central and peripheral nervous systems that understand why interventive exercise may be effective in increasing

reactive balance in those who have suffered from stroke. This extensive search of the current scientific literature aims at providing an insight into these two gaps in the literature. Foremost, a thorough review will be conducted to determine which interventive exercise or perhaps series of exercises yields the greatest increase in reactive balance. Equally as important, this study will also look into understanding the factors behind what makes interventive exercise effective from a neurologic and physiologic standpoint in order to better design future exercises for the post-stroke demographic. Mechanisms involving the CNS and peripheral nervous system (PNS) will also be studied to understand the efficacy of exercises that succeed in producing an increase in reactive balance.

The findings of this study would provide a benchmark for which interventions are most capable of increasing automatic balance responses, as well as a better understanding of the neurologic and physiologic mechanisms that allow for this increase. This, in turn, could have significant clinical and research implications, in that clinicians could design more comprehensive programs post-stroke that could combat falls. In reference to future studies, researchers could better recognize on another level why such exercises are proven effective, and thus theorize and study more effective interventive exercise methods. In addition, by understanding the underlying mechanisms causing an increase in reactive balance, researchers would have a new measures and biomarkers, or objective measurements from neuroimaging indicative of change, from which to test for the efficacy of future exercises.

## 2. Methods

Relevant studies for this systematic review were primarily selected using the Summon Oberlin College Library. An advanced search was conducted, with the term “balance,” and “stroke,” in the title, and “perturbation” in the abstract. Publication dates were limited to the



*Figure 1. A summary of the search strategy employed*

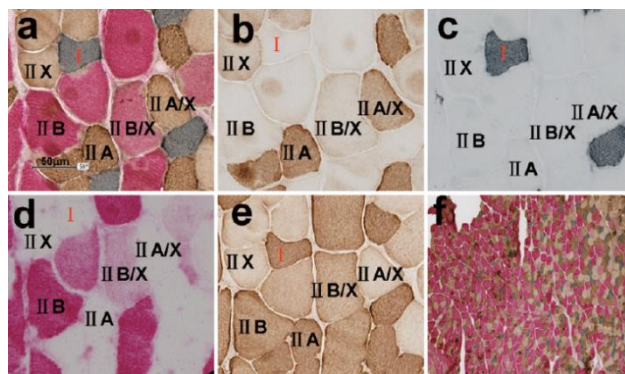
last 5 years from the date 8/25/2018. Exclusionary factors included a limitation to content types of “Journal / eJournal,” and “Journal Article,” which fell into the disciplines of “anatomy & physiology,” “applied sciences,” “biology,” “medicine,” “occupational therapy & rehabilitation,” “physical therapy,” in the English language. The papers selected were also limited to peer reviewed publications, which excluded newspaper articles, book reviews, and dissertations. Seventeen papers were returned as a result of this search, of which seven were used in this review. These papers were selected based on their focus to PBT and balance, which was determined by a reading of the abstract. Additional papers to be included were identified via the references of these papers, a Google search (when specific papers could not be found on the Summon Oberlin College Library database) for published reliable papers relevant to the research topic, and on recommendation of a mentor. Seventeen papers total were included.

### 3. Factors that Contribute to a Deficit in Balance Control

Several factors that contribute to a deficit in balance control into a changed morphology in muscle fiber types and biomechanical factors related to falls.

#### 3.1 Changed Morphology in Muscle Fiber Types

Failures in reactive balance, and causes of falls in stroke survivors, are many. For example, in individuals post-stroke, muscle fiber type drastically changes. Muscle types can be classified according to metabolic enzyme activity, dependent on the aerobic-oxidative and anaerobic-glycolytic enzymes.



**Figure 2.** Histochemical staining on a cross section of a normal tibialis anterior muscle detailing different muscle fiber types. Lighter-stained fibers are fast-twitch type I muscle fibers, whereas darker-stained fibers are slow-twitch type II muscle fibers. a) triple immunoenzyme staining (TIE) at 20x magnification; b) a BA-F8 (antibody) stain; c) a BF-F3 (antibody) stain; d) a BF-F35 stain; e) is a BF-F35 stain at 20x magnification; f) TIE staining at 5x magnification. (Source: Wu et. al., 2017)

Two main muscle fiber types have arisen from this classification, including slow-twitch type I muscle fibers, and fast-twitch type II muscle fibers, which can be further subdivided into more aerobic and anaerobic fibers (Holzer et. al. 2005). Mechanically speaking, type I muscle fibers are better equipped for endurance-type activity, whereas type II muscle fibers are important to muscular activities that demand short bursts of force. Histochemically, muscle fibers can also be stained and classified methodically, with slow-twitch fibers staining darker, and fast-twitch fibers staining lighter.

In stroke survivors, changes in muscle fiber types includes an atrophy of type II or “fast-twitch” fibers, and a hypertrophy of the slower-acting type I fibers. This is of particular note because although atrophy of fast-twitch muscles may not be reversible, the increased hypertrophy of type I muscle fibers can be achieved through strengthening exercise (Arene et. Al. 2009). This could also, in turn, lead to an increase in muscle force, or the amount of power a muscle is able to exert at a single time, and an improved ability to ambulate. Strengthening interventions help stimulate the hypertrophy of type I muscle fibers. Changing the morphology of the muscles in this way contributes to greater control over the limb, in turn contributing to greater reactive balance over time.

### **3.2 Biomechanical Factors Related to Falls**

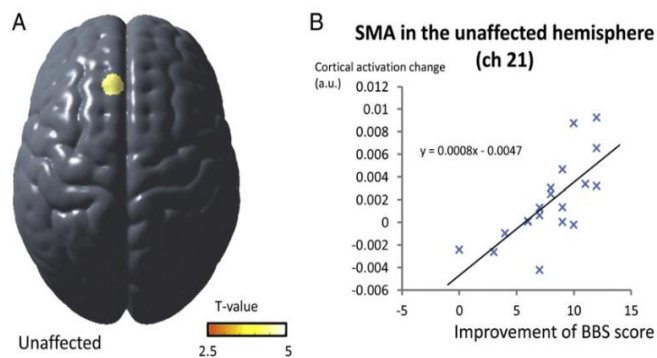
In addition to a changed muscle morphology, stroke survivors also conduct different strategies, or deficits in these strategies, when experiencing perturbations. This includes a larger number of compensatory steps, a delay in the initiation of a step, as well as an underestimation of step length (Salot 2015). In addition, stabilizing balance using a single step proves more difficult in individuals’ post-stroke, especially in the paretic leg, which often exhibits motor impairment (Martinez et. al., 2013). These deficits, in part, have been shown to be rectified by performing training on a moving platform (Mansfield et. al. 2010). A recent study has also shown how impairment in early automatic postural response (APR) was linked to poor reactive stepping (Kam et. al. 2017). The same study details how side steps by the paretic limb are dependent on rapid response by the hip abductor. There exists evidence which suggests that people with stroke, early APRs, as well as reactive stepping mechanisms, can be improved with perturbation-based exercise. In a cross-sectional study by Salot et. al. (2015), biomechanical factors in stroke survivors which contributed to a loss of balance and greater fall risk were identified as decreased postural stability, lack of sufficient limb support, and poor compensatory steps. Also important, muscle firing deficits exist in stroke survivors, which impede reactive stepping mechanisms. A loss of connection between motor fibers and motor neurons leads to a lessened number of functioning motor units, in turn leading to a failure in reactive stepping which can become essential to a retention of balance during larger perturbations(Arene et. al., 2009) (Miller et. al., 2014). In addition, decreased ability to retain an individual’s center of mass (CoM) within their base of support (BoS) is characteristic of a reduced dynamic balance (Miller et. al., 2014).

#### 4. Central Nervous System Mechanisms Involved in Balance Function

Two central nervous system areas, whose mechanisms are involved in balance function are the supplementary motor area, and the right cerebral hemisphere.

##### 4.1 The Supplementary Motor Area

In a study by Fujimoto et. al. (2014) examining cortical changes in survivors of hemiplegic stroke, it was found that the supplementary motor area (SMA) plays an important role in balance recovery after stroke. The SMA, located anteriorly to the primary motor cortex, has been theorized to be involved in the sequential organization of muscle activation. Longitudinal cortical activation in the SMA saw an increase in both the affected and unaffected hemispheres after therapy. In addition, the presence of oxygenated hemoglobin signals in the SMA of the unaffected hemisphere was also linked to increased balance function. These findings suggest that the SMA may play an important role in balance recovery after stroke. This study also proposes a clinical application of the Functional Near-Infrared Spectroscopy (fNIRS) scan, which was used to determine cortical activations. The conclusion that the SMA is involved with balance recovery foundationally serves as evidence for viable neuromodulation therapy in the future.



**Figure 3.** Balance recovery and cortical activation changes in the SMA exhibit significant correlations. A) Cortical activation changes, due to perturbation, correlated with an individual's balance function B) Analysis between cortical activation change and berg balance scale (BBS) score. (Source: Fujimoto et. al., 2014)

##### 4.2 Right Hemisphere Specialization for Balance Control

There is a consensus among the literature that the right cerebral hemisphere has a specialization towards balance control, especially for right dominant persons. Sainburg (2014) was one of the first to propose that the right hemisphere is specialized in impedance control. Further studies based on his model indicate that in healthy test subjects, impedance mechanisms accounted for the left or nondominant arm movements. Similar studies have

found consistent findings in those with unilateral brain damage. A recent study conducted by Fernandes et. al. (2018) aimed to find right cerebral hemisphere specialization in both quiet and perturbed balance control, using unilateral stroke patients. In the study, a poorer control of balance was attributed to those who had suffered stroke in the right hemisphere, in comparison to not only healthy subjects, but also subjects who had suffered similar damage in the left hemisphere due to unilateral stroke.

It is of note that such mechanisms and their functions, inclusive of those present in the SMA and right cerebral hemisphere, can become strengthened and redirected through interventions.

## **5. Interventions**

Both perturbation-based balance training (PBT) and isokinetic strength training (coupled with balance training) are interventions which have been present in the literature and have correlated with increased balance control in participants who have undergone such interventions. Typically, physical therapy interventions do include some type of walking exercise, which may include difficulties such as stepping over obstacles, which is similar to PBT in that it also induces external perturbation onto the patient. In addition, some physical therapists may already include isokinetic strength training in a patient's exercise routine in order to increase strength in lower limbs. In this systematic review, PBT and isokinetic strength training will be reviewed in their ability to improve reactive balance specifically.

### **5.1 Perturbation-Based Balance Training (PBT)**

In a preliminary study, conducted by Mansfield et. al. (2017), subacute stroke patients performed PBT training, and their self-reported fall count was compared to that of a control group who did not undergo PBT training. Results showed that PBT participants reported 0.84 falls per person-year, whereas those in the control group reported 2.0 falls per person-year. Thus, PBT training seems to have some effect on decreasing number of falls in stroke victims. Future iterations of this study include a randomized controlled trial conducted by Mansfield et. al. (2018). The study included a look into the efficacy of perturbation-based balance training (PBT), with a focus on increasing instability responses, which was measured against conventional balance training, focusing on stability in functional tasks. Participants wore a safety harness at all times. Both internal perturbations, including kicking a soccer ball against a wall, and external perturbations, such as a push from the physical therapist. It was found that although PBT was not effective at reducing fall rates in the entirety of the study participants, those who had participated in PBT saw improvements in both balance and mobility and were able to conserve their improvements

over the span of a year. Thus, PBT may be viable in its application of future clinical practice focused on improvements in reactive balance.

## **5.2 Isokinetic Strength Training**

As stated earlier, use of strength training exercises is seen to increase hypertrophy in type I muscle fibers, in turn increasing muscle strength and balance. Sekhar et. al. (2013) sought to investigate the efficacy of isokinetic strength training in stroke survivors, particularly in the lower limb. In this randomized control study, two experimental groups, one performing isokinetic strength training and balance exercises, and a control group receiving conventional exercise, were compared. Individuals who received both strength training and balance exercises showed improved strength of lower limbs, as well as improved balance.

## **6. Balance Outcome Measures**

Balance outcome measures are an integral part of any study which hopes to measure balance in some capacity. These outcome measures are systematic way of quantifying the range of balance in a patient. This provides a standard way to assess a patient baseline ability, as well as any progress which may be exhibited throughout the duration of a program. Because balance outcome measures lead to a quantitative representation of an individual's balance performance, either a progress or digress in performance is objectively identified. Thus, clinically significant changes can be assessed in this manner.

### **6.1 Berg Balance Cscale (BBS)**

The BBS is an outcome measure used to assess static balance. It requires individuals to complete 14 balance items, ranging from simpler tasks such as sitting unsupported, more difficult tasks such as retrieving objects from the floor.

Studies, including one conducted by Sekhar et. al. (2013), employed the Berg balance scale to measure balance.

### **6.2 Mini-Balance Evaluation Systems Test (mini-BEST)**

The mini-BEST assesses four subscales related to balance, including anticipatory balance, reactive postural control, sensory orientation, and dynamic gait. Like the BBS, the mini-BEST requires individuals to complete 14 balance items, but unlike the BBS, the mini-BEST's balance items have a slightly higher difficulty.



### **6.3 Timed Up & Go (TUG)**

In the TUG, patients are required to sit completely back in an arm chair and stand up and walk using a normal pace to an area marked 3 meters away from the chair, turn, walk back to the chair, and sit down again. The TUG attempts to assess an individual's static and dynamic balance.

## **7. Secondary Outcome Measures**

Some research teams may opt to include secondary outcome measures. This is done in order to provide measurements on parameters other than those measured primarily (in this case balance). This provides researchers with a more holistic portrait of the effectiveness of interventions in other terms and parameters.

### **7.1 Rate of Falls**

Rate of falls is defined as the amount of times a person makes unintended contact with the ground within a specific frame of time, usually measured in falls per person-year. In many studies, falls were for the most part, self-reported.

In the 2018 Mansfield et. al. study, a primary outcome measure was the occurrence of falls reported a year succeeding PBT interventions. Falls were self-recorded on a calendar by the study participants. Falls were confirmed by the researchers over a telephone questionnaire designed to determine the causes and conditions surrounding the event.

### **7.2 Physical Activity Scale for Individuals with Physical Disabilities (PASIPD)**

The PASIPD is a 13-item physical activity questionnaire used to assess an individual's physical abilities. This measure takes into account the amount of physical activity an individual undergoes a week, which is translated into an average daily that is multiplied by a metabolic value, and summed over different items.

### **7.3 Subjective Index of Physical and Social Outcome (SIPSO)**

The SIPSO is a 10-item questionnaire that measures social integration in people post stroke. Each question is scored on a scale from 0-4, with the maximum amount of points awarded being 40.

## **8. Limitations and Recommendations**

### **8.1 Drawbacks of Previous Studies**

Some limitations seen in the studies reviewed include the sample population, which in cases such as in Mansfield et. al. (2015), were relatively high-functioning, and in Salot et. al. (2015), were suffering from chronic stroke, thus findings could not be generalized to wider stroke-population. In addition, the method to report falls included self-reporting. Although this was considered the best way to collect data of the sort, self-reports may have been subject to participant bias or subjectivity on part of the participants on what may be considered a fall.

### **8.2 Insight into Future Research Expansion**

Thus far, no single literature review has exhaustively outlined the changed central nervous mechanisms which affect stroke survivors. This review has looked at the role of the right cerebral hemisphere and the supplementary motor area, and their effect on balance, which can be extended to their contributing mechanisms in deficit in balance control. It would be interesting to see how these two areas interact in people post-stroke, as well as how other areas of the brain, such as the primary motor cortex (which was previously believed to be the predominant center of balance in the CNS), or the cerebellum, contribute to balance function in this same population. Furthermore, a recent study that comprehensively outlines SMA cortical activation and/or right cerebral hemisphere activity in people prior to stroke compared to SMA cortical activation and/or right cerebral hemisphere in people post stroke after PBT, to the knowledge of this review, has not been conducted. A study that includes this may provide additional evidence for SMA relevance in balance control, as well as a new avenue of viewing balance improvements through cortical activations captured via neuroimaging techniques.

Also investigated in this review was the effectiveness of isokinetic strength training, which has been seen to be implemented primarily in lower limb muscles. Perhaps future studies can investigate the effect of this strength training on specific antagonists and agonists, such as the quadriceps and hamstrings, or on muscle groups not in the lower limbs (such as in the arm). This may be relevant because some studies have also pointed to the importance of grasping in fall-prevention strategies. In addition, future studies can look into the effectiveness of an intervention program that includes primarily PBT, but also isokinetic strength training, and how these interventions may, as some literature suggests, or may not contribute to improvements in a patient's reactive balance.

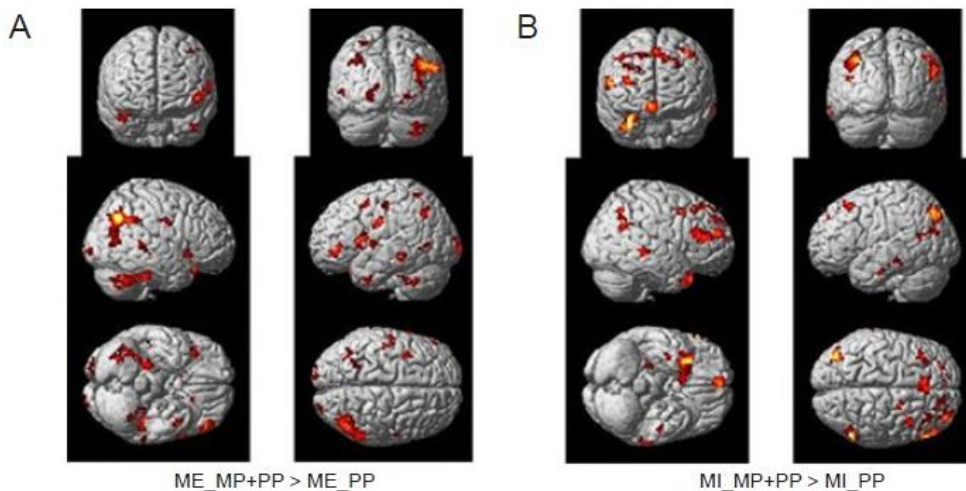
## 9. Conclusion

A thorough review of the scientific literature has revealed that PBT remains as one of the most effective intervention programs in people post stroke. In various studies conducted by Mansfield et. al. (2010, 2017, 2018), PBT as an intervention has been refined. Mansfield et. al. (2018) demonstrates the efficacy of PBT in improving and retaining reactive balance control when measured against a control group. A study by Bhatt et. al. (2012) also found that after a single session of “fall-resistance training,” motor memory of fall strategies was retained for 6 months. A literature meta-analysis by Mansfield et. al. (2015) discovered that individuals who had participated in PBT experienced a lower fall risk when compared to control groups. A lower risk of falls may translate into an increase in reactive balance post PBT interventions. This is significant given that falls are the leading cause of death and injury in older people, especially in those suffering from physical or neurologic disabilities which impair effective responses to falls.

Other interventions were also examined for improvement in reactive balance, including conventional interventions typically found in the control group of most studies, and isokinetic strength training. In virtually all cases, the experimental group (receiving PBT or isokinetic strength training) outperformed the control group in outcome measure scores. Although PBT has been proven efficacious in improving reactive balance in individuals post stroke, an implementation of isokinetic strength training as a supplement to existing PBT programs can be advantageous. This is because PBT focuses, for the most part, on training reactive stepping and reactive balance, whereas isokinetic strength training focuses on strengthening lower limb muscles. It is known that stroke survivors suffer from an atrophy of type II muscle fibers, thus by undergoing exercises that lend to type I muscle fiber hypertrophy, an increase in strength of the lower limbs can lend itself to greater ability in reactive balance. The data supports this assertion, showing that patients who underwent isokinetic strength training, coupled with balance exercises, saw an improvement in strength and balance (Sekhar et. al., 2013). An advantage of both PBT and isokinetic strength training is that they require little training to conduct and would be relatively easy to implement with resources already present in many physical therapy centers.

Those who suffer from stroke see changes in not only muscle morphology, but also central nervous system mechanisms. Some literature suggests right cerebral hemisphere specialization for balance control. As previously explained, right-dominant individuals who are victims of unilateral stroke in the right cerebral hemisphere see a pronounced deficit in balance ability when compared to a healthy control group and those those who suffer from left cerebral hemisphere lesions. Simply, lesions to the right cerebral hemisphere contribute to deficits in balance, which becomes especially detrimental to stroke survivors. In a study by Liu et al (2015), groups which received neurorehabilitation, comprised of both “mental practice” and “physical practice” saw an increased activation intensity in the right cerebral hemisphere, and the SMA, when compared to a control group.

Also crucial to balance function is the SMA. Neuroimaging demonstrates that in stroke survivors who have undergone intervention show significant activation in the SMA, which was linked to increased balance control. Changes in the right cerebral hemisphere and the SMA suggest that changes in people post-stroke occur on a level deeper than just neuromuscular or morphologic deficits in the lower limbs; such changes can be also attributed to changes in the central nervous system. Findings also suggest a high level of plasticity in both the right cerebral hemisphere and the SMA. Future research will be needed into this field to establish this as true, which may lead to new intervention techniques that incorporate neuromodulation therapy.



**Figure 4.** “Average brain activation maps derived from the comparison of motor execution (ME) and motor imagery (MI) between groups (post-training) and within groups (post-training minus pre-training). Clusters with significant differences were overlapped on render views (posterior, on the left; anterior, on the right (row 1), right, on the left; left, on the right (row 2), inferior, on the left; superior, on the right (row 3). The color in the image represents activated intensity. Red to yellow represents higher activation intensity. (A) After training, activation intensity in the right cerebellum, right temporal gyrus, left inferior frontal gyrus, and left primary somatosensory cortex (S1) was higher in the treatment group (MP + PP) receiving mental practice (MP) combined with physical practice (PP) training, compared with the control group receiving PP training during the ME task. (B) After training, the activation intensity of the right angular gyrus, right inferior frontal gyrus, right middle frontal gyrus, left superior frontal gyrus, and left supplementary motor area in the treatment group was higher compared with the control group during the MI task.”  
(Reprinted from source: Liu et. al., 2014)

The research question that was posed in this systematic review of the literature was: How do perturbation-based interventions help reactive balance control in stroke survivors? This review has suggested that perturbation-based interventions take advantage of the neuroplasticity of certain areas in the central nervous system, such as the right cerebral hemisphere, and the SMA. Most perturbation-based interventions were administered within

a period of six weeks, and progress was assessed up to a year after discharge. The repetitive nature of the sessions led to learned fall-prevention strategies in patients, as well as an indication that CNS mechanisms may have been changed as a result of these interventions. It can also be inferred that much like isokinetic strength training, the repeated sessions (including booster sessions) of PBT may have led to some strengthening of the lower limbs, although this is conjecture is yet to be founded by the literature.

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## Gender Difference in Network Strength and Mode of Transformation in Entrepreneurial Learning

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### Abstract

This paper investigates the difference between male and female entrepreneurs' preference of utilizing weak or strong networks and the association of this preference to their tendency to rely on the exploitative and explorative mode of transformation during the entrepreneurial learning process. This paper first includes an online survey to examine male and female entrepreneurs' preference of network strength and then presents interviews result from 12 randomly chosen respondents to investigate how their preferences of network strength influence their predominant mode of transformation during the entrepreneurial learning process. This paper concludes: 1. Males prefer weak ties and females prefer strong ties. 2. Males who prefer weak ties have a tendency to rely on the explorative mode of transformation and females who prefer strong ties have a tendency to rely on exploitative modes of transformation. 3. Males who prefer strong ties do not have a bias towards either predominant mode of transformation (exploitative or explorative) and tend to achieve a balance between the two. The study's findings have significant implications for practitioners to launch programs to activate weak/strong networks for male and female entrepreneurs and also group male entrepreneurs and female entrepreneurs together to best exploit their networks respectively to enhance the overall entrepreneurial performance. Additionally, network activation is beneficial in encouraging more females to become entrepreneurs and bridging the gender gap in entrepreneurship, which has significant implication in supporting female entrepreneurs through a different modality of social networks.

## Introduction

The development of the world brings women empowerment. From encouraging women to not consider family as their only life stages to creating more employment opportunities for them, the world is now motivating women to set up their own enterprises. The process of entrepreneurial learning is indispensable for starting an enterprise. The difference in the entrepreneurial learning process brings the gender disparity in the entrepreneurship field. Therefore, this paper aims to reduce the gender disparity in Entrepreneurship by adjusting the entrepreneurial learning process, a key determinant for the success of entrepreneurial ventures.

There are many entrepreneurial papers that examine related topics about entrepreneurial learning, gender difference between entrepreneurs, and entrepreneurial networks. There is literature suggesting that an entrepreneurial network is of paramount importance to entrepreneurial activity (Soetanto, 2017), as well as research investigating how gender difference plays a role in entrepreneurship (Dempsey & Jennings, 2014, Fellnhofner, Puumalainen & Sjögrén, 2016, Wilson, Kickul & Marlino, 2007) However, few studies establish a relationship between these two important factors. As a result, this paper wants to uncover the relationship between gender difference in entrepreneurial networks and the network's influence on entrepreneurial learning, which is an essential process for a successful entrepreneurial venture.

Accordingly, this paper will investigate male entrepreneurs' and female entrepreneurs' preferences for utilizing the weak or strong network and the correlation between the preference and their tendency to rely on exploitative and explorative modes of transformation during the entrepreneurial learning process. The following questions will be answered:

*RQ1.* Whether male and female entrepreneurs have a preference for a strong or weak network?

*RQ2.* How do male entrepreneurs' and female entrepreneurs' preferences for strong or weak networks influence their predominant mode of transformation during the entrepreneurial learning process?

The paper proceeds as follows: the next section will present the related literature review on the related topics about the two predominant modes of transformation during the entrepreneurial learning process and their significance respectively, the difference between strong ties and weak ties and their influence on entrepreneurial activity, how to measure the tie strength, and the difference between male entrepreneurs' network and female entrepreneurs' network and also develop the hypothesis. Then the paper will demonstrate the design of both quantitative and qualitative research followed by the research findings and discussions. Finally, the paper will discuss the limitations of this paper and the implications for future research and for practice.



## Literature Review And Hypothesis Development

### *Entrepreneur Learning*

There are many articles investigating the entrepreneurial learning process. According to Kolb (1984), the process of transforming a previous experience into acquired knowledge is the experiential process. Consequently, the process of entrepreneurial learning can be presented as a process where the entrepreneurs transform previous experience into knowledge. The transformation process thus becomes very important in entrepreneurial learning and receives a lot of attention from scholars. Minniti & Bygrave (2001) divided the transformation process of experience into different courses based on how entrepreneurs transform their experience into knowledge: exploitation and exploration. These two are called the predominant modes of transformation. Entrepreneurs who rely on exploitation utilize their old experience, while entrepreneurs who rely on exploration explore new ways they have never taken. There is much literature showing the importance of both the exploitative and explorative routines. Politis (2015) concludes that exploration is important for the entrepreneur to recognize and act on entrepreneurial opportunities while exploitation is essential for the entrepreneur to cope with the liabilities of newness. As recognizing entrepreneurial opportunities and coping with the liabilities of newness are all important to the entrepreneur, none of the two predominant modes of transformation is more important than another and it is essential to embrace both modes to transform during the entrepreneurial learning process.

### *Strong Ties & Weak Ties*

There are many journals investigating the difference and the influence between strong ties and weak ties in entrepreneurial activities. According to Granovetter (1973), strong ties require relatively frequent contact that is reciprocal, trustworthy, and emotionally intense. Granovetter also argued that weak ties provide more novel information than strong ties do because people use strong ties to jump out of their narrow social networks. Danny (2017) developed a study and built a connection between the tie strength and the predominant mode of transformation during the process of coping with difficulties and he obtained the following conclusion:

Networks dominated by weak ties are effective in facilitating explorative learning elicited by difficulties in dealing with management, organization and the entrepreneurs' self-crisis.

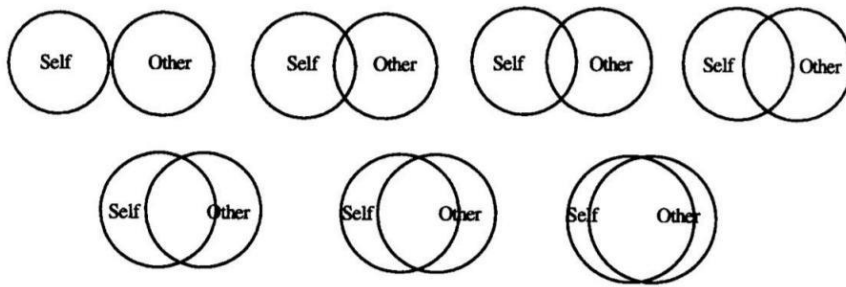
Networks dominated by strong ties are effective in facilitating exploitative learning elicited by difficulties in dealing with external threats and entrepreneurs' self-crisis. However, this research does not incorporate a gender dimension.

### *Measure Tie Strength*

Granovetter (1973) uses the indicators of the tie to define tie strength, but no one yet has a clear definition of tie strength. According to Granovetter (1973), there are at least these five indicators to determine the tie strength: frequency of contact, time duration, reciprocity, trustworthiness, and emotional intensity. While Granovetter (1973) uses the indicators to define tie strength, Marsden and Campbell built a measurement model with variables—indicators and predictors—to investigate what the best indicator is for measuring tie strength (Marsden & Campbell, 1984). Indicators are actual components of tie strength, such as frequency of contact, trust, and emotional intensity. According to Marsden and Campbell, predictors are aspects of relationships that are related to, but not components of, tie strength—such as kinship and neighbor or co-worker statuses. (Marsden & Campbell, 1984). According to their study, they found that a measure of closeness or intensity is the best indicator to measure tie strength because it is free of contamination from other indicators or predictors, that is to say, a measure of closeness not influenced by other indicators or predictors. In addition, other indicators may be misleading in specific contexts: time duration may overestimate the tie strength of kin and the frequency of contact may also overestimate the tie strength of neighbors.

There are many scales to measure the closeness between people: the “Inclusion of the Other in the Self” (IOS) Scale (Aron, Aron & Smollan, 1992), the 'Personal Acquaintance Measure' (PAM) questionnaire (Starzyk, Holden, Fabrigar & MacDonald, 2006), the Relationship Closeness Inventory (RCI) (Berscheid, Snyder & Omoto, 1989), etc. Researchers wonder which one is a relatively reliable method to measure the closeness of relationships. Consequently, Gächter, Starmer Tufano conducted three online studies and concluded that IOS is a highly reliable way to measure the closeness of a relationship combined with the advantage of simplicity and portability (Gächter, Starmer & Tufano, 2015).

The IOS scale consists of seven graphs of different combinations of two circles. One circle represents yourself and the other circle represents another person. The two circles overlap with each other in different degrees and the area of the overlapping part represents the closeness of the relationship. For example, if the person feels unrelated to another person, the pair of disjoint circles will represent the closeness between them; if the person feels very close to another person, the almost completely overlapping set of circles may be the best representation of their relationship.



**Figure 1.** *The Inclusion of Other in the Self (IOS) Scale (Aron, Aron & Smollan, 1992)*

### ***Difference Between Male And Female Entrepreneurs' Network***

Plenty papers have shown the difference between male and female entrepreneurs' network: men tend to have a more sex homophilous networks than their female counterparts, especially when men are the majority of the work establishment (McPherson, Smith-Lovin & Cook, 2001). Women tend to incorporate more kinship in their entrepreneurial networks than their male counterparts (Marsden 1987). Female focal entrepreneurs are more likely to involve female family members who are not partners (Klyver 2011). Male entrepreneurs prefer to expand their network and learn from professionals while their female counterparts prefer to learn from a narrow group of people, mainly from friends and family (Ignatius 2015). Even though there is plenty of research investigating the difference between male and female entrepreneurs' network, there is little understanding about how the gender difference in their network strength has influence on their predominant mode of transformation. Consequently, this study investigates the relationship between the gender difference in tie strength and their predominant mode of transformation and add a gender perspective on Danny's (2017) research. Based on the above literature review on gender difference in building a network and the difference between exploitation and exploration and Danny's (2017) study, we propose the following hypothesis:

H0: Males and females have no difference in preference for weak or strong ties and thus no extra influence on their predominant mode of transformation.

H1: Males prefer relative weak ties and females prefer relative strong ties.

H2: Males who prefer weak ties have a tendency to rely on explorative modes of transformation and females who prefer strong ties have a tendency to rely on exploitative modes of transformation.

## Research Design

Since gender is not a one-dimensional category, it always intersects with other identities, such as race, ethnicity, and age to produce a complex influence. Many of these factors may have an influence on the tendency to choose a weak tie or strong tie and thus influence the predominant mode of transformation. In this case, we keep these factors (race, ethnicity, and age) constant among our samples. The independent variable in this research is gender and the dependent variable is the network strength and the predominant mode of transformation. Because there are three units in this research (gender, network strength, and predominant mode of transformation), the researcher divided the whole research process into two parts:

### *The first Quantitative Survey*

The first part investigates the relationship between gender and network strength.

As the IOS Scale (Aron, Aron & Smollan, 1992) is a highly reliable way to measure the closeness of a relationship combined with the advantage of simplicity and portability (Gächter, Starmer & Tufano, 2015) as discussed in the last literature view section, we use the IOS scale in this quantitative survey to measure the closeness between the respondent and his/her network and the measured closeness is a good indicator of the tie strength between respondents and their network. (Marsden & Campbell, 1984).

The researcher designed a simple entrepreneurial scenario to the respondents: You are a successful entrepreneur and you are going to design a business model. However, while testing the business model, you find that this business model may have some problems. If you want to find three people to help you improve your business model, who will be the three people you will first turn to? And what's the relationship closeness between you and the person you specify? Please use the "Inclusion of the Other in the Self" (IOS) Scale (Aron, Aron & Smollan, 1992). The respondents are asked to name the three people first and then choose the best-fit combination of the circle from the IOS Scale to represent the relationship between the respondent and the person they name.

The extent of the two circle's overlapping area in the IOS scale (Aron, Aron & Smollan, 1992) represents the relationship closeness between the two people, i.e the larger the overlapping area, the more closely the relationship between the two people. As Marsden & Campbell in 1984 investigates that the best indicator for the tie strength between the two people is the relationship closeness between them, we can then use the relationship closeness to determine the tie strength between the two people. As a result, we associate values 1 through 7 to the seven different combinations according to the extent of the overlap between the two circles i.e. the first combination with no overlap has the value of 1 while the seventh combination with almost complete overlapping has the value of 7. We define the value as the "Strength Value" because the extent of the overlapping area is not only a measure of the relationship closeness but also a measure of the tie strength between the two people. Then we

add all of the "Strength Values" of males' and females' choices for the first person, the second person, and the third person respectively to get the total "Strength Value" and the mean "Strength Value" for males' and females' choice for the first person, the second person, and the third person. By comparing the mean "Strength Value" of male's and females' choice, we can then test our H1.

According to each person's response, we can then divide these respondents into four groups based on the result: Group 1: males with a strong network; Group 2: males with a weak network; Group 3: females with a strong network; Group 4: females with a weak network.

In this part of the research, there are internal validity threats. Participants may have different interpretations of the survey question: the question simulates a scenario that the participant encounters a problem while testing a business model. Different participants may imagine different levels of problem—some easy and some difficult—so that they will name the three people according to their imagined difficulty level because the difficulty level is not specified in this question. In order to mitigate this threat, we select students from the same school with the same international curriculum, in other words, they all from one school and all take the A-level curriculum. Besides, we randomly select the students who have relatively the same academic capabilities so that the difficulty level they imagined will be relatively same and the effect on the three people they name will thus be mitigated.

### *The Second Qualitative Interviews*

The second part will be a qualitative investigation. We will randomly select three students from the four groups, conduct interviews with them, ask them questions about how they utilize their networks and how their network helps them, and investigate whether they use exploitation or exploration as their predominant mode of transformation based on the interviews. There are two situations in the second part of the experiment contingent on whether we support or not support H1.

If H1 is supported in the first part of the experiment, then we can continue to test H2 based on their interview response and also investigate how the two minority exception groups (Group 1 and Group 2) use their networks and its relationship with their tendency on their predominant mode of transformation and the researcher illustrates the following hypothesis:

H3: Males who prefer strong ties and females who prefer weak ties (the minority groups) do not have a bias towards one predominant mode of transformation and they achieve a balance between the two modes.

If H1 is not supported in the first part of the experiment, then we continue the second part of the experiment and illustrate the following hypothesis:

H4: Males who prefer strong ties and females who prefer weak ties (the majority groups) do not have a bias towards one predominant mode of transformation and they achieve a balance between the two modes.

Like the first situation, we will also investigate the two minority groups (Group 2 and Group 3) and investigate how they utilize their networks and the relationship with their tendency on their predominant mode of transformation and illustrate the following hypothesis:

H5: Males who prefer weak ties have a tendency to rely on an explorative mode of transformation and females who prefer strong ties have a tendency to rely on an exploitative mode of transformation.

Both in the two parts of the research—the first quantitative survey and the second qualitative interview, there is a common internal validity threat. Concerning about the limited number of real entrepreneurs around the researcher and the desire to maximize sample base and get more data, the researcher uses students' network as a proxy of the entrepreneurial network by giving students the entrepreneurial scenario. This may be different from what the real entrepreneurs encounter while they are testing a real business model. However, by simulating an entrepreneurial condition, we can still find the relationship between the gender difference in network strength and their tendency to rely on either one of the predominant modes of transformation by asking how their network helps them to tackle the problem they encounter and see whether the way their networks help them is more exploitative or exploitative. (Minniti & Bygrave, 2001)

## **Research Findings And discussions**

### ***The First Quantitative Survey***

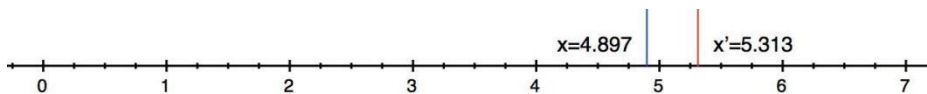
The first quantitative survey is distributed online as a questionnaire and the respondents are all students from International Department of Nanjing High School of Jiangsu province ranged from 16 years old to 18 years old. The researcher received a total of 61 responses with 29 male students and 32 female students.

The following findings are designed as follows: there are three parts— the first person, the second person, the third person. For each part, there is a data table and a graph. The data table displays the following information: 1. the number of females and males for choosing each combination of the IOS scale (Aron, Aron & Smollan, 1992). 2. The total value and the mean value for male and female choices. For the graph, the horizontal axis is an equal scaled

axis with values ranged from 0 to 7. The blue line represents males' mean "Strength Value" in choosing the IOS scale circles (Aron, Aron & Smollan, 1992) while the red line represents females' mean "Strength Value" in choosing the IOS scale circles(Aron, Aron & Smollan, 1992)

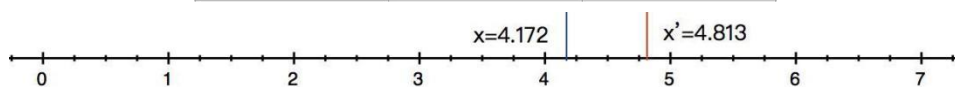
**First Person**

First person		
Strength Value	Male	Female
1	1	0
2	3	1
3	4	3
4	4	8
5	2	3
6	8	7
7	7	10
<b>Total value</b>	142	170
<b>Mean value</b>	4.897	5.313



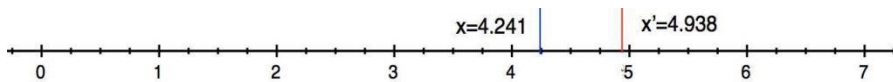
**Second Person**

Second person		
Strength Value	Male	Female
1	2	1
2	6	4
3	3	3
4	5	5
5	4	5
6	5	7
7	4	7
<b>Total value</b>	121	154
<b>Mean value</b>	4.172	4.813



***Third Person***

Third person		
Strength Value	Male	Female
1	2	0
2	2	3
3	9	5
4	3	3
5	4	7
6	5	8
7	4	6
<b>Total value</b>	123	158
<b>Mean value</b>	4.241	4.938



From the three graphs and the three data tables, we can see that the red line is always positioned on the right side of the blue line on this horizontal axis, which means that females' mean network "Strength Value" is always larger than males' mean network "Strength value" for all the three people they choose. What's more, comparing the distance between the blue line and the red line in all these three graphs, we see that the distance between them is increasing from the first person to the second person, which indicated that the difference between their preference to choose relatively strong network or relatively weak network becomes larger and larger. This could indicate that the choice between male and female diverges more and more as the number of people they choose increases.

The three graphs consistently find that males' networks have a lower strength value than females' network. Accordingly, we can demonstrate that males prefer to use relatively weaker ties compared to females. According to these results, we can support our H1 that males prefer weaker ties and females prefer strong ties.

***The Second Qualitative Part***

According to the data from the first quantitative survey, our first hypothesis is supported. From the research design, the second qualitative design has two situations depending on whether the H1 is supported or not supported. According to our first quantitative survey, the H1 is supported and the paper can thus employ the first situation that we can continually test our H2 and also the H3 about the two minority groups (females with a weak network and males with a strong network).



Based on their answers from the first quantitative survey, we divided the student into four groups: males with a strong network, males with a weak network, females with a strong network, and females with a weak network.

Empirically, the paper draws on 12 in-depth interviews with three students randomly chosen from each of the four groups, i.e. 3 students from males with a strong network group, 3 students from males with a weak network group, 3 students from females with a strong network, and 3 students from females with a weak network. All the 12 students are studying A-level curriculum in the International Department in Nanjing High School of Jiangsu Province and all of their class curriculums include Economics. The interviews were conducted between August 2018 and September 2018.

The researcher conducted semi-structured topic interviews that relate to the topics considered in the theoretical framework and literature review but left the room for respondents' individual narrations. Topics included, but were not limited to: respondents' relationship closeness with the people they named in the first quantitative survey, the specific resource/help/advice they think they can get from their close and distant network, respondents' preference for exploitative or explorative learning, respondents' views about the successful entrepreneur's preference of exploitative or explorative learning, respondents' view about the difference of network closeness between male entrepreneurs and female entrepreneurs. The interview questions emphasize their reasoning behind their choice.

Nine interviews were conducted face-to-face, while three were conducted through Wechat phone call. Each interview consists of 10 questions and usually maintains 20—30 minutes. As the respondents are Chinese students, the interviews were conducted in Chinese to avoid misunderstanding due to the language barrier. All interviews were conducted by only one researcher. In each interview, the researcher kept writing notes throughout the interview process. The researchers will translate the respondents' responses into English with the most accuracy.

The interview questions are basically divided into two part: Part I consisted questions about their reasoning for choosing the three people they will first turn to if they encounter problems; Part II consisted questions about their tendency to rely on exploitative learning or explorative learning. In Part II, the researchers explained the two terms using plain language—exploitative as based on the previous experience and explorative as being novel and innovative (Minniti & Bygrave, 2001)—so that the respondent can understand the two academic terms and express their tendency. The researcher would also ask them whether they are more comfortable with exploitative or explorative learning.

There are two tables below. The first table represents all twelve respondents sorted into four groups(male with a strong network, male with a weak network, female with a strong network, and female with a weak network). The first table also shows the respondents' choices of the three people in the first quantitative part of the research and the "Strength Value" they associate to each person to represent their relationship closeness. (The "Strength Value" is displayed as numbers in the bracket behind each choice) Due to the concern for the

respondents' privacy, this paper keeps the anonymity of the respondents by using random capital letters to represent their name.

The second table displays respondents' short answer in the second quantitative part. The researchers ask them about their preference on the exploitative or explorative mode of transformation after giving them the meaning and definition of these two modes. The table records their answers.

Gender	Network Strength	Respondent	Choice of 1st person and associated Strength Value	Choice of 2nd person and associated Strength Value	Choice of 3rd person and associated Strength Value
Male	strong network	GRY	Himself(7)	Girlfriend(6)	Parents(6)
		ZJZ	Employee(6)	Business partner(5)	Customer(4)
		XZY	Mother(7)	Classmate(4)	Classmate(5)
	weak network	GYT	Elder brother(3)	Classmate(4)	Classmate(3)
		XY	Teacher(2)	Consulting Services(1)	Parents(4)
		ZCC	Venture Capitalist(3)	Customers(2)	Parent(3)
Female	Strong network	CYB	Friend(7)	Friend(6)	Mother(6)
		LJN	Parents (7)	Sister(7)	Friend(6)
		SY	Classmate(7)	Classmate(6)	Classmate(5)
	weak network	WAZ	Friend(4)	Friend(3)	Friend(4)
		YYJ	Parent(3)	Aunt(3)	Friend(4)
		LQX	Business partner(4)	people with the same career(2)	Friend(3)

Gender	Network Strength	Respondent	mode preference
Male	strong network	GRY	Exploitative but admire explorative
		ZJZ	Exploitative
		XZY	60%explorative+40 % exploitative
	weak network	GYT	Explorative
		XY	Explorative
		ZCC	explorative
Female	Strong network	CYB	exploitative
		LJN	exploitative
		SY	exploitative
	weak network	WAZ	exploitative
		YYJ	more explorative but also combined with exploitative
		LQX	explorative

The following findings are presented into four groups. Group 1 is males with a strong network; group 2 is males with a weak network; group 3 is females with a strong network; group 4 is females with a weak network. Each group will consist of two parts of the interview. The first part is about their network behavior and the second part is about their mode preference. For example, 1.1 represents the interview response from the first group and the first part of the interview regarding network behavior; 1.2 still represents the interview response from the first group and the second part of the interview regarding mode preference; 2.1 represents the interview response from the second group and the first part of the interview regarding network behavior. Overall, in the following displayed findings, the first number represents the group while the second number represents whether it is the first part or the second part.

### ***1.1 Males with a strong network—network behavior***

According to the table, the three male respondents with a strong network are GRY, ZJZ and XZY all of them choose their strong networks such as their parents and partner. However, the reasoning is relatively different.

GRY expressed,

*I am a suspicious person and it is not easy for me to trust my distant network. As a result, whenever I encounter a problem, I prefer to solve the problem on my own. If I must choose my network to help me with the problem, I will definitely choose my parents and partner because I trust them and I think it is particularly important to find trustworthy people to seek advice if you are entrepreneurs and initiating business as every step you take in business is risky. (GRY, Wechat phone call, August 26, 2018)*

However, ZJZ stated a different reason that,

*I would like to find a person who knows me best because only they would provide me with the most appropriate advice. I cannot imagine how an unfamiliar person can provide you with reliable advice. (ZJZ, personal interview, September 02, 2018)*

XZY stated,

*My mother has majored in business and the two friends I chose will major in business in the future. [...] As a result, they can provide me with professional advice. Besides, as they are*

*my close network, they know me better and their advice may be more suitable for me. (XZY, personal interview, September 03, 2018)*

### **1.2 Males with a strong network—mode preference**

While asking about their own preference for exploitative or explorative, none of them were resolutely giving their preference.

GRY suggested,

*I am more comfortable with exploitative learning now and the experience I may base on is the books I have read and all the events I have encountered. However, I really admire the explorative learning and I may approach this kind of learning in the future. In addition, I consider these two as a dynamic process as it is hard for me to determine which one I will use most. In some cases, it may be more secure and safe for me to use exploitative learning, while sometimes it is necessary for me to use exploitative learning to gain some new things. (GRY, Wechat phone call, August 26, 2018)*

ZJZ gave an entirely different answer. He mentioned,

*I'm more comfortable with exploitative learning, but I want to try explorative learning first and then use 'exploitative' method to exploit the experience I accumulate while I was exploring. (ZJZ, personal interview, September 02, 2018)*

XZY declared,

*For me, it's 40% exploitative and 60% explorative. I do consider that explorative way is more important because it endows me with new ideas. However, I think exploitative is also important because the likelihood of success is higher as the previous experience has been verified. (XZY, personal interview, September 03, 2018)*

### **2.1 Males with a weak network—network behavior**

According to the table, the three male respondents with a weak network are GYT, XY, and ZCC. Both XY and ZCC considered the professional consulting services as one of their three choices. Besides asking their reasons for choosing whom they have chosen, the researchers also asked them whether they would choose to discuss their business trouble with their close networks such as their parents and their future partner.

XY, who consider the professional consulting services as his second choice declared,

*I will choose to pay money and find a professional counselor at some consulting companies such as McKinsey because I think that they have more professional knowledge and their advice may help me improve my business model. In addition, as they are not the people I contact often, their advice may give me some unexpected inspiration. On the contrary, I may have already thought about the possible advice that my close network will support me because we are really familiar with each other. [...] Besides, even though I rated our relationship as 1 (according to the IOS scale), I do think that if the counselor and I cooperate further, he may provide me with more business connection to enlarge my network. It's like you can find more network and help through the consulting companies. It may be helpful to get your parents' acceptance and encouragement. However, I worry more about whether they will feel worried about my business dilemma and I do not want them to worry about me, sometimes letting them worry about me makes me feel more burdensome. (XY, Wechat phone call, August 29, 2018)*

ZCC, who is also willing to pay money to consult company, would choose certificated risk manager. He would also choose to consult customers. He explained,

*The certificated risk manager will help me [...] and help me reduce the risk while improving the business model. In addition, the novel advice that the risk manager will provide is usually out of my reach and I bet my close network will not know about them. I believe that what my close network knows is already what I have known. As a result, I will not choose the close network if I want some new information. In addition, it is better for the company to gain some advice from the customers so that we can know what the market demand. I do think that customers' advice is more practical. For example, [...] It is hard to ask my parents for any practical advice for improving the business model. Whenever I encounter some problem, they will not point out my fault and problem because they are afraid of disappointing me. In order to encourage me and relieve my frustration, they always offer optimistic opinions, which are actually not helpful. (ZCC, personal interview, September 02, 2018)*

The rest one respondent GYT did not choose to seek the consulting company. However, he chooses his elder brother and his two distant classmates, whom he rated as 3,4,3 respectively in the IOS scale. He mentioned,

*I may not connect with my elder brother and my two classmates often, but as I know they are professional in the business field, I will definitely choose to ask their advice if I encounter some problems. [...] It is hard for my parents to provide any professional advice because of the generation gap between us. (GYT, Wechat phone call, August 26, 2018)*

### **2.2 Males with a weak network—mode preference**

While asking them about whether they are more comfortable with exploitative or exploitative, all of them states that they are more comfortable with explorative learning while illustrating different reasons for their tendency for relying on the explorative learning.

XY illustrated,

*I think continually exploiting previous experience without innovation will inhibit a company's progress and development because they are always using the same thing again and again without making something new. For example, if the company designs the product while never trying to think about how to make some innovation about the product, customers will gradually lose interest in the product and also the company. (XY, Wechat phone call, August 29, 2018)*

Instead of concerning about a company's development as XY does, GYT concerned about the personal development and he declared,

*Actually, I don't know how explorative learning and exploitative learning plays out in entrepreneurship, but as a student, I prefer exploration. For example, [...] while solving a difficult Maths problem, trying to use some explorative methods makes me feel like I am learning new things and I am fulfilled with a sense of achievement. However, while solving the problem with the old method, I still find the answer in the end, but I cannot feel the excitement and enthusiasm for solving that problem. (GYT, Wechat phone call, August 26, 2018)*

ZCC mentioned,

*I cannot specify what makes me feel more comfortable with using explorative learning, maybe it's just cool to innovate. (ZCC, personal interview, September 02, 2018)*

### **3.1 Females with a strong network—network behavior**

According to the table, the three female respondents with a strong network are CYB, SY, and LJN.

For CYB, she chose two friends and her mother as the people she will first turn to if she wants some advice for improving her business model. She illustrated a lot of reasons,

*First, my mother is also a businesswoman so that she has previous experience to help me with the business model. [...] She also has a lot of colleagues with related experience and*

*resources because they may have gone through the same situation before and I believe that their previous experience will help me a lot. Second, the two friends I chose are my best friends. I guess I will be nervous and my brain will be blank if I encounter a problem while testing the new business model. Because they are my best friends, I believe that they will calm me down and give me some comfort. Besides, they are all going to major in business in the future so that they may have a very comprehensive grasp of business knowledge and they may also have the peer resources to help me. (CYB, personal interview, September 02, 2018)*

Compared to CYB's explanation, SY's reason is relatively simple, but she also explains how she thinks that the advice from her close network may help her improve the business model. She stated,

*The emotional comfort is most important when I encounter a problem because only when I have emotional encouragement and emotional support can I calm down and engage in thinking about ways to improve the business model or otherwise I will be welled with frustration. My close network is familiar to me and my experience as well. If I am an entrepreneur, I must have some previous success or failure experience. However, while encountering a problem, I may be anxious and frustrated and this kind of emotion inhibits me from recollecting my previous experience. For example, [...]. However, my close friend or family will first calm me down and remind me of my previous event, either success or failure. For instance, they may say, "Do you remember last time while you [...]. This kind of conversation with them can help me recollect the previous experience and then help me find a solution to deal with that problem. (SY, personal interview, September 04, 2018)*

While asking LJNI how she thinks her strong network will help her, she got the relatively similar answer, stating that,

*My close network's reminder may help me collect my previous experience [...] and I do think that my previous experience may give some inspiration for me to find a solution in my newly encountered problem. (LJNI, personal interview, September 03, 2018)*

### **3.2 Females with a strong network—mode preference**

While asking them about whether they are more comfortable with explorative learning or exploitative learning, SY explained that,

*I may use exploitative learning more because it is relatively hard to think of a novel way to tackle a problem. Maybe whenever I encounter a problem, the previous experience will*

*first jump to my mind first. However, I still recommend to combine with explorative learning because it is also important.* (SY, personal interview, September 04, 2018)

Both CYB and LJN claimed that they prefer to use exploitative learning because they are risk-averse. CYB mentioned,

*Using previous experience gives me a sense of safety because it seems like there is less risk involved and I don't really want to take so many risks.* (CYB, personal interview, September 02, 2018)

#### **4.1 Females with a weak network—network behavior**

According to the table, the three female respondents with a weak network are WAZ, YYJ, LQX. WAZ, who chose the three friends, explained,

*These three friends know me best and their suggestions will be more suitable and useful for me. Besides, if I encounter some problems or trouble, they will find a way in which I will accept readily instead of the advice I am reluctant to take.* (WAZ, personal interview, August 27, 2018)YYJ, who chose her mother, aunt, and one of her friends as the first three people she is going to turn to suggested,

*I choose my parent and my aunt due to at least two reasons. First, they are my relatives and I trust them more than anyone else. Besides, they are all business women so that they can teach me a lot of practical experience. [...] As a result, if I was in the scenario (finding some problems while testing the business model and then want to ask three people's resources/help/support), I will definitely think of them immediately.* (YYJ, personal interview, September 04, 2018)

#### **4.2 Females with a weak network—mode preference**

While asking them about whether they are more comfortable with explorative learning or exploitative learning, YYJ explained,

*I would like to combine both explorative learning and exploitative learning. If I am the entrepreneur, I think that the general structure of my business will not change and I think this is a kind of exploitative learning as I will base on my previous experience. However, while filling things into the general structure of my business, something like how to manage the company human resources, how to promulgate out business product etc. requires innovation*



*and exploration, or otherwise, my company will not stand out among all the companies.* (YYJ, personal interview, September 04, 2018)

While YYJ would like to combine explorative and exploitative together, LQX and WAZ give two different answers. LQX stated,

*I like to try new things and I believe that 'innovation is a revolution'. Sometimes the products of innovation are incredible and may have a huge impact over the globe. [...] I think the most well-known example is the invention of the iPhone.* (LQX, personal interview, September 05, 2018)

On the contrary, WAZ declared,

*I prefer exploitative learning because this is the thing I always do. I do not know whether I will do the same thing if I become an entrepreneur in the future, but at least now, as a student, I think applying my previous experience or my previous knowledge is more practical.* (WAZ, personal interview, August 27, 2018)

If we see part 2.1 and 2.2, we can find that a male who prefers to use the weak network is more comfortable with explorative learning and the most frequently suggested reasons are as follows: 1. using explorative learning is better for the companies' development and maintains their customers. 2. using explorative learning can help themselves learn new things and fulfill them with a sense of achievement. Besides, they also point out how their distant network helps them if they encounter any problems. They mention that the reason why they will not choose their close network is that they think they have already known what their close network knows so and thus their close network will not provide them with valuable advice. However, the distant network has new networks and new information that is usually beyond their reach and they think that asking them help is also a way to get to the distant network's resources. They think that their distant network's help is more professional and new and thus would better help them improve their business model.

If we see part 3.1 and 3.2, we can find that females who prefer to use a strong network are more comfortable with exploitative learning and the most frequently suggested reasons are as follows: 1. It is hard to think of an innovative way. 2. The exploitative method ensures more security. In addition, they suggest how their strong network helps them if they encounter any problems. They mention that their strong networks can provide them with emotional encouragement and support first. Additionally, because their close networks have known them for a long time, their close network may help them recollect their previous success or failure experience and thus help them find a solution.

According to the conclusion we draw from part 2.1&2.2&3.1&3.2, we can support our H2 that males who prefer weak ties have a tendency to rely on the explorative mode of transformation and females who prefer strong ties have a tendency to rely on the exploitative mode of transformation.

If we see part 1.1 and 1.2, we can find that males with strong network usually do not determine their way of thinking as exploitative or explorative. Rather, they have two different situations: 1. they consider these two as dynamic processes, with explorative in some cases and exploitative in other cases (eg. GRY and XZY in part 1.1 and 1.2). 2. they use these two in order: either exploitative first and then explorative or explorative first and then exploitative (eg. ZJZ in part 1.1 and 1.2). In both of the two situations, none of them will confine themselves to either explorative or exploitative. They combine them together instead of having a preference towards one of them.

If we see part 4.1 and 4.2, we cannot find a general pattern of how females with weak network determine their preference of either exploitative or explorative mode of transformation. The three respondents gave three entirely different answers: WAZ considered herself to prefer exploitative mode; YYJ prefers explorative mode but also would also like to combine a little exploitative mode; LQX prefers explorative mode. We may conclude that females who prefer weak network do not have a preference for either exploitative or explorative mode, but it is hard for us to conclude that females who prefer a weak network can achieve a balance between explorative and exploitative because only one of the three respondents is willing to combine these two together.

From the conclusion we draw from part 1.1&1.2&4.1&4.2, we can only partially support our H3 stating that males who prefer strong ties and females who prefer weak ties (the minority group) do not have a bias towards one predominant mode of transformation and they achieve a balance between the two modes. The conclusion we find from part 1.1 and part 1.2 only supports that males who prefer a strong tie do not have a bias towards either predominant mode of transformation (exploitative or explorative) and they achieve a balance between the two modes. On the contrary, the conclusion we draw from part 4.1 and 4.2 cannot support part of the hypothesis about females who prefer weak ties because we cannot find a pattern in part 4.1&4.2. Accordingly, H3 is partially supported.

## **Conclusion**

This paper contributes to our understanding that gender difference in entrepreneurial network strength influences the predominant mode of transformation during the entrepreneurial learning process. The paper successfully builds a connection between the gender difference in the entrepreneurial network strength and the network's influence on the predominant modes of transformation in entrepreneurial learning process. Through both the quantitative survey and the qualitative interviews, the paper reaches the following conclusion:

1. Males prefer weak ties and females prefer strong ties. 2. Male who prefer weak ties have a tendency to rely on the explorative mode of transformation and female who prefer strong ties have a tendency to rely on the exploitative mode of transformation. 3. Males who prefer strong ties do not have a bias towards either predominant mode of transformation (exploitative or explorative) and they can achieve a balance between the two. The paper still cannot establish whether females who prefer weak ties can achieve a balance between exploitative and explorative modes of transformation. This paper has the following limitations and implications for the future practice and research.

## **Implications**

### ***Implications For Practice***

As exploration is important for entrepreneurs to recognize and act on entrepreneurial opportunities and exploitation is essential for entrepreneurs to cope with the liabilities of newness (Politis, 2015) and both the abilities to act on entrepreneurial opportunities and the ability to cope with the liabilities of newness are important, it is essential for male and female entrepreneurs to develop both strong and weak network. As the paper has supported H2 that males who prefer weak ties have a tendency to rely on explorative modes of transformation and females who prefer strong ties have a tendency to rely on exploitative modes of transformation, we can know that the male or female entrepreneurs can consciously change their network strength by choosing different people to ask for help during the venture starting process. This would influence their predominant modes of transformation so that they can achieve a balance between exploitation and exploration and improve their abilities to both recognize and act on the opportunity and cope with the liabilities of newness. (Politis, 2015). As we also support H1, we now know that the majority of males who prefer a weak network have a tendency to rely on explorative transformation and the majority of females who prefer a strong network have a tendency to rely on exploitative transformation, the majority of male and female entrepreneurs may need to change their network strength to consciously influence their predominant mode of transformation and thus achieve a balance between explorative and exploitative mode of transformation. By achieving a balance between the two modes, both male and female entrepreneurs can achieve a balance between recognizing opportunity and coping with the liabilities or newness. As a result, we can enhance the overall entrepreneurial performance and boost the entrepreneurial activity prosperity, which is beneficial for our economy.

As our findings indicate, female entrepreneurs use strong entrepreneurial networks more and a lack of weak entrepreneurial networks ties may lead to a lack of exploitative learning and thus a lack of the ability to recognize and act on the entrepreneurial opportunity (Politis,

2015). The government can also try to launch programs to help women establish weak entrepreneurial network ties to help improve their exploitative learning and improve female entrepreneurial performance. Previous findings suggest that the reason for less female entrepreneurs is a lack of female entrepreneurial role models (Klyver, K., & Grant, S. 2010). As a result, by enhancing the female entrepreneurial performance through changing their network strength, more female entrepreneurs are likely to be successful and thus more and more female entrepreneurs are becoming role models. As a result, we can attract more females to enter the entrepreneurship field because they see more role models with higher entrepreneurial performance. Therefore, we can effectively reduce the gap between the number of male entrepreneurs and female entrepreneurs and thus take a step towards a gender equity in entrepreneurship.

In addition to consciously changing the network strength to influence the predominant mode of transformation to acquire the ability to recognize and act on the opportunity and cope with the liabilities of newness. (Politis, 2015), the entrepreneurs can also be grouped together to enhance the overall entrepreneurial performance. As the paper has supported H2 that males who prefer weak ties have a tendency to rely on explorative modes of transformation and female who prefer strong ties have a tendency to rely on exploitative modes of transformation, the government can also launch programs to group male and female entrepreneurs together to enhance the group entrepreneurial performance. For instance, the government can launch the program that group male entrepreneurs who prefer weak network and female entrepreneurs who prefer strong network together and let them cooperate with each other so that the whole group has both the explorative and exploitative mode of transformation and thus both the ability to recognize and act on the opportunity and cope with the liabilities of newness (Politis, 2015) and the group entrepreneur performance will be enhanced significantly.

### ***Limitation And Implications For Future Research***

The paper's first quantitative part's findings have not shown whether there are any distinctions between the three people males and females choose. The future researchers can use a larger sample and gather more data to investigate whether there is any significant trend between the "Strength Value" males and females associate with the three people, i.e whether males prefer to choose a distant network at first and then choose more close network when choosing the third person or the versa and whether females prefer to choose close network at first and then choose more distant network when choosing the third people or the versa.

Besides, this research has the limitation that it uses students as a proxy to entrepreneurs by giving them an entrepreneurial scenario and then investigates the gender difference in network choice and the research also uses students' preference on exploitation or exploration as a proxy to the entrepreneurs' preference on either predominant mode of transformation in the entrepreneurial learning process. The future researchers can choose the sample of real

male and female entrepreneurs and conduct interviews with them to see whether the pattern revealed by this research paper will be applicable in real entrepreneurship.

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## **A Quantitative Estimation of the Probability of Renal Dysfunction Resulting from the Intake of Cadmium-contaminated Rice Samples in China**

Yangyang Zhao

*Author Background: Yangyang Zhao grew up in China and currently attends Shenzhen Foreign Languages School in Shenzhen, China. His Pioneer seminar program was in the field of chemistry and titled “Chemistry of Contaminants in the Environment”.*

### **Abstract**

Cadmium is one of the most common sources of heavy metal contamination. A bivalent transitional metal, cadmium has several oxidation states, and its toxicity often varies with salinity and other surrounding factors. Major channels of exposure to cadmium are inhalation and ingestion, the latter of which plays a more important role in non-smoking populations. The adverse health effect brought on by cadmium consumption include acute intoxication and chronic intoxications, which are often in the form of kidney, lung, and bone disorders. In general, chronic poisoning often poses a greater threat on human beings because of its irreversibility and the unlikeliness of being detected in earlier stages of intoxication, in which symptoms are usually absent. The most severe form of chronic cadmium poisoning is the itai-itai disease, which inflicts unendurable pain on patients.

As world’s largest rice producer, China has seen the issue of cadmium contamination in rice in recent decades. Rice samples, especially from mining sties, were discovered to contain an excessive amount of cadmium. In order to quantitatively estimate the risk of renal dysfunction, in particular, from the consumption of cadmium-contaminated rice, data, and a logistic dose-response model from previous studies are used. In addition, in calculation set 2, the synergistic effect between cadmium and other heavy metals, when consumed by the human body, is taken into consideration. Here, relationships between heavy metals established for a common species of nematodes are assumed to be applicable to human beings.

**Key Words:** Cadmium-contaminated rice, Renal dysfunction, China, Toxicology, Dose-response, Heavy metal contamination

## Introduction

### Cadmium: General Facts

Cadmium (Cd), a soft white metal, is often found in Earth's crust and is associated with zinc, lead, and copper ores (Agency for Toxic Substances & Disease Registry, 2012). Located in the fifth period and twelfth group in the periodic table, cadmium is a d-block post-transitional (sometimes also referred to as transitional) metal. Although similar to zinc in many aspects, cadmium can form more complex compounds than zinc can (Holleman, Wiberg, & Wiberg, 1985). As summarized in Table 1, it has an atomic number of 48, a relative atomic weight of about 112.41 (International Union of Pure and Applied Chemistry (IUPAC), 2016), and a density of 8.69g/cm<sup>3</sup> (Royal Society of Chemistry, 2018). Due to its high density and large relative atomic weight, cadmium is commonly defined as a heavy metal. This is also partly because it has no biological function (that has been yet discovered) and is considered an inessential element (Chang LW, 1996). In addition, cadmium also has a relatively low melting point of 594.219 K, which is equivalent to 321.069°C or 609.924°F.

<b>Group</b>	12	<b>Melting point</b>	321.069°C, 609.924°F, 594.219 K
<b>Period</b>	5	<b>Boiling point</b>	767°C, 1413°F, 1040 K
<b>Block</b>	d	<b>Density (g cm<sup>-3</sup>)</b>	8.69
<b>Atomic number</b>	48	<b>Relative atomic mass</b>	112.414
<b>State at 20°C</b>	Solid	<b>Key isotopes</b>	<sup>114</sup> Cd
<b>Electron configuration</b>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup>	<b>CAS number</b>	7440-43-9

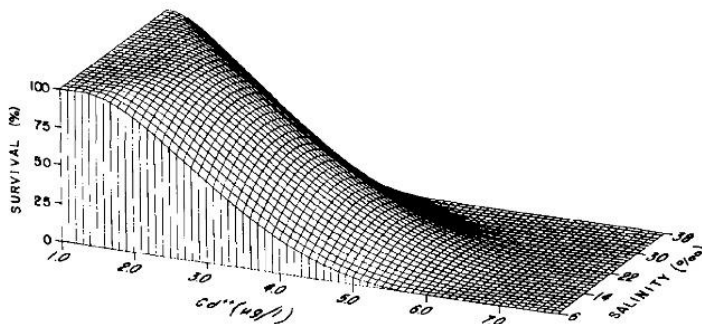
*Table 1. Basic physical properties and facts about elemental cadmium. Adapted from Periodic Table by the Royal Society of Chemistry (Royal Society of Chemistry, 2018). Retrieved September 15, 2018, from <http://www.rsc.org/periodic-table/element/48/cadmium>. Copyright 2018 by Royal Society of Chemistry*

### Speciation

A bivalent metal, cadmium has oxidation states of 0, +2, and sometimes +1. In general, the most common oxidation state for cadmium is +2. The most common form of cadmium is cadmium sulfide (CdS), a yellow solid that is often found in similarly structured zinc ores (Wiberg & Holleman, 2001). Formerly used in paintings, CdS is also known as “cadmium yellow.” Although now the use of cadmium sulfide has faded in art, it is still widely applied as a pigment on plastics because of its relative stability.



The toxicity of cadmium varies with different salinity, as indicated in a study conducted by De Lisle and Roberts, Jr., which focused on the effect of various salinity to the toxicity of cadmium to *Mysidopsis bahia*, an estuarine mysid species (De Lisle & Roberts Jr., 1988). As illustrated in the regression surface on the next page, the toxicity of cadmium first increases and reaches a peak, then decreases back again, forming an approximately symmetric shape.



**Figure 1.** Regression surface of  $\text{Cd}^{2+}$  toxicity for *Mysidopsis bahia* over a salinity range of 6 to 38‰. Reprinted from “The effect of salinity on cadmium toxicity to the estuarine mysid *Mysidopsis bahia*: role of chemical speciation,” by De Lisle, P. F., & Roberts Jr., M. H., 1988, *Aquatic Toxicology*, 12, p. 362. Copyright 1988 by Elsevier.

### Health Effects: Cadmium Poisoning

Cadmium poisoning can be categorized into acute poisoning and chronic poisoning. According to the Occupational Safety and Health Administration, a branch of the United States Department of Labor, “acute inhalation exposure (high levels over a short period of time) to cadmium can result in flu-like symptoms (chills, fever, and muscle pain) and can damage the lungs. Chronic exposure (low level over an extended period of time) can result in kidney, bone and lung disease” (Occupational Safety and Health Administration, 2018).

Classified by the International Agency for Research on Cancer (IRAS) as a carcinogen, cadmium is often considered one of the most toxic industrial pollutant (International Agency for Research on Cancer, 1993). Regarding its effect on human health, there are several standards of the maximum intake by an adult, as set by different institutions and organizations. For example, the FDA reference dose (Rfd) for human exposure by water intake is  $5 \times 10^{-4}$  mg/kg/day (Agency for Toxic Substances and Disease Registry, 2008). For food, the FDA Rfd is  $1 \times 10^{-3}$  mg/kg/day (Agency for Toxic Substances and Disease Registry, 1999). The WHO Provisional tolerable monthly intake (PTMI) is  $2.5 \mu\text{g}/\text{kg}$  body weight, as established by The Joint Food and Agriculture Organization of the United Nations (FAO)/WHO Expert Committee on Food Additives (JECFA) in 2010 (World Health Organization, 2010)

Compared with acute poisoning, the adverse effect of chronic exposure to cadmium are often unlikely to be detected before severe health problems like renal dysfunction arise, making it more dangerous to the human population. In the long run, adverse health effects resulting from the intake of cadmium includes chronic renal failure, bone fragility, reproduction-related issues, and human cancer (Satarug & Moore, 2004), while kidney, in particular, is the target organ of cadmium (World Health Organization, 2010).

### **Channels of Exposure**

Major channels of exposure to cadmium include inhalation, ingestion, and skin contact, the last of which is often considered a negligible route of exposure (Agency for Toxic Substances and Disease Registry, 2008). Besides natural cadmium that exists in a variety of foods, the cadmium ingested with food sometimes also comes from industrial contamination (Agency for Toxic Substances and Disease Registry, 2008). Such contamination of food crops (rice in particular), due to the large amount of their consumption by a massive population, poses an especially severe threat for human health.

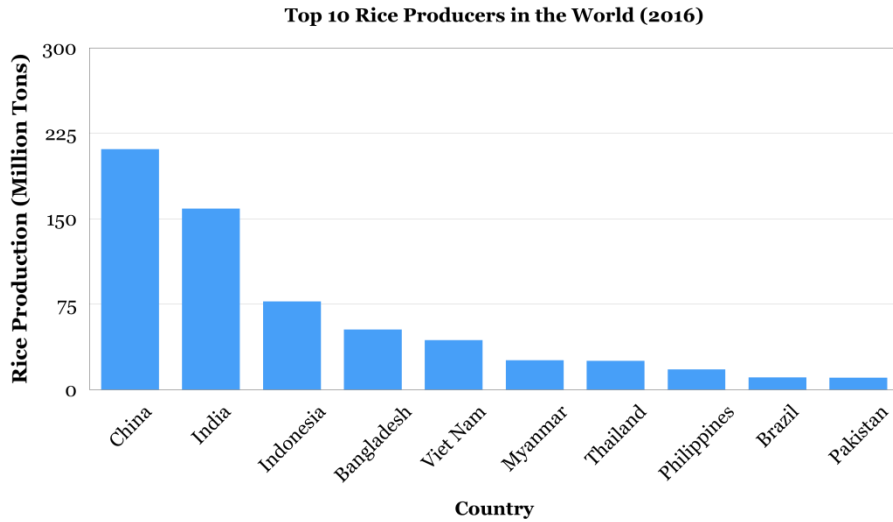
### ***Itai-itai* Disease**

According to Kobayashi et. al, “[t]he most severe case of Cd-induced health effects is *itai-itai* disease” (Kobayashi, Okubo, Suwazono, Kido, & Nogawa, 2002). In Japanese, *itai-itai* literally means “ouch-ouch”, resembling the dreadful screams uttered by patients suffering from unendurable pain. With victims primarily from Jinzu River Basin in Japan, where zinc mining ores upstream were continually releasing large amount of cadmium into the water bodies used for drinking and irrigation, the disease is characterized by bone deformation and debilitating pain (Hamilton, 2009). Known as one of the Four Big Pollution Diseases in Japan, *itai-itai* disease was an extreme result of cadmium contamination.

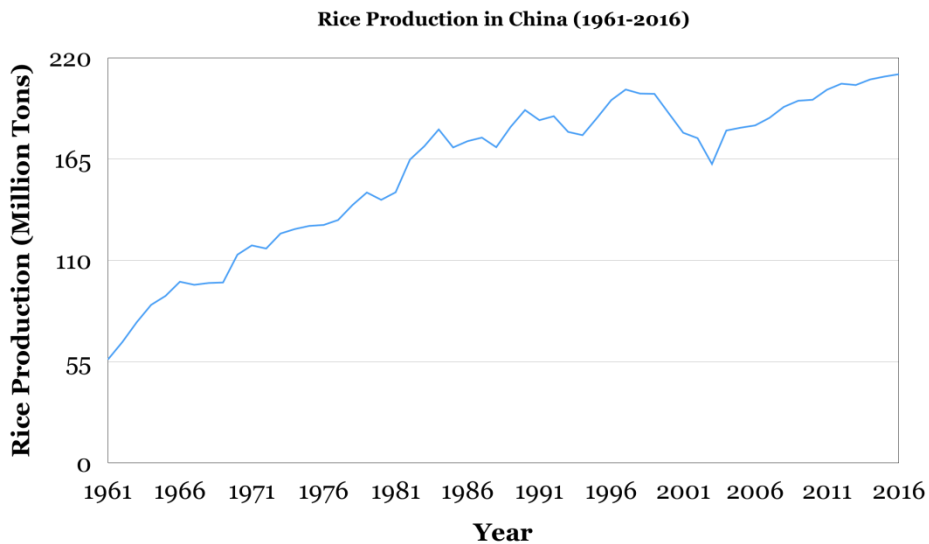
### **Rice Production & Contamination in China**

Rice is one of the key crops in agriculture in several major countries. In fact, more than half of the world’s population rely on rice as staple food (Hu, Cheng, & Tao, 2016). In Asian countries, rice is one of the most important food crops. As shown in Figure 2, the top ten rice producers in 2016 were states in East Asia, Southeast Asia, and South Asia, with the exception of Brazil, a South American country. China produced the largest amount of rice among all the world’s countries. It is estimated that in 2016, China produced 211 million tons of rice, which was about 23% of the world’s total rice production in 2016. In addition, the amount of rice produced by China in 2016 was about 1.4 times India’s rice production (158 million tons), which ranked second, and about 3 times the rice production

of Indonesia, which ranked third. (Food and Agriculture Organization of the United Nations, 2016).



*Figure 2. Top 10 rice producing countries in the world in 2016 (Food and Agriculture Organization of the United Nations, 2016).*



*Figure 3. Change in the amount of rice produced in China from 1961 to 2016. Data from (Food and Agriculture Organization of the United Nations, 2016).*

As industrialization in China proceeded at a rapid rate in recent decades, cadmium contamination of soil began to pose a severe threat to human health. When rice is grown on contaminated soil, the cadmium accumulated in the soil transfers into the rice. According to the standard on contaminant concentrations in food proposed by the Chinese government

(GB 2672 – 2017), the tolerable concentration of cadmium in rice is 0.2 mg/kg. However, according to data from the work of Hu et. al, 17 of the 31 (about 55%) rice samples examined in the years of 1995, 2008, 2009, 2013 from mining districts exceeded this standard (Hu, Cheng, & Tao, 2016). In addition, the production of rice is positively correlated with time. From 1961 to 2016, the annual amount of rice produced skyrocketed to four times of its original value in 1961 (Food and Agriculture Organization of the United Nations, 2016).

In 2013, it was discovered in a survey that about 10% of the rice samples in the market contain an excessively large amount of cadmium, far exceeding the national standard (People.cn, 2013). In addition, among 31 samples containing an excess amount cadmium, 14 of them are from Hunan Province, where mining sites are prevalent (People.cn, 2013). From these data, it can be plausibly concluded that cadmium contamination in rice is becoming an issue that requires for more attention in China.

## **Context**

Several studies focusing on cadmium poisoning have been conducted, especially by scientists and researchers from Japan, where *itai-itai* disease was once an urgent issue. In a large-scale study conducted by Nogawa et. al, the benchmark dose (BMD) of the cadmium concentration in rice was calculated, and it was discovered that gender difference can affect the value of BMD, with women in general having lower BMDs and thus, are more vulnerable to cadmium-related diseases (Nogawa, et al., 2017).

Several dose-response analyses have also been carried out in the past. In a study performed by Järup et al., a clear dose-response relationship was detected when one cumulative air-cadmium dose and two cumulative blood-cadmium doses were computed for every subject in the study (Järup, Elinder, & Spång, 1988). In addition, according to Järup et. al, the results “suggest that cumulative blood-cadmium is a more sensitive indicator of cadmium-induced renal dysfunction than cumulative air-cadmium” (Järup, Elinder, & Spång, 1988). Another study, carried out by Kido et. al, indicates that the accumulation of 2g of cadmium over a 50 years period, which is equivalent to an average daily intake of 110 µg, can be considered as the maximum tolerable consumption of cadmium that does not lead to significant risk of renal dysfunction (Kido T. , Shaikh, Kito, Honda, & Nogawa, 1991). In another study conducted two years later, featured by a research team that include some of the researchers in the 1991 study by Kido et. al, it was further discovered that age is irrelevant to the risk of kidney failure, and only total intake of cadmium has a significant relation with the risk (Kido T. , Shaikh, Kito, Honda, & Nogawa, 1993).

However, up to this point, few studies established formularized dose-response models and curves that can be expressed using equations, possibly limiting the applicability of all these findings. Additionally, not many previous studies have examined and predicted the

risk of renal dysfunction associated with the consumption of cadmium-contaminated rice, using the amount of rice consumed as an independent variable. Also, few existing studies actually considered the synergistic effect between cadmium and other heavy metals when absorbed simultaneously by the human body.

Since the news of cadmium contamination in rice from Hunan was reported by media and the fact that about 1/6 of cultivated lands in China are polluted by heavy metals was revealed by surveys in 2013, it seems that the concern regarding these issues of the general public is diminishing (People.cn, 2013). In fact, one of the possible implications of the calculations performed in the following section is to raise attention from both the general public and the government to further explore and re-examine the issues concerned with rice cadmium contamination.

In the following section of calculations, data of cadmium concentration in rice samples in China from previous studies, which has not been used often for similar calculations, and a model constructed by earlier work are used to quantitatively estimate the risk of renal dysfunction as a result of the intake of rice containing cadmium. The major distinction between the two sets of calculations is that while Calculation Set 1 will focus primarily on the analysis and processing of data from various regions, Calculation Set 2 will put an emphasis on the assumed synergistic effect.

## Calculations

### Calculation Set 1: Rice Samples from Regions in China

According to the Agency for Toxic Substances and Disease Registry (ATSDR, 1999), it is estimated that 6% of oral intake cadmium is absorbed by the human body. From this, about 50% is accumulated in the human liver and kidneys, which are the centers of metabolism of the human body (HSDB, 2006). As evident in data from a study conducted by Heilmaier et. al, almost all of the amount accumulated in the liver and kidneys does is absorbed in the latter (Heilmaier, Drasch, Kretschmer, & Summer, 1987)

This calculation set explores the probabilities of kidney dysfunction corresponding to different levels of cadmium intake from rice. The data for rice cadmium concentration comes from several mining sites in Southern China. In the calculation, a logistic dose-response model derived in a dose-response analysis relating liver and kidney cadmium level conducted by Ellis et al. is used. The model is presented as follows:

$$\ln \frac{p}{1-p} = 0.144 \times \text{KCd}(\text{mg}) - 5.53$$

where  $p$  denotes the probability of kidney dysfunction, and KCd represents the mass of cadmium in kidney. (Ellis, Yuen, Yasumura, & Cohn, 1984)

As suggested by China's Dietary Guidelines, the daily intake of grain by an adult aged 18 is about 200 to 300 grams, whereas the suggested daily intake of grain by a 65 years old adult is 200 to 250 grams (Chinese Nutrition Society, 2016). Considering that this is an average value, a value of 250g is used in the calculation.

Since renal dysfunctions are chronic and are often results of a long-term intake of cadmium, this calculation set tries to find the number of years it takes for certain probabilities of kidney dysfunction.

From data recounted by Hu et al., the calculated mean arithmetic means of rice samples collected from various mining sites is 0.325mg/kg (Hu, Cheng, & Tao, 2016). Therefore, the annual intake of cadmium would be

$$0.325 \frac{\text{mg}}{\text{kg}} \times 250 \frac{\text{g}}{\text{d}} \times \frac{1\text{kg}}{1000\text{g}} \times \frac{365\text{d}}{1\text{yr}} = 29.66\text{mg}$$

Among the 29.66mg of cadmium taken in by an average adult each year, about 6% of it is absorbed by the human body, and about 50% of it is deposited in the kidney. Therefore, the annual cadmium deposited in the kidney (AKCd) is

$$\text{AKCd} = 29.66\text{mg} \times 6\% \times 50\% = 0.890\text{mg}$$

The point of 50% probability is calculated. Let  $n$  denote the number of years the average Chinese adult consume such amount of rice annually. Then, the KCd value can be calculated by multiplying the number of years,  $n$ , and the annual kidney cadmium, KCd.

$$\text{KCd} = \text{AKCd} \times n$$

Substitute such association into the original model to obtain:

$$\ln \frac{p}{1-p} = 0.144 \times \text{AKCd} \times n - 5.53$$

When the probability of kidney dysfunction is 50% ( $p=0.5$ ), the equation can be written as

$$\ln \frac{0.5}{1-0.5} = 0.144 \times \text{AKCd} \times n - 5.53$$

Exponentiate both sides and solve for  $n$  to obtain

$$n = 43.1$$

Therefore, after 43.1 years of consumption of rice from mining sites, an average Chinese adult has a 50% probability of suffering from kidney dysfunction.

Following the same procedure, the number of years it takes to reach a 50% and 1% level probability of kidney dysfunction caused by the consumption of other rice samples containing different levels of cadmium are calculated. The results are summarized in the table below

Sample	Cadmium Concentration (mg/kg)	<i>n</i> (years), 50%	<i>n</i> (years), 1%
Mining Districts Average	0.325	43.1	7.3
Non-mining Districts Average	0.065	215.7	36.5
Randomly Selected Average	0.081	173.0	29.3
South China	0.064	219.4	37.1
Central China	0.059	238.5	40.2
Southwest China	0.062	225.9	38.3
North China	0.010	1422.3	237.2
Nationwide	0.050	280.3	47.4
Nationwide – <i>Japonica</i> rice	0.070	200.0	33.9
Nationwide – <i>Indica</i> rice	0.17	82.6	14.0
Nationwide – Non-contaminated areas	0.035	400.8	67.8
Maximum Concentration	1.96	8.05	1.2
Minimum Concentration	0.008	1753.6	296.4

**Table 2.** The number of years (indicated as *n* in the table) it takes for the probability of renal dysfunction to reach 50% and 1% through the concentration of rice.

### Calculation Set 2: Synergistic Effect of Cadmium & Other Heavy Metals

In practice, rice is often exposed to multiple contaminants when planted in fields. Among these sources of contamination, heavy metals other than cadmium including copper, zinc, lead, chromium, and mercury, are usually also present (Cao, et al., 2010). When consumed together with cadmium in foods, these heavy metals may act synergistically with cadmium in causing disease. In this calculation set, the synergistic effect is considered

when calculating the probability of kidney dysfunction resulting from the consumption and accumulation of cadmium in human body, using the same model as in the previous calculation set. However, due to obvious ethical issues, very few studies have used human subjects to examine such a synergistic effect. In this section, data from a study conducted by Chu and Chow is used in which the subjects of the experiment are *Caenorhabditis elegans*, a free-living nematode species. This study, focusing on the lethal concentration (LC) levels of several heavy metals for the nematodes, clearly revealed such a synergistic effect. Assuming that the relationship established also applies to human kidney dysfunction related to cadmium, it seems that when cadmium is combined with other heavy metals, the likelihood of having kidney dysfunction will be significantly higher. In fact, some genetic similarities between human and *C. elegans* have been discovered. According to a UCSB news report on the discoveries in a genetic analysis, “[p]ost-doctoral researcher Morris Maduro and Rothman found that there is a common regulator gene that controls the formation of many of the internal organs in both nematodes and vertebrates” (Gallessich, 2001). This suggests that the dose-response associations of cadmium poisoning constructed for nematodes may be, possibly to some extent, applied to humans.

As displayed in Chu and Chow’s study, the consumption of cadmium and copper together at the LC<sub>20</sub> benchmark of cadmium leads to a mortality rate of 100%, while the consumption of cadmium together with nickel at the same level leads to a mortality rate of 45% (Chu & Chow, 2002). Comparatively, zinc seems to have a neutralizing effect, making no significant change in the control mortality rate when consumed together with cadmium (Chu & Chow, 2002). In the following calculation, the conclusion is assumed to be equally true for human renal dysfunction as a consequence of cadmium intake. Therefore, it can be estimated that for the same intake of cadmium, the risk of kidney dysfunction is five-fold of the original value when this amount of cadmium is consumed together with copper at the same time.

To more directly illustrate the multiplication of probability, a new variable is introduced. Here, the synergistic *probability* factor  $k$  is defined as the proportion of mortality rate in the study when multiple metals are present to that of a single metal:

$$k = \frac{\text{mortality rate (Multiple metals)}}{\text{mortality rate (Single metal)}}$$

Thus, the original model can be rewritten in the general form

$$\ln \frac{0.5/k}{1 - \frac{0.5}{k}} = 0.144 \times \text{KCd}(\text{mg}) \times n - 5.53$$

In the specific case where cadmium and copper are consumed simultaneously, for example,



$$k = \frac{100\%}{20\%} = 5.0$$

For rice samples from mining sites, the AKCd value calculated from the arithmetic mean, as indicated in the previous calculation set, is 0.890mg. Thus, the number of years it takes to reach a probability of 50% for kidney dysfunction (when the synergistic effect is considered),  $n$ , can be solved for in the following equation:

$$\ln \frac{0.5/5.0}{1 - 0.5/5.0} = 0.144 \times 0.890 \times n - 5.53$$

Exponentiate both sides and solve for  $n$  to obtain

$$n = 26.0$$

Comparatively, when copper is not present, the number of years it takes to reach a risk of 50% is 43.2 years. This implies that for the same concentration of cadmium in rice, the time it takes to reach a probability of 50% for kidney dysfunction when copper is simultaneously consumed is only approximately 60% of the original value.

In order to more clearly quantify such synergistic effect, a new variable,  $T$ , or the synergistic *time* factor, is calculated. Here, the synergistic time factor  $T$  is defined as the ratio of the number of years it takes to obtain a probability of 50% for human kidney dysfunction with intake of multiple metals to that of with only intake of cadmium:

$$T = \frac{n \text{ (Multiple metals)}}{n \text{ (Cd Only)}}$$

Therefore, for the value calculated above, the synergistic time factor is

$$T = \frac{26.0}{43.1} = 0.603$$

Which accurately indicates that it takes only 60% of the original time to reach a probability of 50%.

The table below summarizes the number of years it takes to reach a probability of 50%,  $n$ ; the synergistic factor,  $k$ ; and the corresponding synergistic time factor,  $T$ , based on the rice sample used in the previous calculation.

Combination	Mortality rate (Combination)	Mortality rate (Cd Only)	$k$	$n$ (years)	$T$
Cd Only	20%	20%	1	43.1	1
Cd & Cu	100%	20%	5.0	26.0	0.603
Cd & Ni	45%	20%	2.25	33.4	0.775
Cd & Cu & Hg	70%	10%	7.0	23.1	0.536
Cd & Cu & Cr	75%	10%	7.5	22.6	0.524

*Table 3. The original data in the study and the corresponding values derived.*

## Discussion

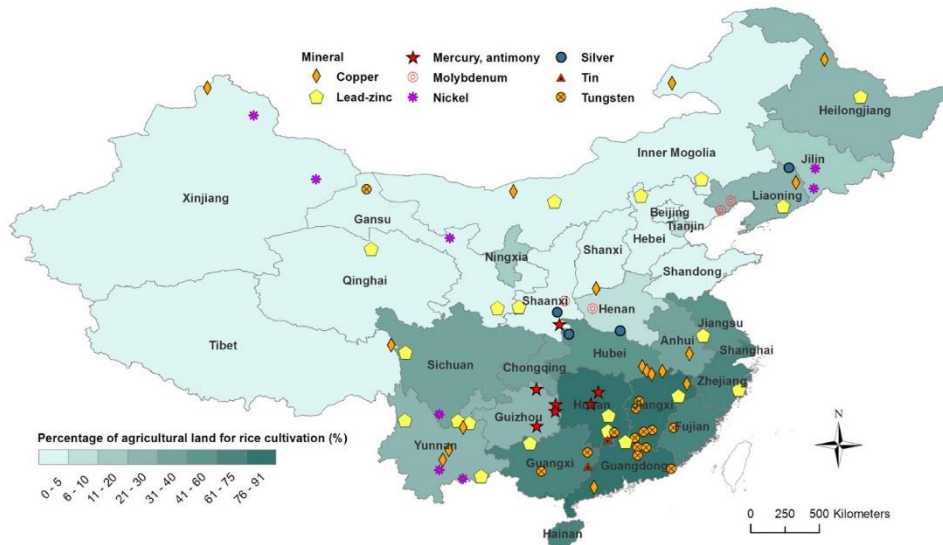
As the result of calculation set 1 indicates, the consumption of rice samples from mining sites in China in general leads to a significantly high risk of kidney dysfunction: on average, it takes 43.2 years to reach a risk of 50% if a suggested amount of rice is eaten every day. In the worst case, according to the data displayed in the work by Hu et. al, it takes only a little more than 8 years to reach that level of risk. In other words, approximately 50% of the population living in mining sites in China will suffer from irreversible kidney dysfunction resulting from the intake of cadmium-contaminated rice in about 43 years, and in the worst case, this will occur in 8 years.

On the other hand, in non-mining sites, the risk is significantly lower. It is estimated that the number of years it takes to obtain a 50% chance of kidney dysfunction is about 215 years, approximately five times of that resulting from the intake of rice samples from mining sites. In the best-case scenario, where the cadmium concentration is merely 0.008mg/kg, it takes more than 1700 years to arrive at a risk of 50%.

This dramatic difference can be explained by the fact that most mining sites are the major sources of cadmium emissions. Often present as a common impurity in zinc and copper ores (Agency for Toxic Substances & Disease Registry, 2012), cadmium is likely to be released into the environment during the process of smelting, thus polluting soil in paddy fields and water sources implemented for irrigation, leading to the existence of cadmium in rice. Therefore, the rural population living close to mining sites has a much higher danger of being exposed to cadmium through ingestion.

It should also be noted that among all regions referred to in the calculation, rice samples from Northern China contain the least amount of cadmium. This phenomenon can be attributed to the geographical distribution of mining sites and rice cultivation: whereas Southern China makes the most intense use of land for paddy fields in the nation, Northern China utilizes a much lower proportion of land for growing rice; Southern China, in

addition, also has a much greater quantity and density of mining sites (primarily tungsten and zinc-lead mines) than its Northern counterpart (Hu, Cheng, & Tao, 2016).



**Figure 4.** The distribution of mining sites and agricultural land for rice cultivation. Reprinted from “The Challenges and Solutions for Cadmium-contaminated Rice in China: A Critical Review,” by Yuanan Hu, Hefa Cheng, and Shu Tao, 2016, *Environmental International*, 92-93, p. 518. Copyright 2016 Elsevier Ltd.

Additionally, there is a noticeable disparity in the extent of contamination between two distinct species of rice. It is likely that the difference in the amount of water needed for growth, which may be explained by the extent to which cadmium is absorbed by the plant, the region in which they are grown, and other similar distinctions between the two species. In general, it is likely that such difference partly has its origin in certain physiological features of the two species, as bolstered by a study comparing cadmium level in different rice varieties conducted earlier by Morishita et. al (Morishita, Fumoto, Yashizawa, & Kagawa, 1987).

In Calculation Set 2, the fact that cadmium usually coexists with other common heavy metals such as copper, nickel, mercury, and chromium is considered when estimating the risk (Cao, et al., 2010). The results show an extremely strong synergistic effect when cadmium is consumed along with other metals. When cadmium is absorbed together with copper and chromium, the risk increases by an astonishing seven-and-a-half-fold. Even in the case of cadmium and nickel exposure, the best case presented, the risk still increases by approximately 2.25 times. The fact that these metals often present alongside cadmium and together create a strong synergistic effect further elevates the risk, which makes the adverse health effect brought by chronic intake of cadmium even worse than it first appears.

From the results of the two calculation sets displayed in the previous section, it is clear that paddy fields in China, especially in Southern China where land is extensively used for the cultivation of rice and mining sites assemble, are heavily contaminated by cadmium, posing a severe threat on the health of the Chinese population.

The two sets of calculations in the previous section are relatively simple, and excessively complicated concepts were not introduced in the process, making the results clear-cut and straight-forward. Calculation Set 1 explores and evaluates the risk of renal dysfunction through a wide variety of data including samples from different geographical regions and rice species, reflecting the underlying reasons that account for such difference in the results. In Calculation Set 2, the synergistic effect of various heavy metals is considered, enhancing the applicability of the predictions in real-life situations.

In the previous section, several seemingly confounding factors are not included due to the fact that according to previous studies, these factors have a rather minor or sometimes even negligible effect on the results. For instance, the method of cooking was not considered when data were processed and analyzed in the previous section. In fact, a study conducted by Shindoh & Yasui confirmed that there is only a minor reduction of 5% in the amount of cadmium in contaminated polished rice after cooking, which involves the process of washing, soaking, and finally, cooking the rice in a rice-cooker (Shindoh & Yasui, 2003).

Another seemingly confounding factor is age. According to Kido et. al, “[t]here is some controversy regarding the effect of age on Cd-induced health effects. With regard to renal dysfunction, age has two aspects that require consideration: normal progressive deterioration of the renal function, and Cd-induced renal effects due to increased body burden with the duration of exposure” (Kido T. , Shaikh, Kito, Honda, & Nogawa, 1993).

However, as proved by the studies conducted by Kido et. al, only the total amount of cadmium absorbed is significantly related to the risk of renal dysfunction, thus eliminating another seemingly confounding factor that can have a significant impact on the accuracy and validity of the results (Kido T. , Shaikh, Kito, Honda, & Nogawa, 1993).

With respect to policies, this research project can raise attention from both the general public and the government, partly because the results are relatively clear and straight-forward. After five years have passed since the first exposé of cadmium contamination in rice in Hunan Province, it is necessary for administrative departments of the government to conduct samplings of rice from the same and different regions to monitor and compare data, evaluating the effectiveness of the enforcement of related regulations. Small mining sites, in particular, are generally harder to be monitored and regulated because of their remote locations and the fact that they are primarily driven by profits, thus paying much less attention than large state-owned mines do (Hu, Cheng, & Tao, 2016).

There are some limitations in the calculations presented in the previous section. First, according to Ellis et. al, “[c]hanges in exposure conditions, uncertainty about the half-time of cadmium in the body, and differences in the inhalation and gastrointestinal absorption

rates permit only general approximations of the body burden” (Ellis, Yuen, Yasumura, & Cohn, 1984). Due to the fact that there are a wide variety of confounding factors and uncertainties, it is often difficult to derive a model that fits every individual. (Kjellström, Ervin, & Rahnster, Dose-response relationship of cadmium-induced tubular proteinuria, 1977) (Kjellström, Shiroishi, & P-E., Urinary  $\beta_2$ -microglobulin excretion among people exposed to cadmium in the general environment, 1977). Therefore, the predicted results are rather rough because of the relatively limited applicability of the model used in the calculations in more complex and diverse real-life populations.

Second, in Calculation Set 2, the data of the synergistic effects between cadmium and other heavy metals is obtained from a study focusing on such effects on *Caenorhabditis elegans*, a free-living nematode species. It is still unclear if these combinations of different heavy metals explored in the study conducted by Chow et. al will have the same extent of effects on humans. In fact, there has not been study proving that such effects also apply exactly to human beings as they apply to *C. elegans*. Further research is still needed to establish a model of synergistic effects for human beings, not through direct experiment with humans due to ethical issues but possibly through massive surveys or similar channels, or through inferences originating from the results of studies concerning a wide variety of different species.

In addition, a study conducted by Izuno et. al casted doubts on the validity of using rice as a dose for the dose-response relationship (Izuno, et al., 2000). In this study, researchers discovered that there are a variety of non-negligible confounding factors, and that renal dysfunction cannot be explained by the concentration of cadmium in rice alone, thus reaching the conclusion that rice may not be an appropriate “dose” to be utilized as an indicator (Izuno, et al., 2000). However, there are few existing literatures that address similar issues, thus it is not entirely clear whether rice can or cannot be used as a “dose” to project the risk of renal dysfunction. Nonetheless, in general, it is likely the method of using of cadmium concentration in rice to estimate the risk of renal dysfunction is relatively rough. Further study is still needed in order to more thoroughly evaluate the validity of implementing cadmium concentration in rice as an indicator of the probability of kidney dysfunction.

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# Spontaneous Micro-Expression Recognition

Zheyang Xiong

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## Abstract

Spontaneous Facial Micro-Expression Recognition is a huge challenge in Computer Vision due to its subtlety. Recently, several works have been proposed to implement feature-based approach in Micro-Expression Recognition. In this paper, we propose a Deep-Learning-based method that combines Convolutional Neural Network (CNN) and Long-Short-Term-Memory (LSTM) Network with Eulerian Motion Magnification for micro-expression recognition. The Eulerian Motion Magnification serves as a preprocessor that first magnifies facial micro-expression in video sequences; the CNN serves as a spatial feature extractor that extracts high-level spatial features for each frame in input video sequences; the LSTM learns temporal features from extracted spatial features and classify the expressions. We demonstrated that our proposed method can perform reasonably well and reach an accuracy of 68%.

## 1 Introduction

Human beings are well-versed in recognizing and classifying human facial expressions that other individuals pose – whether others are happy, sad, or surprised. Human beings, however, have trouble identifying spontaneous micro-facial expression. A spontaneous micro-expression is a subtle, instantaneous (1/3 to 1/25 second), unconscious, and subliminal expression that occurs when people encounter an unexpected event or try to conceal their real feelings to others. For example, if a criminal is questioned by prosecution and the criminal decides to tell lies, that criminal may show calmness to disguise his/her sense of fear and hide the truth. However, spontaneously and involuntarily, a quick facial expression of shock and fear would still reveal in the criminal's face, but it is too hard for human eyes to detect unless it is captured by a high-speed camera. Furthermore, even observing frame-by-frame, human experts can only achieve a 47% accuracy in recognizing

spontaneous micro-expression (Frank, 2009). Thus, it would be helpful for future face-related application if machines could learn and recognize these micro-expressions.

Machines, trained by machine learning techniques, have already achieved great success in recognizing deliberate facial expression – they have achieved an accuracy comparable to human eyes. However, spontaneous micro-expression recognition is more challenging because although machines can capture the micro-expressions, they are too subtle to be distinguished from other random fluctuation and noises in videos. Recently, several works have been proposed to improve micro-expression by using typical spatio-temporal descriptors, but Park, Lee, and Ro (2015) admit that these descriptors have low discriminating power if the expression is extremely subtle.

In this paper, we propose a method that combines Eulerian Motion Magnification and Deep Learning to recognize facial micro-expression. In our approach, we first magnify the facial micro-expression and make facial expression evident by using Eulerian Motion Magnification (Wu et al., 2012). After that, we will use the Convolutional Neural Network (CNN) as a feature extractor that extracts high-level spatial features and feeds them into a Long Short Term Memory (LSTM) Network that will then learn the temporal feature of expressions. Our method is tested on CASMEII dataset (Wang et al., 2017), a dataset consisting of 247 different videos of human facial micro-expressions, each categorized into one of five labeled emotions. Eventually, our approach produces a 68% accuracy.

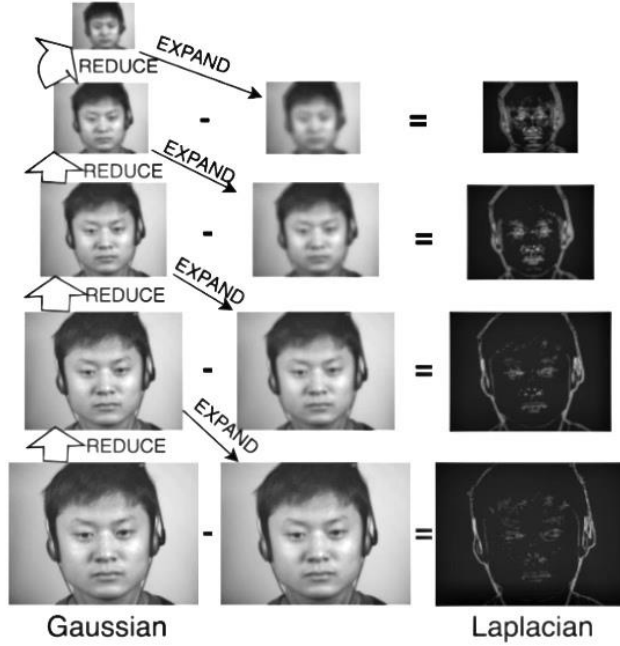
## **2 Background**

In this section, several background methods and structures will be introduced. In particular, the procedure of Eulerian Motion Magnification and usage of Deep Learning, including mechanisms of Convolutional Neural Networks and Recurrent Neural Networks, will be discussed in this Background section.

### **2.1 Eulerian Motion Magnification**

Since human eyes only have restrained spatio-temporal sensitivity (i.e., humans cannot realize a small change either in a small region or within a short time period), small variations like vibration on a running machine cannot be easily detected and recognized by human visual system. To address this issue, Wu et al. (2012) proposed a method called Eulerian Motion Magnification that can amplify subtle variations on a recorded video spatially and temporally. Their approach was founded on a *Eulerian* perspective in fluid dynamic system, which only focuses on how the properties of fluid (magnitude of velocity and direction of velocity) change over time. This approach significantly reduces computational burden – tracking the trajectories of particles and estimating their motion – that occurs in Lagrangian Motion Magnification (Liu, Torralba, Freeman, Durand, & Anderson, 2005), which is inspired by *Lagrangian* perspective,

where each particle is viewed individually and independently. Eulerian Motion Magnification involves two steps: spatial processing and motion magnification as seen in 2.1.1 and 2.1.2.



**Figure 1.** Example of a Gaussian pyramid and a Laplacian pyramid. The images have been resized for display – the original size of images in each level should be half of that in the level below.

### 2.1.1 Spatial Processing

The first step of Eulerian Magnification is to process video spatially. To achieve this, Wu et al. (2012) first decompose the video sequence into different frequency bands by using a Laplacian pyramid (Burt & Adelson, 1983), as is shown in **Figure 1**. To form a Laplacian pyramid, we first need to form a Gaussian Pyramid.

Suppose an image  $g_0$  has  $c$  columns and  $r$  rows of pixels. This image  $g_0$  is the bottom of the Gaussian pyramid, which is the zero level of the pyramid. In order to reach the level 1 of the pyramid, we need to average the values in level 0 in a  $n \times n$  window. This down-sampling process is achieved by the REDUCE function:

$$G_l = REDUCE(G_{l-1}). \quad (1)$$

For example, for a Gaussian pyramid of  $N$  levels where  $0 < l < N$ ,  $0 \leq i < c$  and  $0 \leq j < r$ , and with a window size of  $5 \times 5$

$$G_l(i, j) = \sum_{-2}^2 \sum_{-2}^2 w(m, n) G_{l-1}(2i + m, 2j + n), \quad (2)$$

where  $w(m, n)$  is a weighted kernel

$$w(m, n) = w(m)w(n) \quad (3)$$

and

$$w(m) = \left(\frac{1}{4} - \frac{a}{2}, \frac{1}{4}, a, \frac{1}{4}, \frac{1}{4} - \frac{a}{2}\right) \quad (4)$$

where  $a$  is chosen from 0.3 to 0.6.

Using the REDUCE function, we may obtain a Gaussian pyramid that contains different sizes of the original image. In order to obtain a Laplacian pyramid with  $L_l$  on  $l$ -th level, we need to use the EXPAND function on Gaussian pyramid.

$$L_l = G_l - EXPAND(G_{l+1}) \quad (5)$$

where the EXPAND function is defined as

$$EXPAND(G_{l+1}(i, j)) = 4 \sum_{-2}^2 \sum_{-2}^2 w(m, n) G_{l+1}\left(\frac{i-m}{2}, \frac{j-n}{2}\right). \quad (6)$$

After decomposing the original image into different frequency bands, a temporal filtering – using Fourier Transform – will be applied to each frequency band and extract frequency bands of interests. This helps us extract the motion we want to magnify. For example, if we want to magnify heart rate on the neck, which is about 1.25 hertz, we can only extract frequency bands of interest within 1 hertz to 1.5 hertz and ignore other frequencies.

### 2.1.2 Motion Magnification

To amplify motion, Wu et al. (2012) utilize first-order expansion of the Taylor series to magnify frequency bands of interest.

Let  $I(x, t)$  represent the image intensity at position  $x$  and time  $t$ , and  $\delta(t)$  be the motion displacement function. The intensities, thus, can be expressed as  $I(x, t) = f(x + \delta(t))$  and  $I(x, 0) = f(x)$ . With an amplification factor  $\alpha$ , we derive our equation for synthesized signal:

$$\hat{I}(x, t) = f(x + (1 + \alpha)\delta(t)) \quad (7)$$

Using the first-order Taylor series expansion, the equation (7) can be approximated as:

$$I(x, t) \approx f(x) + \delta(t) \frac{\partial f(x)}{\partial x} \quad (8)$$

Next, let  $B(x, t)$  be the result of applying a broadband temporal band-pass filter to  $I(x, t)$ :

$$B(x, t) = \delta(t) \frac{\partial f(x)}{\partial x} \quad (9)$$

Consequently, the result of synthesizing amplified band-pass filtering processed signal and original signal is:

$$\hat{I}(x, t) = I(x, t) + \alpha B(x, t) \quad (10)$$

$$\approx f(x + (1 + \alpha)\delta(t)) \quad (11)$$

With this equation, we can magnify our spatial displacement function  $\delta(t)$  to a

magnitude of  $(1 + \alpha)$  on the frequency bands of interest. Then, we add the magnified signal to the original frequency bands and collapse the pyramid to obtain the final output.

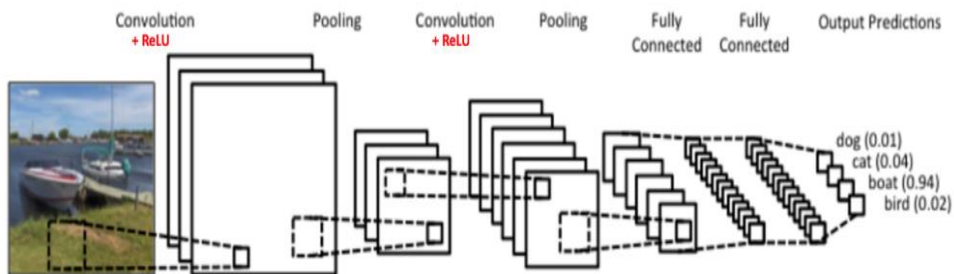
## 2.2 Deep Learning

Deep Learning is a state-of-the-art technique for Machine Learning, especially in recognition and classification tasks. Recognition and classification are tasks that humans are capable of, which involves classifying different data, such as images, statistics, and text, into different classes (categories) depending on their features. For example, when we see a banana, we know that it is a banana because it has a curved shape, a color of yellow, and a smooth texture. We know these features we recognized are what a banana has, so we classify that object as a banana. This process, recognition and classification, is analyzed by our brains. Similarly, Deep Learning can also tell if an object is a banana. This is done by the utilization of neural networks, an architecture with layers of interconnected nodes that simulates our brains.

There are many types of neural networks, and each of them corresponds to a different task. For example, Convolutional Neural Networks (Lecun, Bottou, Bengio, & Haffner, 1998) are used to analyze large data like images, and Recurrent Neural Networks (Mikolov, Kombrink, Burget, Cernocký, & Khudanpur, 2011) are used to process and learn sequential data like text, speech, and frames of a video. CNN and RNN will be introduced in subsequent subsections (2.2.1 and 2.2.2).

### 2.2.1 Convolutional Neural Networks

A Convolution Neural Network is a biological-inspired model that processes information on images, and it is widely used in Computer Vision. CNN usually consists of multiple layers, including input layers, convolution layers, pooling layers, fully-connected layers, and output layers. Each layer plays a different role in an image's feature learning and visual classification. An example is shown in *Figure 2*.



*Figure 2.* An Example of CNN by (Clarifai Inc, 2016).

### 2.2.1.1 Input Layer

In the first layer – input layer, a raw image will be read as a matrix with size of  $R^{H \times W \times D}$  where  $H$  stands for height,  $W$  for width and  $D$  for depth. Normally a color image has three color channels – Red, Blue, and Green, so  $D$  has a size of 3.

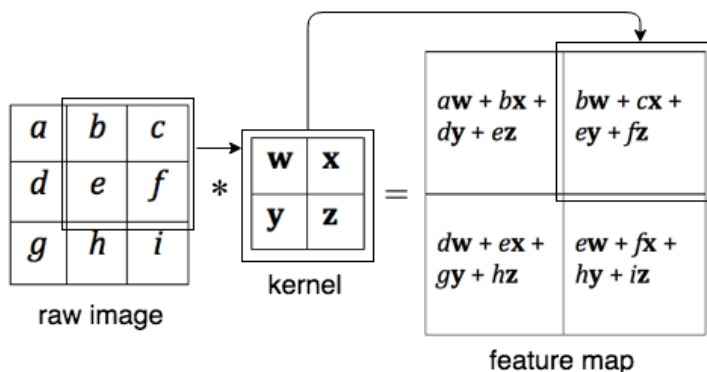
### 2.2.1.2 Convolution Layer

The convolution layer primarily uses the convolving operation. It slides a learned kernel, a 2-D matrix that includes weights  $W$ , spatially over the inputs and computes dot products to form the feature map. In other words, the convolution layer matches the kernel with region in the input that has the same size as the kernel, computes the dot product to form a pixel on the output (the feature map), moves the kernel left a pixel or down a pixel corresponding to the input, and repeats this process to compute the next pixel on the output. A convolution process is roughly shown in **Figure 3**. A pixel in the feature map could be calculated by

$$p_{i,j} = f(x * W + b), \quad (12)$$

where  $p_{i,j}$  is the value of pixel at location  $i$  – th row and  $j$  – th column in the feature map,  $x$  is the receptive field corresponding to kernel  $W$  and bias  $b$ , while  $f$  is the activation function, such as sigmoid, ReLU, and tanh to prevent over-fitting.

A complete CNN may have different kernels that can detect different kind of features, such as vertical edges, horizontal edges, and curved edges. Sometimes padding will be used to prevent information loss since the resulting feature maps will be smaller than previous feature maps or images. Padding can also help the pixels at the corners of feature maps to be efficiently used. There are many ways to pad an image, and the most common way is to pad zeros on the outside of a feature map or image.



**Figure 3.** This figure shows a process of 2-D convolution. Boxes are drawn to indicate how the upper-right pixel in feature map is formed by applying a kernel to the upper-right region in raw image. Activation function and bias are not illustrated in this figure.

### 2.2.1.3 Pooling Layer

In the next stage, a pooling function is utilized to sub-sample the pixels in feature maps. This function is applied in a pooling layer, where each pixel from previous feature maps is replaced by a statistic summary of nearby pixels. The most common pooling functions are the max pooling function, which involves replacing a rectangular region with their maximum value, and average function, which involves averaging the values of a rectangular region. In all cases, according to Goodfellow, Bengio, and Courville (2016), pooling layers would cause the representation to become approximately invariant to small translation of the input. This means that the pixels in the pooling layer will not change significantly if we translate the object in the input image by a small amount. Therefore, it is extremely useful in the classification task because we care more about the existence of a feature than its location.

### 2.2.1.4 Fully-connected Layer and Output Layer

A fully-connected layer is usually a layer that connected to last pooling layer, and it is a vector feature with size of  $R^{N \times 1}$  where  $N$  is number of pixels in previous pooling layer. In this layer, all pixels (neurons) are connected to the final output layer (or another full-connected layer) for classification. The features in the last fully-connected layer will pass through a softmax function to the final output layer, where probabilities of various classes are represented.

### 2.2.1.5 Loss Functions Back-propagation

In the last fully-connected layer, a cross-entropy loss is defined to measure how far the prediction differs from ground-truth classification. A cross-entropy loss function in softmax layer is given by

$$L = \frac{1}{D} \sum_i L_i, \quad (13)$$

where  $D$  is the number of training set and

$$L_i = -\log \left( \frac{e^{s_{yi}}}{\sum_j e^{s_{yj}}} \right). \quad (14)$$

Thus, by minimizing this loss function (i.e., minimizing negative log likelihood of correct class), we can maximize the positive log likelihood of the correct class.

In order to more accurately learn the features from input layer and classify them, we need a mechanism that constantly updates the weights  $W$  and bias  $b$  in each kernel of CNN. To optimize weights that fit for classification (that is, to minimize the loss function), we need a technique called gradient descent to update these weights. The formula for gradient descent is generally

$$W_t = W_{t-1} - \alpha \frac{\partial L}{\partial W}, \quad (15)$$

where  $t$  is current number of iteration and  $\alpha$  is the learning rate (i.e., how far each step should go before reaching the minimum of loss function).

To understand this formula, we suppose we are walking on a mountain. The current altitude could represent the loss in the loss function, and since we are trying to minimize the loss, we want to find a location where altitude is the lowest. The gradient  $\frac{\partial L}{\partial w}$  now denotes the change in altitude with respect to the change in location, which is the value that illustrates how decline the current location is – the slope. In this scenario, gradient descent indicates that if we want to reach the location with minimum altitude, for each step we walk, we need to walk towards the direction opposite to the direction where the altitude increase (or in other words, to walk downward, towards the direction where altitude decline). The learning rate  $\alpha$  determines how long each step should be; each step should not be too big because we may stride over the minimum location and climb on another mountain within one step; each step should also not be too small, otherwise it would take a long time for us to reach the location with lowest altitude. Thus, by walking downward the mountain with an appropriate length of step, we can reach our new location where the minimum altitude is closer to us.

In CNN, gradients and weights in each layer are calculated and updated, respectively, through a back-propagation procedure:

1. Calculate gradient  $\frac{\partial L}{\partial y_l}$  l-th layer where  $y_l$  is the output in l-th layer,
2. Using the chain rule, propagate gradient back to the previous layer and calculate  $\frac{\partial L}{\partial y_{l-1}}$ :  $\frac{\partial L}{\partial y_{l-1}} = \frac{\partial L}{\partial y_l} \times \frac{\partial y_l}{\partial y_{l-1}}$ ,
3. Compute gradient of  $L$  with respect to weights  $w_l$ :  $\frac{\partial L}{\partial w_l} = \frac{\partial L}{\partial y_l} \times \frac{\partial y_l}{\partial w_l}$ ,
4. Update weights in this layer using gradient descent,
5. Repeat the same procedure to all previous layers.

Before training, weights in CNN are set with random values. However, after sufficient epochs of training, the loss  $L$  will eventually converge to its minimum where weights (kernel) in CNN are updated to efficiently extract and classify features. For example, suppose a CNN is trained to classify images of cats and dogs, and after training, kernels inside convolution layers are able extract features like body shape, fur's texture, and ear's size into feature maps. Weights in the fully-connected layers, on the other hand, learned how the existence of different features help the classification. Certain features on an image can increase the probability of this image to be a cat or a dog: if this animal has striped fur, it is probably a cat, or if this animal has large ears, it is probably a dog.

### 2.2.2 Recurrent Neural Network

Recurrent neural network is an architecture that can learn features of sequence, such as

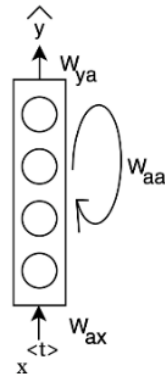


speech, text, and video sequence. A traditional RNN is shown in **Figure 4**. An RNN cell has following recurrence equations:

$$a^{<t>} = g(W_{aa}a^{<t-1>} + W_{ax}x^{<t>} + b_a)$$

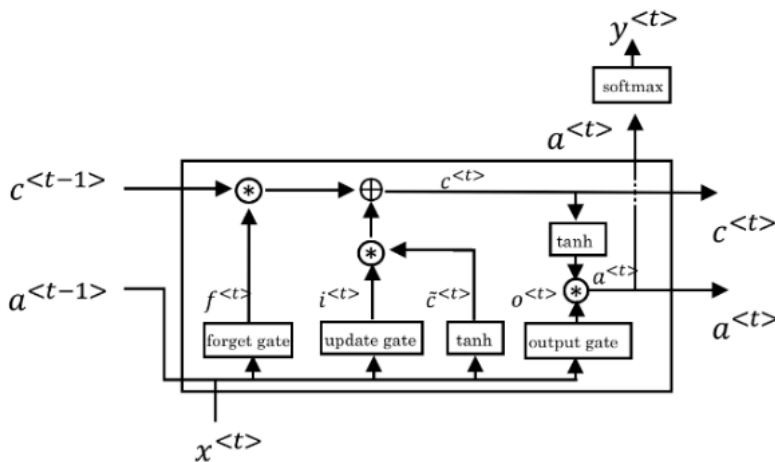
$$\hat{y}^{<t>} = g(W_{ya}a^{<t>} + b_y),$$

where  $g$  is an activation function,  $x^{<t>}$  is the input (the  $t$ -th element in input sequence),  $a^{<t>}$  is the hidden unit in RNN unit, and  $\hat{y}$  is the output for time  $t$ . The input is a sequence  $\{x^{<1>}, x^{<2>}, \dots, x^{<T>}\}$  with length of  $T$ .



**Figure 4.** A diagram of an RNN cell.

Though RNN has proven to have strong performance in some text generation and speech recognition, it is hard for RNN to learn a long-term sequence feature because of vanishing gradients and exploding gradients in a very deep RNN. Thus, the element earlier in the sequence may not affect the final output of RNN due to the lack of long-term memory.



**Figure 5.** A diagram of a LSTM unit by (Andrew Ng, 2017).

Long-Short-Term-Memory (LSTM) unit, an improved recurrent neural network cell, provides a solution for this kind of problem because it specifically let LSTM when to dropout previous hidden states and update hidden states on new input element.

A LSTM unit is shown in **Figure 5**. The equations (Andrew Ng, 2017) in LSTM are defined as:

$$\begin{aligned}\tilde{c}^{<t>} &= \tanh(W_c[a^{<t-1>}, x^{<t>}] + b_c) \\ \Gamma_u &= \sigma(W_u[a^{<t-1>}, x^{<t>}] + b_u) \\ \Gamma_f &= \sigma(W_f[a^{<t-1>}, x^{<t>}] + b_f) \\ \Gamma_o &= \sigma(W_o[a^{<t-1>}, x^{<t>}] + b_o) \\ c^{<t>} &= \Gamma_u \times \tilde{c}^{<t>} + \Gamma_f \times c^{<t-1>} \\ a^{<t>} &= \Gamma_o \times c^{<t>}\end{aligned}$$

where  $\sigma(x) = (1 + e^{-x})^{-1}$  and  $\tanh(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$ . Besides having a hidden unit, a LSTM cell also includes memory cell  $c^{<t>}$ , forget gate  $\Gamma_f$ , update gate  $\Gamma_u$ , and output gate  $\Gamma_o$ . The memory cell  $c^{<t>}$  will provide some memory of early features; the update gate  $\Gamma_u$  will determine if  $\tilde{c}^{<t>}$ , a new candidate for memory cell, will be added to new memory cell  $c^{<t>}$  or not, and the forget gate  $\Gamma_f$  will determine if  $c^{<t>}$  will still keep old memory cell  $c^{<t-1>}$  or not. Thus, LSTM could learn to selectively forget its previous useless memory or adapt useful new inputs. For example, if LSTM is asked to fill in a sentence – “Peter is a boy; he \_\_\_ to play basketball” – LSTM will know that the blank should be a singular verb. This is because after training, the memory cell inside LSTM will notice that the word “is” in the first part of sentence indicates the verb in the second part of the sentence to be in singular form.

LSTM has now become a prevalent sequence model and widely used in sequence learning, such as text understanding, speech recognition, and human activity recognition.

### 3 Related Works

#### 3.1 Micro-expression Databases

In the last several years, numerous works and methods have been proposed to detect and recognize human micro-facial expressions. In the early stage, only dataset for posed micro-expressions existed, which can easily be detected and recognized. Thus, datasets for spontaneous micro-facial expressions, such as SMIC (Li, Pfister, Huang, Zhao, & Pietikäinen, 2013), CASME (Yan, Wu, Liu, Wang, & Fu, 2013), and CASME II (Yan et al., 2014) in **Table 1**, were built to fill this gap. The datasets are produced by recording the face of the subject who is watching different kinds of videos. The subjects in those datasets are asked to hide their true feeling and avoid exaggerating their facial reaction, so their micro-facial expressions are spontaneous both spatially and temporally.

Database	SMIC	CASME	CASME II
Samples	164	195	247
Fps	100	69	200
Resolution	640×480	1280×720	640×480
#Emotions	3	8	5

*Table 1. Spontaneous Micro-expression datasets*

### 3.2 Feature-based Micro-expression Recognition

Since it is hard for humans to recognize any facial changes in micro-expressions, in recent years, several micro-expression recognition methods have been created based on extracting facial features, such as LBP, HOG, and HIGO. Those different types of features are then passed through different classifiers to get the prediction result.

#### 3.2.1 LBP-TOP Based

Local Binary Pattern histograms from Three Orthogonal Planes (LBP-TOP) (Zhao & Pietikainen, 2007) is a spatio-temporal texture that is extracted from facial dynamic feature. Pfister, Li, Zhao, and Pietikäinen (2011) first implement this LBP-TOP as a local feature descriptors for micro-expression recognition. It extracts the histograms from (XT, YT, XY) planes of the video sequence and combine them into a single histogram. The Temporal Interpolation Model (TIM) is also used to get adequate frames as input and helps the feature extraction more statistically stable because micro-expression only happens with a small number of frames. The extracted feature is then trained with SVM, MKL, and RF to classify the resulting micro-expression.

#### 3.2.2 HOG Based

Histograms of Oriented Gradients (HOG) (Dalal & Triggs, 2005) is also a type of feature that is often used as feature descriptor in micro-expression recognition. This method first calculates the local gradient and magnitude from each pixel of the image. Then, a histogram of oriented gradients is computed.

### 3.3 Deep Learning Based Micro-Expression Recognition

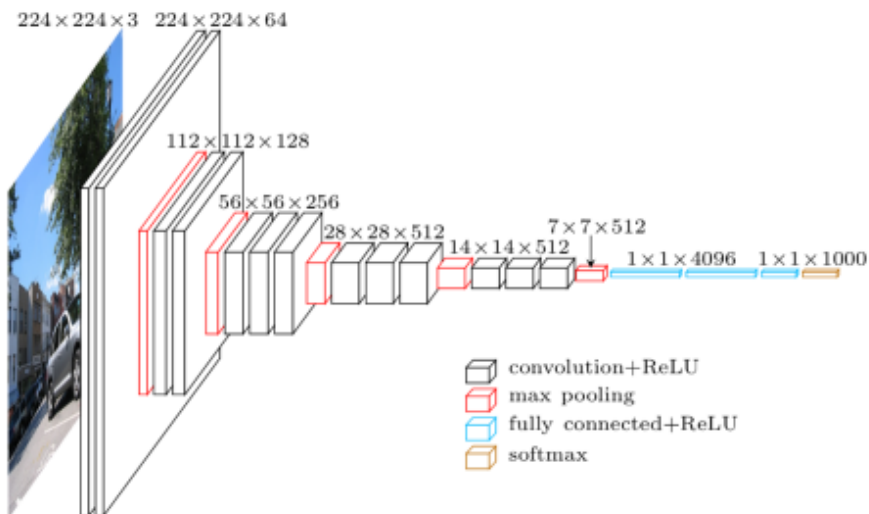
Several early works employed deep neural networks to detect and classify micro-expression. An early work utilized deep learning to learn spatio-temporal feature (Kim, Baddar, & Ro, 2016). This network employed CNN to encode different spatial features of micro-expressions at different expression-states, including onset, onset to apex, apex, and apex to offset. LSTM are then used to learn temporal characteristics with different states.

Another recent early work utilized a Dual Temporal Scale Convolutional Neural Network (DTSCNN) for micro-expression expression (Peng, Wang, Chen, Liu, & Fu, 2017). This DTSCNN is a two-stream network, and different streams of framework were used to adapt different frames of video sequences. The network used optical flow sequences as input, which ensured the shallow networks can acquire higher-level features.

### 3.4 VGG Network

VGG networks (Simonyan & Zisserman, 2014) are kinds of Convolutional Neural Network that are widely used in image recognition. Researchers use VGG Network that already pre-trained (i.e., the weights inside VGG are already updated by previous training) on ImageNet, a large image database for recognition (Deng et al., 2009). The pre-trained model can be a good extractor that extract different levels of features from different layers (e.g., output from latter convolution layer should yield high-level features of images.)

VGG networks have both VGG-16 and VGG-19, which has sixteen and nineteen weight layers, respectively, and they both achieve an accuracy of approximately 90%.

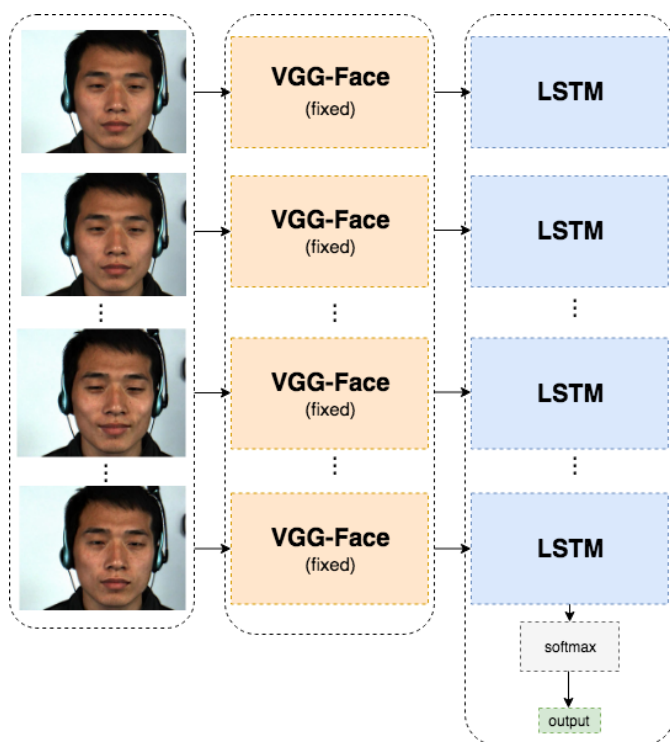


**Figure 6.** An architecture of VGG-16 (Davi Frossard, 2016). VGG-16 consists of 11 convolution layers and 5 pooling layers.

## 4 Proposed Method

This work proposes a network architecture that combines a static CNN with LSTM. CNN serves as a hierarchical visual feature extractor that extracts features from frames of video sequences and provides high-level spatial features for LSTM to learn temporal features in video sequences.

Before extracting features, our approach also provides an optional preprocessing that magnify micro-expression using Eulerian Motion Magnification described in section 2.1. Because spontaneous micro-expression is very subtle, it is very hard to recognize even with human eyes. Applying motion magnification on video sequences beforehand would amplify the magnitude of facial movement, and facial changes in video sequences would be visible and detectable, which would help later temporal learning to some extent.



**Figure 7.** An architecture of our proposed network with CNN combined with LSTM.  
The expression in input sequence is magnified.

**Figure 7** roughly depicts the architecture of our approach with videos that are magnified as inputs. This network utilizes a pre-trained VGG-Face model (Parkhi, Vedaldi, & Zisserman, 2015), which is a VGG network that has already stored suitable weights to extract important features from human faces since it was trained on a large-scale Labeled Faces in the Wild (LFW), a database consists of human faces for face detection (Huang, Ramesh, Berg, & Learned-miller, n.d.). Each frame of a video sequence will first pass through this feature extractor, VGG-Face. Thus, important spatial features for faces are extracted to feed LSTM in later temporal learning. The output features that feed into LSTM is a 512-length feature vector,  $\phi(x^{<t>})$ , from the last pooling layer. In addition, since VGG-Face requires a  $224 \times 224 \times 3$  input, all frames are preprocessed and resized to this size.

On the next stage, we use LSTM to learn temporal features of video sequences. LSTM requires a 3-dimensional input (samples, timesteps, features) where timesteps is the number of frames in each sample. Because our dataset, CASME II, has videos with different frames, we zero-pad each video sequence to make the input to be size of (247,120, 512). This zero-padding will not affect LSTM temporal learning because it will ignore the zero-padded features. LSTM will learn parameters  $W$  for each timestep and only output  $y_i$  in the last timestep for  $i$ -th sample video. The output  $y_i$  will pass through a fully-connected layer and finally a prediction  $P(y_i)$  is computed with softmax function:

$$P(y_i = k | X = x_i) = \frac{e^{s_k}}{\sum_j e^{s_j}} \quad (16)$$

where  $y_i$  is the prediction,  $k$  is the label (different emotions),  $X$  is all sample videos,  $x_i$  is the  $i$ -th sample,  $s_k$  is the probability assigned to the label  $k$ , and  $s_j$  is the  $j$ -th element of the vector of class scores  $s$  – unnormalized probabilities of classes.

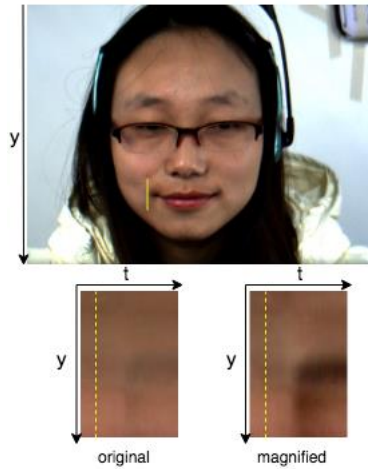
In the training stage, the VGG-Face will be fixed, and we only update weights in LSTM. The loss function is defined as the same as equation (13) and (14), and we train our network using stochastic gradient descent. In stochastic gradient descent, minibatches of video sequences are selected from training samples, and with back-propagation, gradient  $\nabla L$  with respect to all parameters  $W$  for minibatches are computed for updating new parameters.

## 5 Results and Evaluation

### 5.1 Expression Magnification

Before each video enters the VGG-Face feature extractor, it will pass through a preprocessing that magnify the facial micro-expression by Eulerian Motion Magnification. In *Figure 8*, the effect of motion magnification on micro-expression is shown. The magnified video sequence shows a larger change, which is caused by the magnified smile of the subject.

In motion magnification, if the amplification factor  $\alpha$  is too large, an artifact effect (see *Figure 9*) will appear in video, which will thwart both spatial feature extraction in CNN and temporal learning in LSTM. To address this issue, we select the amplification factor to be 15; we also select the range of frequency of interest to be from 0.05 hertz to 0.1 hertz.



**Figure 8.** Result of motion magnification on Micro-expression under a magnification factor of 15. The yellow line in the upper picture indicate the segment that is picked for examination. Two graphs with time  $t$  as horizontal axis and yellow segment as vertical axis are shown.

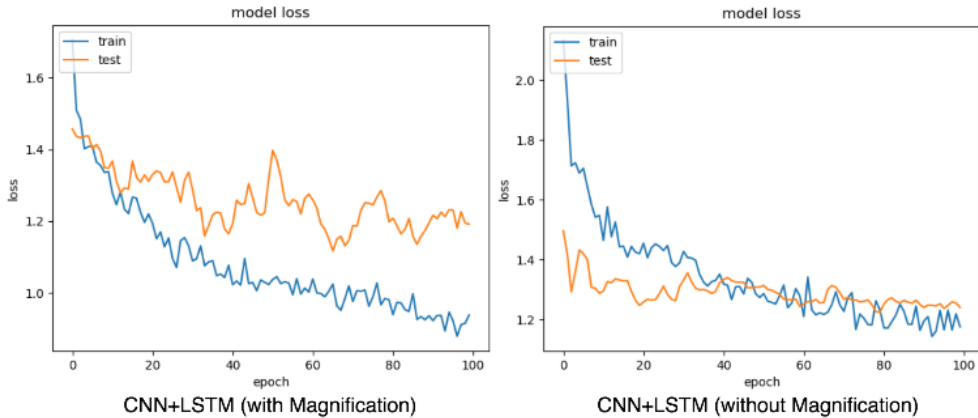


**Figure 9.** Artifact effect after motion magnification

## 5.2 Models

In training the models, we randomly split 247 videos into two sets – the training set and the test set with a ratio of 9:1 (i.e., 222 videos in training set and 25 videos in test set). The training set is only used for training models while the test set, containing data that models haven't learnt, is used for testing models.

We train both models – model with magnification as a preprocessing and model without magnification – on a Nvidia K80 GPU processor. **Figure 10** illustrates the training loss and test loss (validation loss) on both models during a 100-epoch training.



**Figure 10.** The training losses on both models – CNN+LSTM with magnification and CNN+LSTM without magnification – converge at the end of 100 epochs. The test loss on CNN+LSTM without magnification did not change much while that on CNN+LSTM with magnification did converge.

The accuracies of our methods and other methods that use Deep Learning are shown in Table 2.

Method	Accuracy
DTSCNN (Peng, Wang, Chen, Liu, & Fu, 2017)	66.7%
ELRCN (Khor, See, Phan, & Lin, 2018)	52%
CNN-LSTM (Kim, Baddar, & Ro, 2016)	61%
VGG-Face+LSTM (ours)	64%
VGG-Face+LSTM with Mag (ours)	<b>68%</b>

**Table 2.** Accuracies of our methods and previous methods that used Deep Learning.

## 6 Discussion

As is shown in Table 2, our method outperforms other methods that also use Deep Learning. We believe that there are two advantages in our model that help our method outperforms others'.

The first advantage is the utilization of the VGG-Face model. As is revealed in Table 2, although Kim et al. (2016) also used CNN-LSTM architecture, their CNN is used for training. Since the dataset is small, their CNN did not develop fully to extract features of human faces. On the contrary, our method uses a pre-trained VGG-Face as a feature extractor that has already learned how to extract human faces' feature.

The second advantage is the employment of Eulerian Motion Magnification. By preprocessing with this technique, facial micro-expressions are magnified and become significant. Thus, when learning temporal features, LSTM easily notices these magnified



facial expressions thereby achieving a higher accuracy.

However, there are still limitations in our method. One of the limitations is the small sizes of the dataset. Because there are only 247 videos in CASME II dataset, Deep Learning may not exert its full capability in micro-expression recognition because in most cases, the larger the dataset is, the better Deep Learning will perform. A few methods that use Support Vector Machine as a classifier actually outperform our method. For example, Wang et al. (2017) use an SVM that learns LBP-TOP features achieve an accuracy of 75.3%.

Another limitation is the resulting artifact effect from the Eulerian Motion Magnification. Although we've chosen the fittest parameters in motion magnification, artifact effects still exist in some videos, and this may disturb both feature extraction and temporal learning.

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# The Transformation of Hip Hop Music Lyrics in China under Political Censorship from 2017 to 2018

Baoyan Ye

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## Abstract

In the summer of 2017, a reality competition show The Rap of China became extremely popular, bringing Chinese hip hop music from underground to mainstream in a span of two months. At the beginning of 2018, however, the rising hip hop music in China encountered a crackdown from a ban issued by the State Administration of Press, Publication, Radio, Film and Television despite huge public controversy. Considered distasteful by the bureau, the entire music genre could have collapsed under enforced rules. However, effected by this sudden change, the rappers within the industry sought to develop new lyrical styles in mainly two ways to survive in such political circumstances. Some, represented by GAI<sup>1</sup>, have blended traditional poetic Chinese language and dialects with an original hip hop music style as a form of cultural continuation. Another contingent of rappers has started conveying messages of “positive energy,” a concept advocated by the state since 2012, and stopped writing lyrics with political implications. As part of my methodology, I analyze lyrics from 11 songs, both in Chinese and English translation.<sup>2</sup> Hip hop music in China has transformed itself expeditiously into a more distinct musical style as a result of the political ban.

## 1. Introduction of the Historical and Political Context

In this part, I introduce the practice of political censorship in music in the U.S during the Cold War, and how this practice was utilized in mainland China as various music genres emerged and evolved after the Cultural Revolution ended.

<sup>1</sup> The names of rappers mentioned in this paper may be their real pinyin Chinese names or their English stage names.

<sup>2</sup> Complete song texts and English translations are available at:  
<https://adayebyandchinesehiphop.blogspot.com/>

The practice of government censorship is neither a relatively new phenomenon, nor is it tied specifically to the Communist political party. Censorship has been widely applied historically around the globe even in western capitalist countries that are normally perceived as “freer” than others. It refers to the prohibition of some parts or the whole part of any media that are considered inappropriate in a contemporary context. This inappropriateness varies from obscenity and politically unacceptable content, to perceived threats to national security. The extent of censorship application varies across countries.

A typical example of censorship in music as a result of political concerns happened in the U.S during the Cold War era with the urban folk music revival. In the post-World War II era, confronted with the threat of expanding communism in Asia and Europe and the increasingly dominant power of the Soviet Union, fear of communist regimes and espionage activities plotted by the USSR was aggravated, leading to the rise of McCarthyism. This practice of making accusations of treason without proper evidence or procedures was named after Senator Joseph McCarthy, who claimed that he had a list of Communists who worked in the State Department in a speech in February 1950.<sup>3</sup> His appearance marked an era of intensified campaigns aimed at spreading the fear of communism; one of the targets of the campaign was the entertainment industry, part of which was the music industry.

Folk music was especially impacted by McCarthyism. Following the commercial success of The Weavers (with Pete Seeger), with songs such as

*“Good Night Irene,” “Tzena Tzena” and “So Long” climbing to the top of the charts, political forces suppressed them and the urban folk revival more generally, partially because of its advocacy for civil and labor rights. The House Un-American Activities Committee subpoenaed folk musicians to testify, claiming, for instance, that one of the most renowned bands, the Weavers, had Communist ties. Musicians started to lose jobs and performance opportunities due to right-wing political pressure, which also led to the withdrawal of artists from the political arena<sup>4</sup>.*

Pete Seeger was one of the folk musicians who were subpoenaed to testify, but instead of making accusations, he said, “I am not going to answer any questions as to my association, my philosophical or religious beliefs or my political beliefs, or how I voted in any election, or any of these private affairs. I think these are very improper questions for

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<sup>3</sup> Griffith, Robert. *The Politics of Fear: Joseph R. McCarthy and the Senate*. University of Massachusetts Press, 1987, pp. 49-50.

<sup>4</sup> Johnson, Steven. *The New York Schools of Music and Visual Arts John Cage, Morton Feldman, Edgard Varèse, Willem De Kooning, Jasper Johns, Robert Rauschenberg*. Routledge, 2011, pp. 113-130.

any American to be asked, especially under such compulsion as this.”<sup>5</sup> His refusal to name political affiliations led to an indictment of contempt of Congress, and later he was sentenced to ten one-year terms in jail<sup>6</sup>. Personal objection and preference gave way to political values in this case. In such political circumstances, it seemed that any organized social thoughts that differed from the right-wing or government stance were dangerous, as noted by *Possibilities*, a contemporary journal devoted to art issues: “Once the political choice has been made, art and literature ought of course to be given up.”<sup>7</sup> This summary might not be an appropriate depiction of the situation of art after the mid-1970s in the U.S; however, it remains as a core value behind mainland China’s censorship policies. The crisis that folk musicians faced in the 1950s was similar in certain ways to the development of hip hop music in mainland China, the main subject of this paper.

Two years after the Cultural Revolution ended in 1976, China was welcoming a wave of “emancipation of mind” (解放思想)<sup>8</sup>, first stated by Deng Xiaoping, the paramount leader of China who initiated the Chinese economic reform. He used this term in his speech given to the Central Working Conference of the Communist Party of China, a pivotal meeting prior to the 3rd Plenary Session of the 11th Central Committee of the Communist Party of China, during which Deng outmaneuvered Hua Guofeng, the former leader, and initiated his reform. He said, “if we don’t break the petrification of mind, if we don’t emancipate our cadres and people’s mind, there’s no hope for the four modernizations.”<sup>9</sup> His attitude indicated that mainland China was beginning to open up and accept foreign economic and cultural influences rather than sticking to its original economic and ideological path. However, because the ideological reversion led by the party was overly drastic, a large proportion of party members were unable to shift their opinions, leading to skepticism towards newly emerged cultural and artistic phenomena. Apart from this, though censorship was loosened to a large extent, cadres responsible for it remained fearful of making political mistakes, as the result of it would be horrible as demonstrated in the Cultural Revolution. Consequently, until 1989, mainland China’s popular music

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<sup>5</sup> United States, Congress, Cong. House, Committee on Un-American Activities. House.

“Investigation of Communist Activities, New York Area. Hearings before the United States House Committee on Un-American Activities, Eighty-Fourth Congress, First Session, on Aug. 17, 18, 1955.” U.S. G.P.O., 1955, pp. 2447–2459. 84th Congress, 1st session, document

<sup>6</sup> Wilkinson, Alec. *The Protest Singer: An Intimate Portrait of Pete Seeger*. Vintage Books, 2010.

<sup>7</sup> Robert Motherwell and Harold Rosenberg, “Editorial Statement,” *Possibilities* 1 (1947/48): 1. This passage is reprinted in Ann E. Gibson, *Issues in Abstract Expressionism: The Artist-Run Periodicals* (Ann Arbor, Mich.: UMI Research Press, 1990), 239.

<sup>8</sup> The content inside the parentheses are translations, not citations.

<sup>9</sup> Deng, Xiaoping. “解放思想 实事求是 团结一致向前看.” (Emancipate the Mind, Seek Truths from Facts, Look Ahead in Unity) *People.com*, People’s Daily, 29 Dec. 2000, [www.people.com.cn/GB/channel1/10/20000529/80792.html](http://www.people.com.cn/GB/channel1/10/20000529/80792.html).

experienced a development that was full of twists and turns but ultimately a path towards a more open attitude to outer influences, more innovations and increasing popularity.

The song “Love for the Hometown” by Li Guyi (李谷一), released in the last day of 1979, reflected the transition of censorship in music in mainland China. The song became extremely popular immediately after it was released on CCTV, the authoritative TV channel. However, it soon faced attacks from conservative officials who criticized Li as “a decadent voice” and “a voice that will destroy the country” (亡国之音). It is said that an unnamed party leader criticized the song directly in a central conference. Though the song doesn’t reflect romantic love, it was considered by some as reflecting the corrupting western bourgeois lifestyle. In fact, the song just uses a singing technique different from the “high, fast, loud, rigid” (高, 快, 响, 硬) styles that were utilized during the Cultural Revolution.<sup>9</sup>

Despite criticism, whenever Guyi performed, the audience would passionately request her to sing this banned song. People’s enthusiasm for the song reached its peak at the 1983 Spring Festival Gala, the most important TV event of the entire year in China.<sup>10</sup> That night, the venue set up four telephones to accept audiences’ calls to order songs. According to Noon News, “Shortly after the gala began, a girl that was responsible for noting down the songs, with a plate full of notes that ordered ‘Love for the Hometown’ in hand, walked to Huang Yihe (the production director).” Huang said, “if banned things are on TV, especially on the Spring Festival Gala, that’d be a monstrous crime. One’s political life will have problem.” That night, Minister of Radio, Film and Television, Wu Lengxi, was on the venue. Huang told the girl to ask Wu. She brought the first plate to Wu; Wu said no; she then brought the second, the third... Wu started to sweat, then he stomped, made up his mind and said, “Play the song, Huang!” The ban was officially lifted from that moment.<sup>10</sup>

The twisting destiny of “Love for the Hometown” reflects the evolution of Chinese pop and underground music. The rules were cyclically loosened and tightened under the sole control of the State Administration of Radio and Television. When new music genres that included political artistic messages emerged, such as rock in the 1990s, censorship regarding them was tightened and rock musicians like Cui Jian, known as the father of Chinese rock music, were banned on TV. Similarly, hip hop music in 2017 encountered the intensification of censorship rules, as will be discussed in the next section. The enforcement and lifting of censorship used to be a seesaw battle between the liberal reformists and the conservative leftists. Today, such tension still exists; meanwhile, the administration establishes itself as being responsible for mental guidance for ordinary Chinese people, aiming at cultivating their moral values and complying with the Communist Party regime.

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<sup>10</sup> Li, Nan. “李谷一唱《相恋》被高官点名批评.”(Li Guyi was criticized by a high official for singing “Love for the Hometown”) 新闻午报(Noon News), 21 Apr. 2008.

## 2. Hip Hop Music in China

Hip hop is a music genre that came into existence in the U.S during the mid-1970s. It was first acknowledged in Chinese music in Taiwan in the early 2000s, with the rise of rappers like MC Hotdog. Later, Rap, a component of hip hop music, was applied successfully by some pop music artists, as represented by Jay Chou (周杰伦), who gained tremendous popularity in the mid and late 2000s in not only the Taiwan Island but also mainland China. His album *Jasmine* excelled in mainland China, with an official sale of 2.6 million units, which no other Chinese singers had attained.<sup>11</sup> However, hip hop music remained non-mainstream, and pure hip hop music rarely had commercial success until 2017.

The fact that hip hop music was not beloved commercially by popular audiences was attributed to the following reasons. First, the lyrics, in a considerable proportion of cases, include sexual, violent, or indecent content that was not welcomed in mainstream culture. Second, Chinese pop music listeners were accustomed to slow melodic love songs, or “Chinese ballad” (华语芭乐), which achieved dramatic commercial success after 2000, and therefore were naturally resistant to unconventional musical expressions. Despite lack of popular attention, underground hip hop music scenes, and, later, labels emerged simultaneously in various metropolises across China, especially in the western part. Since the early and mid-2010s, labels including GOSH from Chongqing municipality, CDC (说唱会馆) from Sichuan province, and Triple H (红花会) from the city of Xian have been established and are recognized as the top three hip hop music labels nationally today. But generally, hip hop music remained underground until the summer of 2017.

In that season, a Chinese rap competition show, *the Rap of China*, created by iQiyi, stormed China. The show invited three producer groups, which are similar to judges but which also guide rappers through the competition: former EXO member as well as rapper-singer Kris Wu; Taiwanese singer Will Pan; and the duo of MC Hotdog and rock musician Chang Chen-yue. A considerable number of famous rappers participated in the show, including PG One and BrAnT.B from Triple H, GAI and Bridge from GOSH, TY from CDC, and Tizzy T from Yo Nation.<sup>12</sup> The most notable participant was the idol of many Chinese rappers, HipHopMan, aka Jin Au-Yeung, the first Asian American rapper to be signed to a notable U.S record label and who won seven freestyle battles in a row on the program 106&Park.<sup>13</sup> Despite the concern that hip hop is a sub-culture, the show was

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<sup>11</sup> Fung, Anthony Y. H. “Western Style, Chinese Pop: Jay Chou's Rap and Hip-Hop in China.” *Asian Music*, vol. 39, no. 1, 2007, pp. 69–80., doi:10.1353/amu.2007.0047.

<sup>12</sup> Che, Che, director. *Rap of China*. iQiyi, 2017, [iqiyi.com/v\\_19rr7454c8.html#curid=702050900\\_69a532de6d1c02f5595acd96124302e3](http://iqiyi.com/v_19rr7454c8.html#curid=702050900_69a532de6d1c02f5595acd96124302e3).

<sup>13</sup> “106&Park.” Performance by Jin Au-Yeung, Freestyle Friday, BET, 2002, [youtube.com/watch?v=KqwYE7\\_G5Gw](https://youtube.com/watch?v=KqwYE7_G5Gw).

unexpectedly a stunning commercial success: within four hours after the first episode was released, the hits had reached 100 million<sup>14</sup>. “Do you have freestyle?” became the top one buzzword of the year 2017 according to a survey conducted by People’s Daily<sup>15</sup>.

Eventually, at the beginning of September 2017, the final episode was released, and surprisingly, the show announced joint winners, GAI and PG ONE, as a result of the draw of the final round of voting. After the competition, hip hop music formally entered the mainstream culture with a dramatically increasing number of fans. Several contestants were signed to major record labels. Some strong competitors rejected the contracts but still gained significant performing opportunities on larger stages. The previously ignored hip hop music seemed finally to unfold its splendor in Chinese mainstream culture. In its heyday, however, the whole industry was suddenly devastated by the ban from the State Administration of Radio and Television.

The prelude of the ban was simply the discovery by some entertainment news media outlet of a secret love affair between one of the winners, PG One, and a renowned married movie star, Li Xiaolu. On December 29<sup>th</sup>, 2017, an unnamed media source divulged in a video that Li Xiaolu slept at PG One’s house and left at 8 a.m. the next day; on the same night, Li Xiaolu’s husband Jia Nailiang, also a famous movie star, was doing a live show at home, and when he was asked about his wife’s location, he responded that Li was getting a haircut.<sup>16</sup> The event immediately became the most heated topic at the beginning of 2018. PG ONE and Li Xiaolu soon faced severe criticism from the public for disloyalty, as Jia had called for his fans to vote for PG ONE in the final round of *The Rap of China* and treated him as a real brother; but none of the organizations associated that with the hip hop music industry until January 4<sup>th</sup>. That day, an authoritative monthly magazine of the Communist Party of China, Tower of Violet Light (紫光阁 Zi Guang Ge), denounced the lyrics of PG One’s song “Christmas Eve” for vulgarity, obscenity and promotion of drugs on Weibo, the largest social platform similar to Twitter in China with 400 million users<sup>17</sup>. The line “With pure white powders walkin’ on the floor, I roll with my homie” was especially the target of attack as pure white powders refer to ketamine powder. “I ride on her shoulders, exhausting

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<sup>14</sup> Rap of China. “Weibo.” Weibo, 25 June 2017, [weibo.com/iQiyiTheIdol?is\\_all=1](http://weibo.com/iQiyiTheIdol?is_all=1).

<sup>15</sup> People's Daily. “Weibo.” Weibo, 11 Dec. 2017, [weibo.com/rmr?refer\\_flag=1001030101\\_&is\\_all=1](http://weibo.com/rmr?refer_flag=1001030101_&is_all=1).

<sup>16</sup> Sina Entertainment. “曝 PGONE 圣诞节夜访李小璐家 贾乃亮当日在外拍戏.”(PGONE visited Li Xiaolu’s home at Christmas, Jia Nailiang was shooting a film that day) Sina, 1 Jan. 2018, [ent.sina.com.cn/s/m/2018-01-01/doc-ifyqefvw9573778.shtml](http://ent.sina.com.cn/s/m/2018-01-01/doc-ifyqefvw9573778.shtml).

<sup>17</sup> Tower of Violet Light. “[Instigate teenagers to take drugs and humiliate women in public! You’re onto something big bro!] Recently, some netizens have reported that PG ONE instigates teenagers to take drugs and humiliate women in his song Christmas Eve. As a public figure, he should guide teenagers online with correct values and spread positive energy, not the opposite! If “Pure white powders are” really “walking on the floor”, then he has broken the law!” Weibo, 4 Jan. 2018, [weibo.com/u/5467852665?refer\\_flag=1001030101\\_](http://weibo.com/u/5467852665?refer_flag=1001030101_).



my fuels and singing Jingle Bells. She says I'm too strong. That dazzling masculine is like her love King Kong" was controversial as well for its vivid sexual depictions that were unacceptable to the usually conservative Chinese audience. In the following two days, the Central Committee of the Communist Young League (Jan 4<sup>th</sup>)<sup>18</sup>, Xinhua Net (Jan 5<sup>th</sup>)<sup>19</sup>, and People's Daily (Jan 6<sup>th</sup>)<sup>20</sup>, all authoritative media of the party, supported Tower of Violet Light on Weibo.

After Tower of Violet Light voiced its criticism, however, the official media noted that fans of PG ONE misrecognized the magazine as a restaurant that used illegal oil.<sup>21</sup> According to Xinhua Net<sup>22</sup>, in defense of their idol rapper, these fans bought a trend<sup>23</sup> on Weibo through Taobao, an online shopping site in China, titled "Tower of Violet Light's illegal cooking oil". To show their contempt of PG ONE, thousands of netizens topped this

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<sup>18</sup> The Central Committee of the Communist Young League. "[Warning: This song possibly instigates teenagers to take drugs!] Recently, some netizens have reported that the song "Christmas Eve" instigates teenagers to take drugs and humiliate women. Public figures should be the exemplary figure and guide teenagers online with correct values. If "Pure white powders are" really "walking on the floor", then he has broken the law. #Teenager online quality class#" Weibo, 4 Jan. 2018,

[weibo.com/p/1001063937348351/home?profile\\_ftype=1&is\\_all=1#\\_0](http://weibo.com/p/1001063937348351/home?profile_ftype=1&is_all=1#_0).

<sup>19</sup> Xinhua Net. "#Xinhua insight# [Even if you don't want your name to be imperishably glorious, you shall try not to be infamous in history] Vulgarly isn't personality; infamy isn't an exchange for capital. Singing lyrics that "instigate teenagers to take drugs and humiliate women", this singer doesn't respect the industry and the audience, and can't spread "peace and love". Even if he had won some kind of competition, he doesn't deserve the stage of hip hop. We should of course say no to those who provide platforms to spread vulgarity. You can dream to earn fame, but don't play to die." Weibo, 5 Jan. 2018, [weibo.com/2810373291/FCUT5hBlm?type=comment#\\_rnd1534918620354](http://weibo.com/2810373291/FCUT5hBlm?type=comment#_rnd1534918620354).

<sup>20</sup> People's Daily. "[#Hello, tomorrow#] Singer PGone is trapped by pressure from the public opinion because of his lyric controversy. After Year One of hip hop, how should China embrace hip hop culture? Reflecting direction is a more immediate concern than criticizing individuals. Encouraging youngsters to express their passion of youth is definitely part of freestyle, but promoting vulgarity and violence certainly isn't. Besides being good at saying everything, Rap idols should be good first and foremost. Rap should be about life, be real, not really vulgar." Weibo, 6 Jan. 2018, [weibo.com/rmr/b?refer\\_flag=1001030101\\_&is\\_all=1](http://weibo.com/rmr/b?refer_flag=1001030101_&is_all=1).

<sup>21</sup> Tower of Violet Light (紫光阁) is an authoritative magazine, but its name can also be taken as a restaurant in Chinese.

<sup>22</sup> Xinhua Net. "Weibo." Weibo, 8 Jan. 2018, [weibo.com/p/1002062810373291/home?profile\\_ftype=1&is\\_all=1#\\_0](http://weibo.com/p/1002062810373291/home?profile_ftype=1&is_all=1#_0).

<sup>23</sup> The Weibo has a ranking list of the most frequently searched phrases that is displayed to the users. Phrases that are on the list are called "trend" (热搜). It cannot be truly confirmed whether Weibo trend can be bought.

trend by satirizing PG ONE under the same title. Tower of Violet Light then responded humorously on January 7<sup>th</sup>.

*"#Tower of Violet Light illegal cooking oil# got the trend? How should I deal with this "negative" news? 1, delete comments? But that would cause the news to be even more heating and place myself in a passive situation! 2, pretend that I didn't see this? But silence wouldn't prove myself clean, and instead would be perceived as silently resigned! 3, clarify immediately? But you will never wake up those that are pretending to sleep! I'm just a little babe that can only tremble in the Tower of Violet Light restaurant!"<sup>24</sup>*

As a result of the pressure from "above", three days before the "Tower of Violet Light illegal cooking oil" event, PG One had already posted on Weibo that "in my early stage of hip hop career, I was influenced deeply by African American music and had a misunderstanding of the core positive value. I apologize for this." and that "I've removed all of my songs from online music stores and will re-release them after being approved"<sup>25</sup> on January 4<sup>th</sup>. Therefore, after the trending event, the heated discussions and controversy surrounding PG One were gradually quelled. Other rappers' commercial performances had not been affected; on January 12<sup>th</sup>, GAI, the other winner of *Rap of China*, participated in one of the most prominent music competition shows, *Singer 2018* and competed with other renowned singers who came out from the underground in less than a year. Meanwhile, VAVA, one of the top four rappers of the *Rap of China*, had been invited to *Happy Camp*, the most popular Chinese variety show that has been airing for 21 years.

On January 18<sup>th</sup>, the tide suddenly turned against hip hop rappers. It was said by some user-operated media that GAI was forced to quit the competition, and VAVA's and his faces were removed from their respective shows. Soon the news was confirmed implicitly by the staffers of the two rappers. On the next day, Sina Entertainment formally announced that the head of one of the sub-ministries of the State Administration of Radio and Television, Gao Lisi, stated a new ban during a regular meeting that required TV channels to utilize four "don't use" criteria when inviting guests: don't use those that are immoral or disloyal to the party; don't use those that are vulgar; don't use those that are low in styles or state of mind; don't use those that have scandals and moral issues. It was clearly ruled that tattooed, hip hop, sub-cultural, or decadent artists should not appear in mainstream TV channels.<sup>26</sup> Undergoing this change, all hip hop musicians lost their opportunities to

<sup>24</sup> Tower of Violet Light. "Weibo." Weibo, 7 Jan. 2018, [weibo.com/u/5467852665?refer\\_flag=1001030101\\_](http://weibo.com/u/5467852665?refer_flag=1001030101_).

<sup>25</sup> PG One. "Weibo." Weibo, 4 Jan. 2018, [weibo.com/pgone?refer\\_flag=1001030101\\_&is\\_hot=1](http://weibo.com/pgone?refer_flag=1001030101_&is_hot=1).

<sup>26</sup> An, Dong. "总局提出节目嘉宾标准:格调低纹身嘻哈文化不用." (SART Raised Program Guest Criteria: Don't use low, tattooed and hip hop guests) Sina Entertainment, 19 Jan. 2018, [ent.sina.com.cn/tv/zy/2018-01-19/doc-ifyquptv7935320.shtml](http://ent.sina.com.cn/tv/zy/2018-01-19/doc-ifyquptv7935320.shtml).

perform on larger stages, to be seen by more audiences across China through mainstream TV channels, or to be reported and interviewed by major media. GAI's song "The Sea Laughs" was removed from the music store; his existence was eliminated even in the first episode after Hunan TV's edition, and all performance videos of this song were blocked one after another even though some video site users persistently tried to upload them. This ban led to a massive boycott on all major media platforms, including but not limited to Weibo, WeChat, a social app with over a billion users, and Zhihu, a question-and-answer site that is similar to Quora with 30 million users. Despite that, hip hop music was unable to find a place for enough significant exposure to the public as a result of the ban. In this political circumstance, hip hop music in China, which was already undergoing a slight transformation, was motivated to further transform under political censorships. According to Zheping Huang, a reporter for Quartz, rappers were "cleaning up their lyrics" in fear of authorities.<sup>27</sup> However, he did not extensively investigate the following transformation of Chinese hip hop music as a result of political interference. This change will be discussed in detail in the next two sections, along with the change in the second season of *Rap of China*.

### 3. Rappers' Lyrical Innovations: Poetry and the Localization of Hip Hop

In a discussion of the New Taiwanese Song Movement, Liao Ping-hui argues that musicians in the post-martial law period in Taiwan, a rapidly developing economic entity that was however marginalized by other countries, were "strongly desirous of transnational codes and technologies"<sup>28</sup> that indicated their more active participation in the global order. Therefore, as well as an attempt to cast off "the shackles of Mandarin monolingualism . . . artists associated with New Taiwanese Song endeavored to create music that was stylistically diverse and reflective of the island's unremitting hybridity, merging popular Western and traditional Taiwanese song forms in compositions that sounded simultaneously cosmopolitan and local, modern and traditional."<sup>29</sup> As a pioneering contingent of artists that used Chinese-associated dialect rapping in the Chinese music circle, Taiwanese artists successfully re-established their recognizable cultural identity through the integration of western influences in their localized music.

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<sup>27</sup> Huang, Zheping. "Chinese Rappers-Fearful of Authorities-Are Cleaning up Their Lyrics." Quartz, Quartz, 19 Jan. 2018, [qz.com/1183806/chinese-rappers-fearful-of-authorities-are-cleaning-up-their-lyrics/](https://qz.com/1183806/chinese-rappers-fearful-of-authorities-are-cleaning-up-their-lyrics/).

<sup>28</sup> Ping-Hui Liao, "Postmodern Literary Discourse and Contemporary Public Culture in Taiwan," *boundary 2* 24.3 (Autumn 1997): 57–58.

<sup>29</sup> Schweig, Meredith. "Hoklo Hip-Hop: Resignifying Rap As Local Narrative Tradition In Taiwan." *Chinoperl*, vol. 33, no. 1, 14 July 2014, pp. 37–59., doi:10.1179/0193777414z.00000000016.

Hip hop musicians in mainland China in recent years share a similar concern with their Taiwanese antecedents. Most Chinese have been taught that China had been one of the most advanced countries for at least three thousand years until the Qing dynasty. They are eager to completely revive the nation after falling behind western civilization in the past three hundred years, experiencing disastrous revolutions, wars and domestic violence resulting in hundreds of millions of deaths. Since the Chinese economic reform started in 1978, the government, led by the party, has brought the country unprecedented economic growth: from 1978 to 2017, Gross Domestic Product per capita had increased fifty-fold from 156.4 USD to 8827 USD.<sup>30</sup> Accompanying dramatic economic growth and eradication of poverty are inequality, domestic cultural interactions with foreign influences, and similar to Taiwan during the pro-martial era, a desire to seize a reputable place on the global cultural stage, on which the mainlanders had been absent for half a century.

When hip hop music was imported to China, the first major adaptation was the combination of the Chinese and English languages in lyrics; simple English words or short sentences, such as “homie”, were inserted in Chinese sentences, such as “从天上来的 flow, 都来自我的手”, which means “Flow from the sky all comes from my hand.” Apart from this common practice, there are generally two paths for hip hop musicians. The first path stems from that mentioned desire, and attempting to satisfy it, some musicians, such as rappers from Triple H, create Chinese hip hop music in western conventions. They sing about lifestyles similar to the lifestyles of their western counterparts, apply as many advanced western music techniques as possible, and pursue flows with various complex rhyming. In this way, their music can be accepted both globally and domestically by Chinese audiences that have been exposed to western cultures for over 20 years. They believe such music would ultimately internationalize Chinese hip hop music and bring music of higher taste to Chinese audiences who have been listening to “ballads” that are considered falling behind other countries in terms of music tastes.

Some musicians diverge from this path, believing that instead of fully incorporating western elements, Chinese musicians should create something of their own and that this is the only way to establish an imperishable Chinese cultural identity in the global market. One way to achieve that is the unprecedented wide use of dialect rap in every major city or area with hip hop scenes, including but not limited to Chongqing, Sichuan, Sinkiang, Shanghai, Beijing and Harbin. Another relatively small contingent of musicians, represented by C-Block from Changsha, apply a distinct traditional Chinese concept of Jiang-Hu, literally rivers and lakes, in their rapping. Jiang-Hu, which shares a similar aspect with the U.S gang culture, refers to a sub-society of rebels and adventurers, usually with Kung Fu, that live outside the existing law and practice a moral principle, “Xia”(侠) or chivalry. It is a

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<sup>30</sup> World Bank. “GDP per Capita (Current US\$).” GDP Growth (Annual %) | Data, data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=CN.

world commonly depicted in Chinese fiction, films and TV series and yearned for by most Chinese when they are young. As GAI summarized in the documentary “Trap in the Southwest”, he wanted to make C-Trap, or China-Trap, because “you should sing things from where you come from” as “there’re lots of things that you can’t learn” if singers sing things from other places.<sup>31</sup> Whether it is dialect or Jiang-Hu, they are concepts that originated only in China.

## GAI

The two winners of *Rap of China* precisely embody the two paths, and GAI gained particular controversy as he rose to the public attention with his catchy Chongqing-dialect slogan of “this is fog town”<sup>32</sup>. The songs he performs in the show include dialect gangsta rap (“Hotpot Soup Packet” and “the Soul of Chongqing”) and Jiang-Hu style dialect rap (One Hundred and Eight, Empty-City Strategy, Song for the Mortals and Ascetic Monk). Because of his highly distinct performing style, some rappers and even the producer (judge) Kris Wu mistook his style as a way of singing folk songs from the mountains (山歌)<sup>33</sup>. Despite that, his attempt was positively acknowledged by professional critics, including Ear Emperor (耳帝), a critic recognized by renowned Chinese singers like Tia Yuan and Jane Zhang on Weibo with 10 million fans.<sup>34</sup> But generally, during the competition stage, GAI was exploring the possibilities of his music.

After signing a major contract with mainstream producer Liu Zhou, GAI successfully fit into the mainstream under censorships by abolishing indecent words in lyrics and participating in music TV shows like King of Mask Singer and “I want to go to the Spring Festival Gala” show. Liu’s cooperation with GAI had a clear intention as shown in his announcement of the foundation of his independent label Door&Key. He said, “We will make hip hop that belongs only to the Chinese and present it on the international stage” and “we want to explore how hip hop could survive in China and an international expression of Chinese stories and culture.”<sup>35</sup>

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<sup>31</sup> Starman, Billy, director. Trap in Southwest. Trap in Southwest, Noisey, 2017, noisey.vice.cn/read/trap-in-southwest-part-1.

<sup>32</sup> Fog town, or Wu du, refers to Chongqing.

<sup>33</sup> Wu, Kris. “Rap of China.” Season 1, episode 10, 26 Aug. 2017, iqiyi.com/v\_19rr88aopg.html

<sup>34</sup> Ear Emperor. “#2017 Top 10 Live Shows# Top 5: GAI/BooM/Chang Chen-Yue/MC Hotdog ‘Song for the Mortals.’” Weibo, 30 Dec. 2017, weibo.com/eargod?is\_all=1&stat\_date=201712#feedtop.

<sup>35</sup> Liu, Zhou. “Weibo.” Weibo, 7 Nov. 2017, weibo.com/u/2726435621?profile\_ftype=1&is\_all=1&is\_search=1&key\_word=door#\_0.

Their production, “The Sea Laughs”, on the stage of the first episode of Hunan TV Singer 2018 that was released on January 12th was never disappointing. The song was ranked 3 out of 8 among the competition between 8 reputable singers, including Jessie J, Wang Feng (a pioneering rock singer) and Angela Chang. It immediately won accolades from mass media, the audience and professional music critics. Within three days, the hits of the performance video had reached 100 million.<sup>36</sup> The advent of this song reveals a new direction that rappers can follow, a perfect combination and interaction of Jiang-Hu elements, ancient Chinese poetry and hip hop. An excerpt of the lyrics is as follows:<sup>37</sup>

何处笙箫	<i>Where is the melody</i>
琴声入鞘	<i>Chin<sup>38</sup>'s beautiful sound flows into the sheath</i>
我以黄河水蘸墨挥毫	<i>I paint the world with the Yellow River as my ink</i>
可路正遥 今生如刀	<i>But the road is faraway. Life is like a sword.<sup>39</sup></i>
若一晌喝醉看我未老	<i>I'd never grow old with a liquor.</i>
要海阔天高	<i>Beyond the vast ocean and sky,</i>
高声大笑	<i>I laugh</i>
笑过勾销	<i>Wiping out</i>
恩怨 妄念 贪恋 再逍遥	<i>Gratitude, resentment, desires and retrieving my freedom</i>

The first part of the first verse, as shown above, perfectly integrates the ideal chivalry spirit and Chinese poetic languages with hip hop. The second part of this verse is as follows:

翻开你人生的简历	<i>Flipping through your life resume</i>
发现你啥子都没得	<i>You found yourself with nothing</i>
该如何看待你自己	<i>How should you think of yourself?</i>
时间该咋个切支配	<i>How should you manage your time?</i>

<sup>36</sup> w 三月莺时 w . “Weibo.” Weibo, Hunan TV Singer, 15 Jan. 2017, [weibo.com/u/3907840724?is\\_all=1&stat\\_date=201801&page=7#\\_rnd1534925826546](https://weibo.com/u/3907840724?is_all=1&stat_date=201801&page=7#_rnd1534925826546).

<sup>37</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/gai-sea-laughs.html>. All translations of lyrics are from my blog, <https://adayebyandchinesehiphop.blogspot.com/>, which also contains additional translated songs that might be useful in understanding some rappers' previous careers. Please read the introduction of the blog first before reading the lyrics:

<https://adayebyandchinesehiphop.blogspot.com/2018/08/important-introduction-of-blog.html>

<sup>38</sup> Chin is a seven-stringed traditional Chinese instrument with poetic and beautiful connotations.

<sup>39</sup> See Appendix on translation of lyrics.

是哪些人混不下去 *Who can't persevere*  
土豆吃起去下力 *Having a potato and keeping working*  
选哪条路都不好走 *Neither path is smooth*  
啥子命我都不抗拒 *I embrace all kinds of destinies.*

Here GAI sings in dialect as an ordinary Chinese worker or a farmer who is struggling for a decent life. Then comes the part that indicates the core theme of the song:

我命硬学不来弯腰  
*I never learn to succumb!*  
一山还要比一山高  
*There's always a more splendid view after I surmount this mountainous barrier!*

GAI does not rap in a normal manner, but instead sings in a similar tone to traditional Chinese folk songs in which farmers or workers encourage themselves when working tiredly through cadent shouting. With these features, this song is already an amazing production, while the next lyric stuns the audience from a brand-new angle.

天 地 人 和 [The] Heaven. [The] Earth. [The] Human. [The] Harmony.

These four words in English are literally one word in Chinese with four symbols inside. This Chinese word captures the essence of Daoism, a fundamental Chinese philosophy that highlights harmony with nature and has been practiced by numerous scholars and poets throughout history. When GAI sings out that one word separately in the same tone as in the former part, he is voicing not only as an ordinary Chinese worker but also as a philosopher who seems to understand the principle of the world. Ear Emperor commented that in the performing video when GAI powerfully shook his head and sang, he felt that he saw “an invisible flagon flying away from his body, towards the clouds and the seas. At that moment I was stoned, and I suddenly forgot what those four words were.” He concluded that this version of “The Sea Laughs” combines “the natural, unrestrained Chinese chivalry with the ordinary’s earthliness... You feel like he’s part of the immense universe but also from the bustling streets.”<sup>40</sup>

With the sudden enforcement of censorship, the song was removed from the episode and every online music store in China. However, from this exploration GAI and his team realized that such a style would gain popularity and meanwhile retain the original sense of Chinese culture when blending it with hip hop. When the ban was released, immediately his team removed other gangsta rap songs, such as Hotpot Soup Packet, which was released after the *Rap of China*, from major music sites to avoid criticism from the conservative officials. Songs that blend Chinese cultural elements with hip hop were retained. In the following months, GAI was prompted to further move towards his Jiang-Hu path.

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<sup>40</sup> Ear Emperor. “GAI ‘The Sea Laughs.’” Weibo, 12 Jan. 2018, [weibo.com/eargod?is\\_all=1&stat\\_date=201801&page=2#feedtop](http://weibo.com/eargod?is_all=1&stat_date=201801&page=2#feedtop).

On March 2<sup>nd</sup>, “The Long River” by GAI, Bridge (2017 *Rap of China* Top 9 rapper) and Damnshine (member of C-Block, a rapping group from Changsha, Hunan) was released. This song is an accurate representation of regional culture using dialect rap and an implicit application of Chinese poetry. In this political circumstance, although depictions of gang scenes almost disappeared from music, rappers still picture the spirit of the downtrodden people living along the Xiang River and Jialing River through bright and straightforward dialect and vivid portrayals of their struggles as youngsters, mature men and the pillars of families.<sup>41</sup>

人生的长河(he) *The long river of life*  
 我把酒当歌(ge) *I sing my life in liquor*  
 血里流淌着(zhe) *What are in my blood*  
 长江和黄河(he) *Yangtze and Yellow River*

In this hook, GAI uses the structure of five-character fixed-length classic poetry and reconstructs the first line of a classic poem “Short Song Ballad” by Cao Cao, one of the three warlords of the Three Kingdoms period 1800 years ago. Cao Cao writes that “Singing my life to liquor, how long is man’s life”(对酒当歌,人生几何). When the audience read the lyrics, code switching in language will occur, which reminds them of that ancient poetry, thus implicitly implanting the poetic connotations inside the song. The next two lines restate the singers’ distinguished cultural identity as a Chinese person.<sup>42</sup>

Damnshine in this song, on the other hand, directly transplants a classic poem “Bring in the Wine” by Li Bai, the most eminent poet in Chinese history, to the first two lines of the lyrics written below, while at the same time, using the structure of seven-character fixed-length classic poetry.

人生得意需尽欢 *Carpe Diem to live a good life*  
 莫使金樽空对月 *Don't regret when you are gone*  
 举杯独饮会心酸 *Drinking alone makes me grieved*  
 兄弟就在我对面 *But I got my home boys with me*

Another attempt by GAI is the song “The Great Wall”, mv released on June 19<sup>th</sup> and adapted from “The Great Wall will never fall” written by Ye Zhentang in the 1980s. The song is explicitly patriotic and combines Chinese symbols with rapping, but it does not praise the party or the economic development, and instead sings in a tone similar to the

<sup>41</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/gaibridgedamnshine-long-river.html>

<sup>42</sup> I think this part should not be taken as an intentional patriotic expression as the Yangtze River and the Yellow River are two widely used symbols to represent Chinese in Chinese music.



swordsmen by the end of Qing dynasty 100 years ago that advocates for the self-improvement and resilience of the Chinese and non-discrimination towards Asians.

秦时明月汉时关 *The moonlit fort of Qin-Han empire*  
翻过重岭又一山 *And the forbidding frontier mountains*  
流不尽的英雄血 *Have witnessed the heroic blood*  
塞北边疆抵外番 *Spilled in defense of our civilization*  
龙抬头闪耀东方 *The dragon rears its head in the east*  
头顶星辰闪金光 *Beneath the brilliant heavenly vault*  
虎长啸威震三江 *The tiger roars across the mighty streams*  
保家国固若金汤 *To secure our inviolable borderland<sup>43</sup>*

The most noticeable feature in lyrics is the symbols that are specific to China, such as the dragon and tiger, which symbolize courage, legends and a desire for accomplishment, and certain geological features like 三江 (which translates to the mighty streams), or three rivers, which refers to the Yangtze River, the Yellow River and the Lancang River, and 塞北边疆, or the northern frontier of China, a location where wars commonly occurred in history. Another feature is the apparent structure of 7-character fixed-length poetry. In addition, the first line borrows directly from the first line of a classic poem “Going Out of the Frontier” by Wang Changling from the Tang dynasty, a poem in primary school textbooks, adding to its traditionally appealing poetic flavor.

The above three songs represent a transforming process of Chinese hip hop music as musicians are abolishing indecent words, no longer being accustomed to western-style hip hop and attempting to create works of art that belong distinctively to the Chinese by using dialect, applying symbols specifically in Chinese culture, and blending poetic usage with modernism. Among all the rappers that follow this path, GAI is the pioneering one; other rappers like C-Block’s Damshine and Kungfu-Pen, and Bridge made their own Chinese hip hop music with either an increasing application of distinct Jiang-Hu feeling or regional features. Such a trend of transformation represented by GAI is gradually acknowledged by a larger platform, the *Rap of China* Season 2.

The reason that I chose songs from the *Rap of China* program to be my examples is because this program is a relatively mainstream one that is accepted by the general public, though it is not on TV. Therefore, the songs performed in the show are suitable demonstrations of the intentions of hip hop musicians and the values of the music they would like to promote. It is meanwhile a large platform for hundreds of Chinese rappers to present the work they believe is their best and would be acknowledged by the mainstream.

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<sup>43</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/gai-great-wall.html>

## Kris Wu

In episode 10 of the *Rap of China* in 2017, producer Kris Wu commented that GAI sings “山歌”, or folk songs from the mountains, as Kris’ hip hop music was completely different from the second path represented by GAI. This was a reasonable reaction for Kris, a Canadian-Chinese rapper with an international background who spent his adolescence in Vancouver. His previous understanding of hip hop music was demonstrated in the Atlanta trap song “6”<sup>44</sup> he performed at the stage of the *Rap of China* episode 6, and this performance showed that he was a faithful practitioner of the first path. An excerpt of the lyrics is as follows:<sup>45</sup>

*Worldwide tour yayayaya yaya*

看什么 6 你和我 走一波 *What are you looking at? 6 You and me get through this together*

兄弟 义气我们的 crew 不太讲道理 *Brothers, loyalty. Our crew isn't very reasonable.*

*Only on me*

Know 我的 flow 从来都暴力 *Know my flow is always aggressive*

都是一个梦想都是一个模样 *It's all the same dream. It's all the same image.*

*Big house big dreams*

我和你都一样 *You and I are both the same*

谁又不希望有 mula 那么多 *Who doesn't wish to have a lot of moolah?*

谁又不想每天出门开跑车 *Who wouldn't want to drive a sports car every time they go out?*

With the combination of Mandarin and English lyrics, “6” straightforwardly talks about a steadfast spirit that ordinary people should have to realize their dreams instead of always complaining about the difficulties. His low-key voice is coupled with the technique of auto-tune, a TR-808 drum machine and hi-hat cymbals.<sup>46</sup> Apparently in this song, he fully embraces all western musical elements to internationalize his music, despite obvious illogical and repeating lyrics.

In the first season of the *Rap of China*, his tendency to create music with international elements was clear, and he had never advocated for any hip hop music based on traditional Chinese aesthetics, called *zhong guo feng* (中国风), literally translated as “Chinese wind.” *Zhong guo feng* generally refers to a distinct type of artistic expressions or lifestyles that are based on traditional Chinese cultural and historical elements modernized to adapt to the global culture. In the final round of the competition, he strongly supported PG One and

<sup>44</sup> “6” is an internet buzzword in China which means rad.

<sup>45</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/kris-wu-6.html>

<sup>46</sup> Wu, Kris. “6.” QQ Music, 25 July 2017, [y.qq.com/n/yqq/album/001JVaGE2eMDpm.html#](http://y.qq.com/n/yqq/album/001JVaGE2eMDpm.html#).

opined that GAI's music was monotonous. After the ban on hip hop, however, his attitude seemed to have changed, as shown in the *Rap of China* Season 2.

Actually, if the *Rap of China* program is translated literally, the first season should be called the Hip Hop of China, and the second season should be called the New Rap of China because the word for "hip hop" in popular culture is banned by the state. "New" manifests a brand-new consideration of the show: to promote a new style of rapping of China. Since the first episode of season 2, Kris has been advocating the use of traditional Chinese aesthetic (*zhong guo feng*) in rap in his interviews. Poetic languages, Chinese symbols and Chinese idioms appear in rappers' songs to an unprecedentedly wide extent.

The most noticeable transformation was the performance of Kris Wu. On the same stage as last year, he performed "Young OG", a combination of his song "The Heaven and the Earth" and "Cypher" released in May and June 2018 respectively, as shown in the following lyrics.<sup>47</sup>

江湖人说我不行      *People from Jiang-Hu say I'm not capable*  
古人说路遥知马力      *The ancients say distance tests a horse's strength*  
陪我走陪我创天地      *Accompany me when I walk and create my own heaven and earth*  
我从不将就我的命运      *I never succumb to my destiny*

Though Kris uses words such as Jiang-Hu, Tian Di (heaven and earth), and the idiom "路遥知马力" (distance tests a horse's strength), his lyrics are illogical, nor do they reflect a distinct Chinese spirit. It should also be recognized that Kris indeed innovatively integrates electronics into Chinese music. However, when reading the complete lyrics of the song, the readers are unable to find a core theme that ties different verses together; the English part, the modern Chinese part and the aforementioned part deal with separate things. His performance aroused huge controversy in public, with skepticism of his live ability, criticism of his lyrics and compliments for his western practices. On Zhihu, a question-and-answer site with 30 million users, in a question that asks about reviews on his performance, the answer with the highest vote mentions that in the opening part of this song, categorized by him as *zhong guo feng* (traditional Chinese aesthetics), he uses complete English rap, which is absolutely a wrong interpretation of it. Another answer with 1500 upvotes comments that "the stage effect is expensive; the rap lyrics is crap"<sup>48</sup> Other rappers, especially those that were competitors in the first season, supported Kris Wu. GAI, for instance, said in an interview that "I highly respect what Kris has done for Chinese hip hop. I think he has the capability to sit there [as a producer] because it's him sitting there, not

<sup>47</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/kris-wu-heaven-and-earthtian-di.html>

<sup>48</sup> Anonymous. "如何评价吴亦凡《中国新说唱》公演《Young OG》? ." Zhihu, 4 Aug. 2018, [www.zhihu.com/question/288425431/answer/460772305](http://www.zhihu.com/question/288425431/answer/460772305).

you.”<sup>49</sup> This year’s rapper, Yang Xiaochuan said that “if Wu’s show is performed at Hollywood or BET, it’s still the most rad one.”<sup>49</sup>

### Other Rappers

Before Kris’ live performance, such practice was already gaining popularity among rappers that strive to convey Chinese style by inserting simple poetic words into the lyrics unconsciously under the influence of political controls. Most rappers are not masters at this style of rapping, and their use of Chinese poetry is not mature enough to bear literary value. Only a few avoid this blind spot, realizing that *zhong guo feng* are not merely about piling and packing words of poetic connotations and that somehow the core value and the true meaning behind the lyrics matter. In episode 6 of the *Rap of China* season 2, the competition requires the remaining rappers who are divided into 3 groups to each write and perform rap for 3 beats respectively. One of the *zhong guo feng* beats uses traditional instruments such as Guzheng, a plucked string instrument. With its theme of Pan Gu’s creation of the world, which is a traditional Chinese myth, this beat is considered particularly difficult. The four rappers, AIR, Wang Qiming, NICKTHEREAL and ICE, combine traditional symbols with modern, regional and downtrodden expressions. Instead of purely inserting simple poetic words, they start by vividly portraying themselves as giants that endeavor to create a new world for Chinese hip hop using the symbol of Pan Gu’s struggle to create the world using an axe.<sup>50</sup>

我的头顶着天	<i>I hold the sky</i>
我的脚踩着地	<i>I stamp on the earth</i>
站在风口浪尖	<i>I stand against the tide</i>
吸着日月精气	<i>Breathing the essence of nature</i>
我的右手拿着刀斧	<i>I grab an axe in my right hand</i>
正在开天辟地	<i>Creating a new world at the same time</i>
...	
是什么 是这种文化	<i>What is it? It’s that culture</i>
教我 <i>peace and love</i>	<i>That teaches me peace and love</i>
古人说的经典名句	<i>I embrace all</i>
我全都收下	<i>Classics said by the ancients</i>

<sup>49</sup> Father of the Circle. Yang Xiaochuan and GAI's Comments on Kris Wu. 杨晓川 GAI 评价吴亦凡-圈内教父的秒拍, 22 Aug. 2018,

[www.miaopai.com/show/SnMmp2Jr9U02mxsAPyXOR3uh5JO1b6DF6Sh0Wg\\_\\_.htm](http://www.miaopai.com/show/SnMmp2Jr9U02mxsAPyXOR3uh5JO1b6DF6Sh0Wg__.htm).

<sup>50</sup> “Rap of China.” Che, Che, director. performance by AIR, et al., season 2, episode 6, [iqiyi.com/v\\_19rqz2j4e8.html](http://iqiyi.com/v_19rqz2j4e8.html)

要让 Hip Hop 成为主流 *I want hip hop to be the mainstream*  
不只存在地下 *Instead of only remaining underground*<sup>51</sup>

Before the political ban at the start of 2018, hip hop music was experiencing a slight transformation headed by GAI, and this was accelerated by the political ban as more rappers joined this musical path to create music with an original Chinese style. Some, as represented by GAI, blend Jiang-Hu concept, poetic language, a voice for the downtrodden Chinese and dialect rap harmoniously; some, represented by Kris, insert poetic Chinese words in lyrics of music in western styles so as to invoke zhong guo feng; some that are not adept at using poetic language conjure their Chinese imagery in lyrics through ordinary use of language or dialect.

#### 4. Rappers' Lyrical Innovations: "Positive" Energy

Before the enforcement of censorship and ban of hip hop music on TV, there was evidence of political irony and metaphors in songs of hip hop musicians; however, such a phenomenon was generally unpopular among the rappers, nor was it widely perceived by the mass audience. Despite that, there were works of relative literary value and which integrate ultra-modern symbolism into the flow. For instance, in "Nobody Cheers" released in October 2012 by J-Fever, he alludes to the rigorous media censorship in China, the neglect of civil rights, and the indulgence of folks in illusion of living in a great country without any downsides to the government and the party in stream of consciousness.

园公 院影电 角拐 场商 *Krap Amenic Renroc Llam*  
站车火 梯电 台阳 塔视电 *Yawliar Tfil Ynoclab VT*  
发沙 聊无 寓公 铁地 *Afos Murdmuh Tnemtrapa Ortem*

...

谁在鼓掌 天安门前唯一的乞丐  
*Who is clapping? The only beggar in front of the Tiananmen Square*  
尽情崇拜吧 却只能置身墙外 *Enjoy worship, though outside the wall*  
尽情呼喊吧 但是没有回声传回来 *Enjoy shouting, though there's no echo*  
我们都明白 这无时无处不在 *We all understand that it's always everywhere*  
再没什么意外 无人喝彩 *There's no longer surprise. Nobody cheers.*<sup>52</sup>

<sup>51</sup><https://adayebyandchinesehiphop.blogspot.com/2018/08/airwang-qimingnicktherealice.html>

<sup>52</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/j-fever-nobody-cheers.html>

The first 3 lines quoted are an enumeration of words from daily life spelled in reverse: park, cinema, corner, mall, railway, lift, balcony, TV, sofa, humdrum, apartment, metro. The rapper is rewinding the scenes he has walked through and guiding the listeners into a world of monotony he has created. “Who is clapping? The only beggar in front of the Tiananmen Square” is a clear irony regarding the government, and in this line, he depicts a vivid scene of a beggar clapping alone on Tiananmen, the symbolic place of the nation, to satirize that those that are relentlessly praising the party are actually victims of its policy.

Many of J-Fever’s songs were banned because of outrageous political metaphors, but this song has not been removed from stores, which defines the boundary of censorship for unpopular songs. Another song “Not Young Anymore”, released in April 2017 by AIR, a Sinkiang participant of the *Rap of China* Season 2 and Vyan, uses symbolism to call for awareness to pursue democracy and freedom.

如果没了梦 又如何推翻这座高墙

*If we don't have our dream, how could we tear down this high wall,*

在黑暗过后面带微笑迎接新的朝阳

*Smiling to welcome the new sunrise after the darkness*

伟岸的雕像 谁都会抬头瞻仰

*Everyone will lift their head to revere the great statue*

所以不在意谁设计它 谁自娱自乐颁奖

*So nobody cares who designed it or who gave out awards<sup>53</sup>*

“High wall” implies a firewall in China that blocks sensitive information, as well as foreign social sites like Google, Facebook and YouTube. “The great statue” may refer to previous leaders of the nation that have been deified, such as Mao. He ironically depicts how the party historically self-glorifies itself without truly contributing to the citizens. The two examples present the utilization of metaphors and literary techniques in serving a politically ironic purpose before the enforcement of censorship in 2018.

There are mainly two means for hip hop music to remold itself into a politically correct form following the ban. First, some rappers directly evoke patriotism and pride in being Chinese, or praise the governmental progress in economic development in the past 30 years in their music to be in accord with the core values of society promoted by the party. Noticeably, few rappers spend all parts of the song in praise, probably because that would be denounced by listeners as fawning; the majority of them rap in themes that have loose connections with praising the government, such as expressing their love for their hometowns. The following lyrics are from AIR’s song “When I go to Sinkiang” released in April 2018.

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<sup>53</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/airvyan-not-young-anymore.html>

扔掉你对新疆所有的标签      *Throw away your biased tags on Sinkiang*  
 带上爱人、所有胶卷      *Bring your lover and your film*  
 放下顾虑大胆聊天      *Forget your worries. Talk at any time you want.*  
 你才会打破网络上的谣言      *Only in this way can you shatter the rumors online.*  
 山水、坡地、草原、沙漠、戈壁 *Mountains, rivers, grasslands, deserts and gobi*  
 发展中的城市农村缩小着差距 *The developing cities and villages are closing their gaps*<sup>54</sup>

In this song, AIR mainly calls for non-discrimination towards Sinkiang, as previously, a great proportion of Chinese believed it was a dangerous province with conflicting groups of ethnic people and occasional terrorism, as well as singing about the beauty of his hometown. On the surface, it serves no political purpose, but implicitly shapes a good impression of the government's policy to Sinkiang in listeners' mind as this place that used to be perceived as dangerous now becomes a welcoming tourist attraction and a prospering region where poverty is rapidly being eradicated.

The next example illustrates how rappers are effusive about their patriotism and a desire to make Chinese hip hop music that belongs only to the Chinese, as explained by Liu Zhou in the previous chapter, be recognized on the international stage.

*Al Rocco:*

我们每个都有一条龙      *There's a dragon inside everyone's heart*  
 我们武功都有李小龙      *There's a Bruce Lee in our Kung Fu*  
 飞到天空好像孙悟空... *When I fly to the sky, it's like the Monkey King*  
 我要代表我们的五千... *I want to represent our 5000 years*  
 我们都龙的传人      *We're all descendants of the dragon*  
*China man repping that China game*  
 (Hook:) *I am made in China*  
 我们拥有不同的脸 不同的眼 *We have different faces and different eyes*  
*I am made in China*  
 凝聚在一起去冲破天      *Together we shatter the sky*<sup>55</sup>

This is an excerpt from Al Rocco and LIL-EM's performance "Rep that Culture" in episode 5 of the *Rap of China* Season 2.<sup>56</sup> In his lyrics, Al Rocco repeatedly uses conventional symbols that represent Chinese and China, such as a dragon, Bruce Lee, Monkey King and "5000 years", which refers to the 5000-year history of China. Clearly, he

<sup>54</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/air-when-i-go-to-sinkiang.html>

<sup>55</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/lil-emal-rocco-rep-that-culture.html>

<sup>56</sup> "Rap of China." Che, Che, director. performance by Al Rocco, and LIL-EM, season 2, episode 5, 11 Aug. 2018, [iqiyi.com/v\\_19rqy8zme0.html](http://iqiyi.com/v_19rqy8zme0.html)

expresses his patriotic feeling and his dream of producing the real Rap of China in this song. Though his composition of words is plain as he is rapping the pile of slogans again and again rather than rapping much about practical content, his performance is a typical example of a way to rap about the Chinese spirit. Aside from this, it also demonstrates that most rappers, when rapping about this theme, are not capable of creating lyrics of relatively higher literary quality.

Another means of transformation is relatively rare; it cannot be predicted that this means will be widely applied in future Chinese hip hop music, but it is certainly a method that allows hip hop music with political implications to survive under censorship. This is done through the combination of implicit political irony and the use of lines from any authoritative media, such as from the national anthem. In this way, not only is the satirical function of the lyrics preserved, the use of authoritative lines also adds to the ironic sense of the lyrics. An example is as follows:<sup>57</sup>

朱门酒肉臭真音乐没人听  
*Wine and meat rot behind the riches' gates while nobody listens to true music*  
 听口水歌你们就挤破头      *You scramble to enjoy crap songs*  
 无脑的商业歌 遮住了光线而 *Inane ad songs block the lights*  
 原来的路还剩几人留 真兄弟 *How many people are sticking to their original path, real bros?*  
 权力的压迫 和金钱的枷锁      *Oppression from above and the shackle of money*  
 用劣质食品喂养的牢笼帮你画一个... *Draw you a cage fed by bad food*  
 醒来醒来醒来站起来      *Wake up. Wake up. Stand up.*  
 不愿做奴隶的人们醒来 *Wake up! Those who don't want to be slaves!*  
 东方巨龙醒来      *Wake up! The Great Dragon of the east!*

This song “Wake Up” was released in April 2018 in the new EP by C-Block, a hip-hop group mentioned before that focuses on Jiang-Hu style flow and dialect rap. This song is different from the group’s previous music though it applies classic poetry in the lyrics, such as “朱门酒肉臭” (Wine and meat rot behind the riches’ gates). It plays on metaphors, such as “cage”, which refers to the restriction of personal freedom, and indirect condemnation of the ban imposed on hip hop music. The lyrics “How many people are sticking to their original path” describes the fact that many rappers have lost their original direction and catered to commercialization and the mainstream values promoted by the state. “Oppression from above” points out clearly that it is the government who destroys the whole industry and causes people to mindlessly listen to music of little value instead of that of high quality. “Bad food” alludes to a great number of food quality incidents which are exacerbated by the embezzlement and irresponsibility of government officials in China. On the whole, C-Block skillfully uses various

<sup>57</sup> <https://adayebyandchinesehiphop.blogspot.com/2018/08/c-block-wake-up-part.html>



symbols to make accusations, which is a relatively risky practice. However, in the hook, it adapts two lines from the national anthem of China. “Wake up! Those who don’t want to be slaves” is quoted from the national anthem “Arise! Those who don’t want to be slaves”. The repetition of “Wake up” three times is also similar to the repeated use of “Arise” in the anthem. If listeners only listen to the hook, the song can be interpreted as a patriotic song that calls for endeavors to strengthen the country, “The Great Dragon of the East”. In this way, the song can successfully survive under censorship as ensured by the adaptation of anthem lyrics.

## 5. Conclusion

2017 was recognized by the general public, the media including People’s Daily<sup>58</sup>, and critics as “The first year of Hip Hop” because of the *Rap of China* season 1 that for the first time brought hip hop music under public attention and into mainstream culture. Formerly underground rappers unfolded a brand-new world of hip hop on the show’s stage to the ordinary folk who had basically zero knowledge about hip hop, and thereby from this popular program they acquired considerably more performing venues, opportunities and capital to persist in their music career and to be seen by more audiences.

Rappers on the show represented mainly two paths of hip hop music development that have been practiced previously underground. The first path, headed by PG One, Jony J, Afterjourney, Tizzy T, etc., dedicate themselves to the integration of western music elements into hip hop music with Chinese lyrics to make the songs modern and popular among the mass audience in China who are accepting of and are accustomed to foreign influences, which are normally considered progressive and advanced. The second path, pioneered by GAI and Bridge, focuses on the fusion of musical elements in lyrics, beats and themes that originated and developed in China with hip hop music, to produce hip hop music that belongs only to the Chinese so as to establish its own cultural identity on the global stage.

With the enforcement of censorship and political ban at the beginning of 2018, the hip hop music industry encountered a disastrous strike, with the loss of performing opportunities, investments and a relative extent of lyrical freedom. Fortunately, the previous profound impact that hip hop music had left on the mainstream consciousness has not faded away, setting up a solid listener base for rappers. In this circumstance, the previously relatively less popular path was gradually emphasized by rappers headed by Kris Wu. This direction is further promoted in the *Rap of China* season 2 as the largest stage on which current Chinese rappers can perform with enough exposure to the public. This is done

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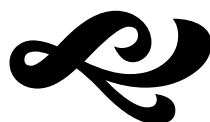
<sup>58</sup> People's Daily. “#Hello Tomorrow#.” Weibo, 6 Jan. 2018, [weibo.com/rmr?refer\\_flag=1001030101\\_&is\\_search=1&key\\_word=%E5%98%BB%E5%93%88%E5%85%83%E5%B9%B4&is\\_all=1#\\_0](http://weibo.com/rmr?refer_flag=1001030101_&is_search=1&key_word=%E5%98%BB%E5%93%88%E5%85%83%E5%B9%B4&is_all=1#_0).

through the producers' voice of supporting the blend of Chinese cultural elements with hip hop and the program group's preparation of beats.

As summarized above, there are mainly three directions in which rappers are moving forward for the interaction and integration of zhong guo feng in hip hop. Some master the utilization of the combination of poetic wording, Jiang-Hu style, dialect rap and depictions of scenes specific to the downtrodden in China. Some superficially add poetic languages in lyrics of music in western styles. Some that are not proficient in poetic language usage create their own Chinese story through ordinary wording or dialect. However, it is yet not a mature transformation as most rappers that just moved in this direction are not adept at using poetic or Jiang-Hu style wording and as a result, although they consider their work to draw on zhong guo feng, the lyrics are of little literary value or are unable to convey insightful thoughts, especially for rappers taking the second direction.

From the political perspective, before the ban, there were relatively few hip hop songs with political irony, nor were they exposed to a wide range of audiences. Despite that, there were plenty of works of high literary value through the proficient use of metaphors, symbolism and emotional appeals. After the ban, however, such works almost disappeared. A new practice of implicit and explicit expressions of patriotism and promotions of values supported by the party is becoming increasingly popular among rappers. However, though lyrics that eulogize the government exist, they are rarely the major theme of the songs; the rappers use these expressions either intentionally or unconsciously to make the songs fit mainstream values. On the other hand, songs that explicitly effuse patriotic values that are not related to the party are performed by many rappers on larger stages, but few of them sing out the Chinese spirit in an innovative, humanistic, and artistic way. Most of them are piling slogans over and over, making the rap generally hollow and unpopular. Another phenomenon to survive under censorship when applying non-mainstream political themes in songs in hip hop is the integration of authoritatively recognized contents that would never be censored into the lyrics with political implications.

In a short period from 2017 to 2018, the hip hop music in China has experienced a dramatic transformation as a result of political intervention: the extinction of indecent words, use of lyrics that comply with the mainstream values, and the disappearance of PG One from public view because of his controversial lyrics. Up to now, it cannot be judged whether the transformation is moving in a positive direction and whether hip hop music can keep itself "real" in the future. The direct translation of "hip hop" in Chinese (嘻哈) has been purged out of the public view, but clearly the industry still exists under the name of rap music. The political ban is a catastrophe, but from another angle, it also might be a starting point for rappers to consider how hip hop music, an imported good, can survive in China with its distinct Chinese identity and restricted public environment.



## Populism & The Paradoxical Politics of Identity

Joanna Ding

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### **Abstract**

Populism has made significant gains in all corners of the world, whether it be through the United Kingdom's Independence Party (UKIP), Germany's Alternative for Deutschland (Afd), France's Front National, Spain's Podemos, or Italy's Five Star Movement. Characterized by Dutch political scientist Cas Mudde as a thin-centered ideology involving the separation of a "true people" from the "corrupt elite," populism is a monist ideology that shadows liberal democracy. This paper challenges the stereotypical characterization of populist constituencies as dominated by a silent majority who benefits directly from a populist's exclusionary policies. It focuses instead on a number of "paradoxical voters," often minorities in their respective communities, who support leaders that directly undermine aspects of the voter's identity, including religion, ethnicity, and sexuality. Structured in a series of case-studies around various contradictory voting groups, this paper seeks to, through the use of poll data, personal accounts, and journalist interviews, identify a number of commonalities within the mindsets of populist voters. It identifies an over-trust in national democratic institutions, a redefinition of personal priorities (including identity), and a deep dislike for the opposing party as the primary three motivations contributing to paradoxical voting trends. Recognizing that these populist voters are neither as politically ignorant or as socially uneducated as mainstream media suggests, this paper pushes greater representation, mutual understanding, and community tolerance as the Establishment's best solutions to mending democracy's broken promises.

The past decade has seen the rise of numerous populist leaders, particularly in the West across Europe and North America. Defined by Dutch political scientist Cas Mudde as pitting elites against a morally-pure group of "true people" in an anti-pluralistic manner, populist leaders (through a number of different strategies) have grown their constituencies

to unprecedented sizes.<sup>1</sup> Populist leaders are the primary motor behind a populist party's function: unlike traditional establishment parties, which are supported in large part by their own specific ideological or policy-based platforms, populist parties are often more widely identified and characterized by the policies and personal characteristics of their primary leaders. In this sense, however, attempts at exposing populist leaders for beliefs that fundamentally contradict the ideals of liberal democracy have been widely unsuccessful in both the political and social arenas.<sup>2</sup> This has led to the idea of populist leaders being relatively immune to political scandals, particularly when compared to established, mainstream politicians. This is further exemplified by the reported recent rise of a small yet increasingly significant class of paradoxical voters who actively support leaders whose policies appear to be a clear attack on certain elements of their identity, such as sexuality, race, ethnicity, and gender. For example, in spite of Trump's anti-immigration, anti-Hispanic rhetoric, the 2018 U.S. Presidential election resulted in historic highs for the number of Hispanics who voted Republican.<sup>3</sup> Similar phenomena occurred across countries in Europe, with Muslims and Jews voting for parties traditionally characterized by Islamophobic and/or anti-Semitic rhetoric.<sup>4</sup> Political scientists, experts, and data analysts made a record number of incorrect predictions with regards to both voter breakdown and turnout, as elections and post-vote surveys around the world produced baffling results.

This paper challenges the existing assumption that populist leaders are not only supported by those who fit into a particular social, economic, or religious mold, but that their antagonistic, exclusionary rhetoric will somehow trigger a flood towards the opposition. The small (albeit growing) quantity of academic literature that exists on this subject focuses on America's history of unequal development, Trump's victory being due to Clinton running as a *status quo* candidate, the political implications of neoliberalism, and Trump's use of social media allowing him greater outreach.<sup>5,6,7</sup> As a result of the image that President Trump and his campaign team have painted, people assume that Trump won his election with the majority support of white working-class America, particularly the sector of the population (previously thought to be a minority, now deemed a 'silent majority') considered regressive supremacists seeking to return America to the age of its expansionist Manifest Destiny. But these narratives, academic or otherwise, are as incomplete as they are presumptuous, given that Hispanics actually played a major role in

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<sup>1</sup> Mudde, Cas, and Cristóbal Rovira Kaltwasser. *Populism: A Very Short Introduction*. New York, NY: Oxford University Press, 2017.

<sup>2</sup> Müller, Jan-Werner. *What Is Populism?* London: Penguin Books, 2017.

<sup>3</sup> CNN, "Exit Polls 2016."

<sup>4</sup> Katz, "How Marine Le Pen Relies on Dividing French Jews and Muslims."

<sup>5</sup> Anderson, "Tweeter-in-Chief: A Content Analysis of President Trump's Tweeting Habits."

<sup>6</sup> Schultz, "Public Administration in the Age of Trump."

<sup>7</sup> Reese, "Cornel West."

solidifying the Republican party victory.<sup>8</sup> Likewise, many French assume that Marine Le Pen from the extreme right-wing Front National party (FN) was making the most gains in her constituency from low-class Christian laborers in regions devastated by a post-industrial economic depression, but Muslims are increasingly challenging this as they rally to support Front National. These assumptions fail to provide the full picture because they ignore the fact that not only are populist leaders frequently supported by members of the very group they seek to marginalize, but support for them is actually growing at an unprecedented rate within these scapegoated groups. For example: while Le Pen does enjoy the most support from Front National's southern stronghold where economic depression and political neglect on the behalf of the establishment have hit hardest<sup>9</sup>, she is experiencing the most rapid growth (percentage-wise) in the Muslim sector of her constituency despite the FN's blatant Islamophobia. While she won only 4% of Muslim votes in the 2012 election, Le Pen is now significantly higher in terms of her support among France's modest population of voting-eligible Muslims. Similarly, in spite of the recent downward trend in the number of Hispanics voting Republican in U.S. Presidential elections, President Trump managed to pull between 28% and 29% of the Latino vote, more than two percentage points above Mitt Romney's Hispanic vote in the 2012 election and the highest a Republican has received for over ten years.<sup>10</sup> Experts incorrectly predicted that due to backlash from Trump's derogatory public rhetoric on Mexicans and immigrants, Hispanic voters would further cement Hillary's victory, particularly in states such as Arizona where Hispanics make up over 22% of the voting population. Of course, this was not the case, as Trump won not only the overall election, but also Arizona, and Hispanic voter turnout dropped 0.4 percentage points while the Republican-voting Hispanic percentage increased by 2 percentage points.<sup>11,12</sup> This reversal in a trend (Hispanics flocking to support Democratic candidates) poses a critical question regarding the behavior of this paradoxical group of voters that has been echoed around the world following populism's rise: why do people vote for a political candidate with policies that appear to directly undermine aspects of their religion, ethnicity, or other aspect of their personal identity?

This paper seeks to answer the aforementioned question by analyzing voting behavior and deciphering trends in paradoxical motivations. Despite the increasing significance of voter behavior, much of the traditional academic literature around it has focused on political tactics used by populists to convert social cleavage into mass support for their candidacy instead of the reasoning from a personal voter perspective. Structured in a series of 3 case-studies around various contradictory voting groups, this paper seeks to, through the

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<sup>8</sup> FAIR, "Exit Polling Data Refutes Claims That Hispanic Voters Punish Candidates Who Support Immigration Enforcement | Federation for American Immigration Reform."

<sup>9</sup> Zerofsky, "Front Runner."

<sup>10</sup> CNN, "Exit Polls 2016."

<sup>11</sup> "Census Shows Pervasive Decline in 2016 Minority Voter Turnout."

<sup>12</sup> FAIR, "Exit Polling Data Refutes Claims That Hispanic Voters Punish Candidates Who Support Immigration Enforcement | Federation for American Immigration Reform."

use of poll data, personal accounts, and journalistic interviews, identify a number of commonalities between the reasoning marginalized contradictory voters have for voting the way they do. It argues that the general reasoning of contradictory voters falls into three categories: over-trusting in the democratic institutions of their country, redefining their own priorities and identity, and deeply disliking the opposition or alternative parties. The paper begins with the case study of French Muslims who voted for Le Pen's Front National party, examining their motives and personal hierarchy of identity. With reasons ranging from economic depression to social conservatism, Front National's Muslim constituency has steadily increased in size and dedication, in spite of the party's attempts at suppressing Islam as a religion in France. This situation is congruent to the second case study of Hispanic Trump supporters, who demonstrated a similar distaste for other candidates and a similar re-prioritization of identifiers. Finally, the paper will discuss as the third case study Trump's increasingly-significant Muslim following, analyzing not only Muslim voter behavior prior to the election, but also approval ratings and opinions after the first year of Trump's presidency. Ultimately, the paper aims to address the question of contradictory voting by using personal accounts and voter statistics to provide both a microscopic and macroscopic view of identity politics.

## **Front National & Le Pen's Political Relationship With Islam**

### **Introduction & Context**

Marine Le Pen, a French politician who assumed control of the far-right political party Front National originally founded by her father Jean-Marie Le Pen, approached a turning point in French political history when she came in second with just over 33% of the vote in France's 2017 presidential election.<sup>13</sup> Among a conservative economic policy, opposition to the European Union, and strong support for the French working class, Le Pen's election platform has also been strongly characterized by attacks on Muslims, poorly disguised as an attack solely on radical Islam. Le Pen issued multiple targeted, inflammatory statements during her Presidential campaign speech, including a line about "financial globalization and Islamist globalization... bring[ing] France to its knees."<sup>14</sup> She further utilized what many see as a blatantly Islamophobic platform to draw in female voters by shouting at a campaign rally that "in France we respect women, we don't beat them, we don't ask them to hide themselves behind a veil as if they were impure. We drink wine when we want, we can criticize religion and speak freely."<sup>15</sup> Many elements of her comments were a clear degrading of Muslim traditions, practices, and general religious beliefs, in reference to the

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<sup>13</sup> Henley and Malkin, "Macron Beats Le Pen in French Presidential Election – as It Happened | World News | The Guardian."

<sup>14</sup> Mechaï and Thwadi-Yimbu, "Meet the French Muslims Backing Marine Le Pen."

<sup>15</sup> Crunden, "Marine Le Pen Is Using Islamophobia to Draw Female Voters."

hijab-tradition, the dietary restrictions, etc. This falls into Muller, Mudde, and other political scientists' theory of a flexible moral stereotype being used by populist parties. In the example of Le Pen, her attacks could be seen by a Caucasian French man living in rural France as criticizing all Muslims, while a female Muslim living in urban Paris would see it only as a criticism of specific Islamic fundamentalists. This powerful manipulability is what props up the entire populist machine, allowing it to appeal to many different groups of people. Other FN officials, particularly on the local and provincial levels, staged multiple anti-Muslim events, including a strategically-marketed "pork festival" directly targeting the Islamic restriction on the consumption of pork.<sup>16</sup> Le Pen herself further announced that school cafeterias in towns won by FN candidates would no longer serve non-pork substitution meals to children, claiming in a statement that excluded both Jewish and Muslims, that there was "no reason for religion to enter the public sphere."<sup>17</sup> She also responded to criticism by claiming that Muslims in Muslim countries would not want to see pork in each restaurant, just as people in France allegedly do not enjoy seeing Halal food in French markets and restaurants. As a result of these exclusionary, targeted policies of aggression, Le Pen was expected to win absolutely no support from France's Muslim voting population, which makes up roughly 7.5% of the French electorate.<sup>18</sup> Shockingly, however, Le Pen's popularity has been steadily increasing amongst Muslims, even in light of her recent outspokenness on tightening French migrant controls and deporting select foreign citizens (a large portion of who practice Islam)<sup>19</sup>. The Muslims that voted for Le Pen are, as a result of her rhetoric and their circumstances, able to internally de-prioritize her capitalizing on Islam-related French terror attacks or her playing up the French fear of Islamic immigration while prioritizing other domestic issues perceived as more relevant to their daily lives.

### **Priorities & Political Beliefs**

The rationale behind Le Pen's Muslim voters falls into a combination of re-prioritizing personal values and disliking other French political parties (the Establishment). On the note of reprioritization, nearly all vote-eligible Muslims have lived in France for extended periods of time due to France's long five-year residency requirement for naturalization (required to register as an eligible voter).<sup>20</sup> This, in combination with what many experts postulate to be the pressure of systemic stereotyping and oppression, has resulted in a number of significant consequences, the first of which is de-valuing the role of religion in seeking to assimilate with French national culture. Benmerzouk, a Muslim man who

<sup>16</sup> Zerofsky, "Front Runner."

<sup>17</sup> Titley, "Pork Is the Latest Front in Europe's Culture Wars | Gavan Titley."

<sup>18</sup> Karoui, "Is There a 'Muslim Vote' in France?"

<sup>19</sup> McPartland and Beretta, "Who Are the Millions of French Voters Backing Marine Le Pen?"

<sup>20</sup> "Voting - General Elections in France - 2012."

immigrated to France in the late 1950s, sees assimilation as the only option for Muslim immigrants: beyond forcing his daughter to wed in a Christian church, he selected stereotypically-French names for his children to diminish their non-Caucasian appearances.<sup>21</sup> He has been an avid proponent of “making invisible” a religion that, after decades spent steeped in French nationalist sentiment, he himself no longer believes in perpetuating. Likewise, he stated in an interview with journalists Hassina Mechaï and Esther Thwadi-Yimbu that he believes “in nation first. It is the basis of a single undivided family. Marine is for French people of all origins. I am a nationalist. I love France, and the French people.”<sup>22</sup> Many French Muslims have grown to value their identity as a French citizen over their cultural ties to Islam. Furthermore, many have admitted following the Charlie Hebdo attacks, which were carried out by two brothers preaching a reversion to fundamentalist Islam, that they too recognized the national security threat posed by jihadists or Islamic extremists; Ahmed Hamrouni, the head of a local North African Association and a Muslim himself, claimed that he would willingly accept the FN vetoing funds dedicated to mosque-building because “if submitting to the conditions imposed by universal suffrage is what it takes for us to live together in this country, well, then, maybe that’s okay.”<sup>23</sup> Populists consistently utilize a re-prioritization strategy, in which they re-purpose and re-package issues that fit into their narrative and bring them to the forefront of public conversation and concern. Le Pen herself did just that when she drove the crux of the French election towards immigration and nationalism. As mentioned earlier, populists thrive on a flexible moral framework that allows them to create an ambiguous group of “true people”; a notable impact of re-prioritization is that it allows people considered by others to be the ‘out’ group convince themselves that they are actually within the ‘in’ group. In this case, Le Pen herself facilitated this delusion by arguing that religion is not the essential criterion for Muslims. Le Pen argued that:

“Many consider themselves French. They have daily problems—taxes, schools for their children, security in the areas where they live—and they, too, are victims of Islamic fundamentalism. So there is no reason why the simple fact of being Muslim should prevent them from being patriots.”<sup>24</sup>

This has allowed even Muslims that value the role of Islam in their private lives disassociate it from their public lives, and to justify their vote via an often-misguided belief that Front National’s policies only relegate jihadists or extremists to outsiders, and not moderate Muslims who practice privately. This is, of course, not the case, as Le Pen’s anti-prayer, anti-hijab, and pro-pork policies would affect even the most casual of practitioners<sup>25</sup>. Furthermore, as a direct result of re-prioritization of values, a number of

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<sup>21</sup> Mechaï and Thwadi-Yimbu, “Meet the French Muslims Backing Marine Le Pen.”

<sup>22</sup> Mechaï and Thwadi-Yimbu.

<sup>23</sup> Zerofsky, “Front Runner.”

<sup>24</sup> Zerofsky.

<sup>25</sup> “Le Pen’s Proposed Ban on Kippot and Veils Could Have Far-Reaching Effects on France.”



Muslims cited favorable policies on economic and social affairs as their reasons for supporting Le Pen.<sup>26</sup> Multiple Muslims named Le Pen's promise to overturn same-sex marriage legislation as one among many of her attractive conservative policies. Mohamed Bellebou joined the FN for its support of the "Harkis", who are Muslim Algerians who served in the French army during the Algerian war. He was quoted in an interview as claiming that "the FN is the only party that recognizes and respects the loyalty of our fathers. The FN has shown its thanks to the repatriated Harkis."<sup>27</sup> Bellebou himself no longer enforces Islamic traditions on his children and is more pre-occupied with honor paid to his ancestors than he is respect paid to present Muslims. More important is that Front National has its most staunch support base in sensitive urban areas and in townships suffering from post-industrial economic depression<sup>28</sup>: Muslims, along with other immigrants, have also been impacted, with many Muslim communities facing poverty, low wages, and high unemployment, leading them to oppose the globalization movement.<sup>29</sup> Benmerzouk vocalized the perspective of many Muslims when he lamented that "in today's globalized world, we are mere pawns." Thus, it is important to recognize that Muslims suffer from the same afflictions that drive the French working class to vote for Front National and can easily consider voting for Le Pen once they begin to reject or de-emphasize Islam as a driving force in both the private and public spheres. Muslims share a number of similarities with other FN supporters, including nationalist sentiments, marked cultural conservatism, and a strong dislike of what the FN calls the UMPS (a comedic combination of the Union for a Popular Movement and the French Socialist Party).<sup>30</sup>

### **Neglect & Under-representation**

This leads into the second reason for increased Muslim acceptance of Front National: a growing feeling of disenfranchisement with mainstream parties. Because Muslims make up only 7.5% of the French electorate, their support has traditionally been, at most, an afterthought to the greater importance of other socioeconomic groups. Following decades of negligence on the behalf of Establishment parties such as the French Socialist Party (PS) and the Union for a Popular Movement (UMP), the former name for the Republican Party known today as Rally for the Republic (RPR), Muslims have been driven to believe that if no parties will fully enfranchise them, they are better served voting for parties with generally-favorable (if occasionally xenophobic) socioeconomic policies.<sup>31</sup> Bellebou and Benmerzouk both initially voted Socialist in the late 1970s, but quickly grew disillusioned

<sup>26</sup> Mechaï and Thwadi-Yimbu, "Meet the French Muslims Backing Marine Le Pen."

<sup>27</sup> Ibid.

<sup>28</sup> Ibid.

<sup>29</sup> Gee, Trigg, and McPartland, "Why France's Muslim Voters Are Not All Panicking about a Le Pen Victory."

<sup>30</sup> Mechaï and Thwadi-Yimbu, "Meet the French Muslims Backing Marine Le Pen."

<sup>31</sup> McPartland and Beretta, "Who Are the Millions of French Voters Backing Marine Le Pen?"

with the abrupt turn towards austerity in 1983, where government measures to reduce the deficit placed uncomfortable economic pressure on those living in post-industrial communities. Many Muslims have accused the socialist party of viewing Muslims as “a disposable electorate.” Both men also later joined the RPR before ultimately leaving because they were made increasingly aware that mainstream right-wing parties “didn’t want Muslims.”<sup>32</sup> This reflects the true extent of delusion, as their justification for a FN vote is that Le Pen only does not want Islamic fundamentalists. Likewise, Omar Djellil, a 46-year-old who joined FN in 2011, said that the “system” was a deciding factor in his switch to the FN because he feels betrayed by the left.<sup>33</sup> Many Muslims in similarly difficult political situations have subsequently turned towards the FN as a party that at least pledges some sort of potential change from the dissatisfactory status quo. Muslims not only already feel disenfranchised from French culture on the basis of their religion, but also distrust other parties just as much, if not more, than Front National. Le Pen may have won only a handful of the already-small Muslim vote, but her support base is growing, and the current political trends in Europe will likely only augment this increase.

### **Hispanics & The Republican Party**

Another minority group in America has faced similar questions as to their controversial voting choices: Hispanics. As mentioned previously, Trump’s support amongst Hispanics defied all expectations when it saw a small but significant increase in the 2016 election, in spite of both a decade-long trend and Trump’s own inflammatory anti-Hispanic, anti-immigrant rhetoric. To begin, we must acknowledge the obvious base of Cuban immigrants in Florida that has consistently voted Republican on the basis of hoping for a regime change in Cuba. This does not form the majority of Trump’s Hispanic support, however, as his constituency is actually much further reaching and diverse than it may initially seem: large numbers of Mexicans, Guatemalans, and Nicaraguans converted from voting Democrat to voting Republican<sup>34</sup>, each on a number of different bases. Similar to Muslims voting for Le Pen, many Hispanics (Mexicans in particular, it seems) are able to either put aside the importance of their ethnicity or convince themselves that Trump’s derogatory rhetoric applies only to illegal immigrants or those living outside the U.S. and not actually themselves. A number of them mentioned in personal interviews and accounts of their first voting experiences that they felt Trump, in spite of his words, did not truly oppose *all* Hispanics, but rather simply the percentage that was attempting to enter the United States through illegal means. Americanization is also a factor, considering the numerous studies showing that Hispanic families are pulling further away from their ethnic

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<sup>32</sup> Mechaï and Thwadi-Yimbu, “Meet the French Muslims Backing Marine Le Pen.”

<sup>33</sup> Ibid.

<sup>34</sup> Walker, “Meet the Latinos Who Voted for Donald Trump.”

roots, with those with second-generation family members Americanizing the most rapidly.<sup>35</sup> Such a phenomenon fits neatly into the populist strategy of establishing a separate group of true people and convincing people that they are or could be included within such a group. Joshua Blank, a manager of polling and research at the University of Texas, has discovered that nearly a third of Texan Hispanics hold restrictionist immigration views and thus voted for Trump due to his strict anti-immigration platform.<sup>36</sup> It is extremely important to recognize that, particularly for Hispanics who arrived in America through legal means (the group most likely to become eligible voters), open borders or more lax immigration policies are not a plus because it insinuates an undermining of the hard work legal immigrants suffered through in order to reach the United States.<sup>37</sup> In fact, Hispanics and Muslims alike are not so different that they do not possess the same grievances suffered by ordinary Americans: minority groups in America also seek universal goals such as economic mobility, safer residential environments, increased public awareness, etc. In fact, FAIR (Federation for American Immigration Reform) President Dan Stein observed that “Donald Trump may not have won the Hispanic vote in this election, but clearly it was not because of his views on immigration. If anything, his positions on immigration seem to have helped him among Hispanic voters whose economic circumstances are being harmed by excessive immigration and unchecked illegal immigration.”<sup>38</sup> Keeping in mind the fact that only U.S. citizens can vote, it is quite understandable that Hispanics would agree with Trump on a number of economic factors and not simply discount him due to the more mainstream narrative of him being an anti-Hispanic, anti-Muslim newcomer with little to no political education.

### **The Opposition**

More significantly, however, Hispanics in America are unique in the extent to which they were motivated by dislike for the opposition or alternative parties. Numerous Hispanics cited disappointment with either the Democratic Party or with Hillary Clinton as a politician as the primary motivating factor behind choosing to vote for Trump. Jessica Reyes, for example, claimed she “never considered voting for Hillary Clinton. [Clinton] failed to deliver when she was in office. As a veteran, the way she failed our brothers in Benghazi hurt me the most. A politician who can’t protect our own people? What can I expect from her as Commander in Chief?”<sup>39</sup> Reyes was referring to the 2012 Benghazi incident where two U.S. government facilities in Benghazi, Libya were attacked by

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<sup>35</sup> Lopez, Gonzalez-Barrera, and López, “Hispanic Identity Fades Across Generations as Immigrant Connections Fall Away.”

<sup>36</sup> CNN, “Trump May Not Be Enough to Swing Latino Turnout Democrats’ Way.”

<sup>37</sup> Gambino, “Viva Trump! What Drives Donald Trump’s Hispanic Supporters?”

<sup>38</sup> FAIR, “Exit Polling Data Refutes Claims That Hispanic Voters Punish Candidates Who Support Immigration Enforcement | Federation for American Immigration Reform.”

<sup>39</sup> Walker, “Meet the Latinos Who Voted for Donald Trump.”

members of an Islamic militant group; a number of Hispanics who have served or are serving in the U.S. military have voiced their dissatisfaction of Hillary Clinton in handling veteran affairs during her time as secretary of state. Reyes had been a staunch Democrat before the start of the decade, but ultimately chose to vote for President Trump due to his stance on fiscal security and his alleged respect for American veterans, two issues that impacted her directly due not only to her own time touring Kosovo as a part of the U.S. armed forces, but also due to her position as a Hispanic educator. She also claims that the Democratic Party had, for eight years thus far, failed her in issues such as wages and immigration. The populist narrative of a valiant challenge to the incompetent incumbent leaders plays significantly to Trump's favor in this case. Interestingly, in poll statistics, more than a supermajority of Hispanics claimed that they liked Hillary as a person and strongly disliked Trump as a person, but a reasonably large chunk of the pro-Hillary percentage actually still voted for Trump, seeing him ultimately as the better leader. One woman named Katherine Vasconez cited being drawn in by Trump's "winning attitude", a stark contrast to Hillary's allegedly-pessimistic pedantry.<sup>40</sup> Trump spun a "positive" (less in the sense of "good" and more in the sense of "additive" or "proactive") vision for the future of America, while Hillary's platform relied primarily on adjustments. This is significant because whereas Trump claimed that essentially all of the status quo was terrible and needed change, Hilary ran on a platform of complacency and settlement, where her message claimed that while the status quo was acceptable, tweaks to minor unacceptable bits could be made. This was likely ineffective because all those who felt neglected by the establishment in the status quo immediately began to see her as a lofty politician unsympathetic to or un-understanding of the plight faced by ordinary working-class Americans. Clearly, people like Reyes bought into Trump's rhetoric not only about himself, but about Hillary as well. Another Hispanic man, the son of two former undocumented immigrants, voted for Trump because he felt that Hillary was a lying, ingenuine politician. Others still supported Trump's pro-life and entrepreneurial spirit, with one Mexican immigrant claiming that Trump's entrepreneurial attitude matched well with Mexico's spirit as an entrepreneurial country.<sup>41</sup> This indicates that Trump's platform had been so successful in its campaigning that people believed in Trump's version of Hilary more than they accepted Hilary's own presentation of herself. Even those who did vote for Clinton claimed that they had voted that way because it was strategic and would block Trump's ascent to power, not necessarily because they liked Clinton as a person or even as a politician. In fact, 64% of Millennial Latinos characterized their votes as being "more a vote against Donald Trump than for Hillary Clinton."<sup>42</sup> As experts themselves are beginning to realize, the Democratic Party is not necessarily a concrete party choice for Hispanics: increasingly, citizens (particularly minorities) are paying attention to specific

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<sup>40</sup> Walker.

<sup>41</sup> Walker.

<sup>42</sup> Krogstad et al., "Millennials Make Up Almost Half of Latino Eligible Voters in 2016."

issues that affect them in their daily lives or the lives of their loved ones. Thus, a clear trend of contradictory voting on an issue-by-issue basis and a strong dislike for the opposition is emerging.

### **Trusting Democratic Institutions**

Alternatively, a large number of Hispanics who voted Republican did so not for Trump himself or his platform-related policies, but rather under the belief that the democratic institutions of America would protect them. Various Hispanic interviewees claimed that they had believed the Supreme Court and Congress would ultimately protect their rights, allowing them to vote for Republican policies without suffering the ramifications of Trump-specific social legislation. Contrary to the stereotyping of Trump voters as politically-uneducated or intellectually-ignorant, many Hispanic Trump voters actually demonstrated considerable understanding of the U.S. government. This group of Hispanics was quoted making statements such as, “He’s going to be held accountable: he won’t run the whole show.”<sup>43</sup> Furthermore, another immigrant woman claimed that she did not think Trump’s plans around building a wall were legitimate statements of intention, believing instead that it would be “hard to put those words into action.” She, along with many others of a similar mindset, ultimately believes that “most politicians are just talk, so [voters] have to decide whether [they’re] going to believe what they say or wait to see what they do.”<sup>44</sup> The logical reasoning of those over-trusting in democracy relates to a justification that Trump is simply saying what he has to in order to get elected. This notion is exacerbated by the fact that Trump himself makes frequent use of social media (in particular, Twitter) to personally confirm or disregard accusations instead of consulting with the White House press team as done by former Presidents. Many Hispanics such as the aforementioned Alvarado appear to believe that either Trump himself will somehow censor his own proposals once in office, or the Supreme Court will intervene in evaluating the constitutionality of Congressional legislature and executive actions.

### **Muslims in America**

A similar phenomenon is noted in the third case study, on Muslims who voted for Trump in the 2016 election cycle. Although (likely as a result of differing political climates) Trump is less known for his Islamophobia than Marine Le Pen, he nonetheless has consistently targeted Muslims before, throughout, and even after his election campaign. For example, Trump publicly questioned former U.S. President Barack Obama’s birth records,<sup>45</sup> challenging them on both geographic location and religious beliefs, as he believed that

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<sup>43</sup> Ibid.

<sup>44</sup> Ibid.

<sup>45</sup> Johnson and Hauslohner, “‘I Think Islam Hates Us.’”

“exposing” Obama as a Muslim would have decreased the chances of a Democratic election victory. Trump has repeatedly legitimized anti-Islam viewpoints, claiming America had a number of different options to remove Muslims from the nation. In November of 2015, roughly a year prior to the presidential election, Trump agreed to strongly consider closing down mosques within the United States in response to the Paris terrorist attacks. A few days later, he also proposed the idea of creating a Muslim registry for all Muslims living in the United States, a clear violation of privacy and a seemingly over-extreme system of government tab-keeping. Later, Trump claimed that a huge Arab population in New Jersey was “cheering as the [World Trade Center] came down,” and quoted falsified poll results stating that 25% of Muslims in the United States felt that “violence against Americans is justified as part of the global jihad.” He further called all Muslims, even those born in neighboring countries such as Canada, “sick people,” claiming that “there’s a sickness going on. There’s a group of people that’s very sick.”<sup>46</sup>

In light of Trump’s inflammatory rhetoric, a majority of Muslims justifiably began to view Trump with great consternation, but a small yet growing percentage contradictorily began to exhibit increasing support for him. In fact, according to a study done through Triton Polling by eMgage, an organization working to “empower engaged Muslim Americans,” 16.8% of Muslim voters in swing states (i.e. Michigan, Florida, Ohio, Pennsylvania, and Virginia) voted for Trump, including over 6% of Muslims who indicated that they were actually Democrats but for the first time had chosen to vote Republican<sup>47</sup>. As for why, a number of interesting trends and developments can be observed. First is the breakdown of which Muslims voted for Trump: according to research done by the Institute for Social and Political Understanding, the first and most significant voting determinant was, as expected, partisanship.<sup>48</sup> Following is degree of education, with multiple studies finding that in the Muslim community, those with no college degree are significantly more likely to support Trump. Most interestingly, Muslim Trump voters scored significantly higher on the Islamophobia index, underscoring the way in which, according to the research published, “bigotry—even against one’s own community—motivates political preferences to a disturbing degree.”<sup>49</sup> Going into an issue-by-issue breakdown, Muslims who ranked national security as highest on their list of concerns were significantly more likely to vote for Trump, and Muslims as a whole ranked economy, foreign policy, and national security as the top three criteria (in that order). Immigration was astoundingly low on the list, contrary to what Hispanic Trump supporters reported.<sup>50</sup> The conclusions drawn from these studies demonstrate a remarkable degree of similarity between Muslim Trump supporters

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<sup>46</sup> Ibid.

<sup>47</sup> “2016 American Muslim Post-Election Survey.” EMgage. 2016. Accessed 2018. <https://www.emgageusa.org/wp-content/uploads/2017/11/Muslims-2016-Post-Election-Survey-Final.pdf>.

<sup>48</sup> Chouhoud, “Which Muslims Voted for Trump?”

<sup>49</sup> Ibid.

<sup>50</sup> “2016 American Muslim Post-Election Survey.” EMgage.

and Trump's stereotypical constituency. Like Hispanics voting for Trump and Muslims voting for Le Pen, Muslims who voted for Trump also seemed to believe that Trump's policies were justified (due to internalized systemic stereotyping and prioritization of national security) and/or targeting fundamentalists and jihadists, not necessarily Muslims already within the United States. Former Wallstreet Journal reporter and co-founder of the Muslim Reform Movement Asra Q. Normani voted for Trump, despite being both a woman, an avid supporter of same sex marriage, a life-long liberal, and an avid practitioner of Islam. She cited safety as the number one factor, claiming that Trump would do the most for National Security on the front of immigration. Despite finding Trump indelicate, she supported him due to her belief that he expressed and professed a truth that people were seeking.<sup>51</sup> Interestingly, in terms of the political spectrum, she wants both the right and the left to move towards the middle. Further notable is the fact that unlike Hispanics, avid dislike for the character of the opposition was not a major determinant in Muslim voter behavior. Muslims appear to place significant stock in the separation of powers concept upon which the United States government is based, thus voting for conservative social and economic policies while hoping to avoid the consequences of discriminatory religious or immigration policies.

Post-election, Muslims initially polled were also asked to participate in a follow-up survey on their opinions on the Trump administration. As of early 2017, only 47.6% of Muslims found their opinions towards Trump very unfavorable, while a significant 17.5% reported a somewhat favorable opinion and 12.5% reported a very favorable opinion, despite Trump's comments on closing mosques, his institution of a Muslim travel ban, and his proposal to create a Muslim registry to document the moves of Muslims within the United States. After Trump's election, 17% of Muslims actually reported feeling more safe living in America.<sup>52</sup> 13% of Muslims indicated that they strongly approved of Trump's policies and the way he was handling his office/position. This is significant because it ties back into the part of populist theory where a populist leader establishes a true pure people and pits them against an opposition. Muslims in America felt more secure post-travel-ban and post-Trump-election because Trump's platform had somehow convinced them that they (Muslims already in the U.S.) were somehow different from all the Muslims who had yet to enter the country. He also instilled within them the ideology of being anti-Islamic fundamentalism, but he expanded it to apply widely to all those from Muslim countries. Similar to Hispanics like Alvarado who was quoted as claiming Trump only sought to deport "uneducated Latinos,"<sup>53</sup> Muslims such as Normani saw Trump's "opposition" group as Muslims either illegally attempting to enter the U.S. or violently carrying out a jihadist, fundamentalist message. Trump's "us against them" mentality therefore brought him

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<sup>51</sup> "One Muslim Woman Explains Why She Voted for Donald Trump | The Takeaway."

<sup>52</sup> "2016 American Muslim Post-Election Survey." EMgage.

<sup>53</sup> Walker, "Meet the Latinos Who Voted for Donald Trump."

support even following policies that would, in almost any other circumstance, be considered incriminating.

Having concluded that a majority of contradictory voting can be explained through either an over-trust in checks on democracy, a redefinition of identity and priorities, and a deep dislike for the opposition or alternative parties, a number of greater observations can therefore be made. The first and most important is that the Establishment (or, in the case of a populist taking over a mainstream party or platform, the opposition) needs to take proactive measures for winning over voters. Particularly in the case of America's 2016 election, it appears evident that relying on dislike does not work in favor of established politicians. The Democratic party made minimal efforts to appeal to groups such as Hispanics and Muslims, even in local or state-level elections for governors and representatives respectively. The Republicans, on the other hand, both recognized their surface disadvantages and took active steps to attract greater numbers of Latino voters. As Trump himself proved, the easiest way to appeal to paradoxical views is to introduce a positive ideal for the future, a step that populist leaders routinely exploit to their advantage all around the world. From the perspective of a populist, a supporter is immediately a part of the 'in group' and any opposition member is immediately a part of the 'out group.' Factoring in the flexible moralist framework populist leader's use, this makes it difficult to expect particular voting standards of a particular group, whether it be on the basis of race, ethnicity, gender, or sexuality. For example, experts initially thought that Hillary's electoral victory would be cemented by both a higher Hispanic voter turnout and widespread Hispanic support for the democratic party. Evidently, this was not the case; while Trump did lose the overall Hispanic vote by a significant margin, he won enough votes to draw awareness from the general public and the Democratic party. Populist leaders champion surprise and capitalize on internalized neglect.<sup>54</sup>

A second conclusion we must acknowledge is that deep dislike for the opposition works one way in favor of the populist, but seemingly not the other way around in favor of the Establishment. While Trump was able to capitalize on public dislike for Hillary, it's important to recognize a key difference that makes the reverse untrue: unlike with regards to the Republican party under Trump, the flame of public dislike for Hillary was heavily fanned by general feelings of neglect growing out of the Obama presidency. Trump was a relatively new target, as a populist completely new to American politics, while Hillary was targeted by everyone with lingering feelings from previous neglect. Defeating populists at their own game via attempts at attacking or exposing is thus fundamentally ineffective. Pulling out to discuss the viewpoint of a populist leader, it is important we understand that leaders will and do use these contradictory groups of voters. The solution to such an issue is most likely the re-enfranchisement of neglected voters by Establishment parties. Recognizing the existence of these paradoxical voters means recognizing the fundamental

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<sup>54</sup> Meckler and Zitner, "Donald Trump's Win Bucks Warnings From GOP, Democrats to Improve Hispanic Outreach."



issues of neglect, disillusion, and political anger that have allowed populism to grow as prolific as it has. As for the future, while populist strategies are not one hundred percent effective in all cases, they do take advantage of fragile existences waiting to be re-shaped, and the only way that populism can be halted or at least pulled onto the normative political spectrum is for us to pay these contradictory cases close attention. They represent entire sectors of people dismissed by traditional parties as unimportant in the grander chess match of an election. Failure to address them in a meaningful manner will eventually lead to greater populist support, and thus these contradictory voters actually have played (and, without meaningful change, will continue to play) a significant role in powerfully yet silently determining the outcome of many elections to come.

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## **The Application of the Buddhist Idea of “Non-Self” to Western Psychotherapy Practices**

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### **Abstract**

In recent years, Buddhism has become more prominent and better known in the west, and because of this many of its ideas, such as meditation, have been used in western practices. The Buddhist idea of non-self, or Anatta, is one that not only encompasses many Buddhist beliefs but can also be beneficial in psychotherapy. The use of Anatta-based meditation and teachings could not only decrease suffering and depression in individuals, but also provide the patients with new skills to approach their everyday life. I conclude that there is a need for more Buddhist psychotherapy practices in the west, and that the idea of Anatta should become more widespread and acknowledged in the western psychology field.

### **Introduction**

From the vantage point of the 21<sup>st</sup> century, we can see the values and benefits of ideas originating from places around the world where entire belief systems and even ways of thinking differ from our own. As a scientific field, psychology has developed from our Judeo-Christian backgrounds and absorbed much of Western philosophy (Hergenhahn, 2013). However, until a few decades ago, it has only relied on its own discoveries and ideas, and therefore has been somewhat alienated from the views of more eastern philosophies. Recently, psychology has begun to question itself and the ideas that have originated throughout time, thus becoming more open to self-criticism and change. One of these changes was the foundation of the Behavioral Economics field, which completely revolutionized views on human rationality and criticized the ideas of mathematical psychology (Do, 2011). This new openness to criticism and new ideas has allowed

psychology to return more to its philosophical roots, and thus question the very foundations of the field. It is this questioning that has allowed the philosophy and psychology of Buddhism to make its way to the west, with great help from the 14<sup>th</sup> Dalai Lama, who started and maintained conversations about the intersection of Buddhism, cognitive science, neuroscience, and psychology (Lama, 2012). One of the most crucial and necessary ideas from Buddhism that should be brought to and used by psychology is that of “non-self.” Adapting the Buddhist idea of non-self could help psychotherapy patients better cope with reentering society and with dealing with their problems. To understand how and why this idea should be incorporated into psychology, we must first look at how other Buddhist ideas have made their way to the west.

One, if not the most, notable Buddhist idea that has been brought to and adopted by the west is the notion of mindfulness and meditation. Meditation is one of the key components of Buddhist philosophy, as it is a crucial tool for the awakening of the mind and progress on the path towards enlightenment. In western studies, meditation has been shown to lessen distractions and focus the mind, thus providing a powerful technique for self-control and self-improvement (Rubin, 1999). Specifically, psychologists and psychotherapists have developed a technique called Mindfulness-Based Cognitive Therapy (MBCT), which is a combination of cognitive behavioral therapy and Buddhist mindfulness meditation practices (Manicavasgar, 2011). MBCT has been used to alleviate stress, anxiety, and depression while managing to mostly remain true to its Theravada Buddhist influences. The rising mindfulness movement has even reached the general population, as persons such as Daniel Goleman and John Kabat-Zinn continue to spread its popularity by marketing techniques such as Mindfulness-Based Stress Reduction to improve our everyday lives (Kabat-Zinn, 2009).

There have also been attempts to incorporate the less practical and more philosophical aspects of Buddhism, such as the idea of “emptiness,” into western psychology. The Buddhist theory of emptiness is a very nuanced and complex idea that requires even most Buddhists an entire lifetime to truly understand, and thus can be very difficult for western scholars to interpret. However, one way to express that idea simply is that emptiness represents the expression that all things are impermanent and do not stand alone in the universe, but rather are part of a more inclusive and constantly changing reality (Lama, 2005). When applied to psychology, it essentially advocates for people to learn how to let things go and be more accepting of suffering rather than indulging in detrimental coping mechanisms (Sundararajan, 2008). The incorporation of “emptiness” also helps people with self-reflexivity, and they become aware of the changes and ways that the outside world is impacting them, and thus become more in tune with themselves (Van Gordon, 2016). The current problem with Buddhist ideas in psychology is that Buddhism is a complex philosophy where each idea plays a large and important role in the grand scheme of things, and therefore it is necessary to first examine an idea’s application in Buddhism before applying it to psychology. Since the focus of this paper is on the Buddhist idea of “self” (or non-self), we

must first examine this idea from a Buddhist perspective to see how it may play a role in psychotherapy.

### **The Buddhist Idea of Self**

Even for Buddhists, the idea of the self is one of the hardest to learn, yet it is also one of the most central teachings on the path towards enlightenment. Like many Buddhist ideas, to most newcomers it may seem paradoxical, yet after some reflection one notices that it makes complete sense. In early Buddhism, the Buddha described the self as the combination of five different aggregates, or “Skandha-s”. The first Skandha is the Skandha of form, which generally refers to all the physical aspects of our existence, namely the body that we inhabit. The second is the Skandha of sensation, which describes our feelings and the sensations we receive from the outside world. The third Skandha is that of perception, which represents the conception of ideas that come from our sensations. The fourth Skandha is that of mental formations, which means our responses to and impressions of our past experiences. The final Skandha is that of consciousness, which is essentially the awareness and sensitivity we have towards the objects around us, tying all experience together (Pérez-Remón, 1980). Together, these Skandhas form what is called the illusion of a self. To be fair, the Buddha never actually stated that there was no self. In fact, he refused to answer the question, since he believed that any answer he gave would confuse those around him, and he would rather have them figure it out themselves through experience.

The Buddhist idea of self is called “Anatta”, and it neither denies the existence of a self, nor the belief in a permanent self. In such a way, it is like a middle path between the two. The self is seen as the combination of these five ever changing aggregates, and thus there does not exist an individual and permanent self, since we are always constantly changing and morphing with the world. This is where the idea of emptiness comes in, as the self is also viewed as empty. It is thus an interconnected and essential component of the entire universe and cannot be taken as separate or “individual” from the rest of existence, since this would be counter to the Buddhist idea of emptiness (MacKenzie, 2008). As Buddhism progressed and changed, many of the Buddha’s ideas were clarified and improved upon, in an attempt to create a more understandable notion of what they meant for enlightenment. In modern Mahayana Buddhism, the idea of Anatta has been expanded upon, leaving the idea of the five aggregates as its basis, but developing upon the interconnectedness and the emptiness of the idea of self. It also steers away from earlier Buddhist and Vedic beliefs about the soul. Normally, we try to fix one specific role or identity for ourselves, and then live by the laws and rules dictated by this identity we have constructed for ourselves. We like to fall back on this construction when we do not know how to act or what to do, since it provides us with an easy instruction manual on what we should want and how we should act. To achieve enlightenment, one must become aware of the fact that there is no separate individual “I”, but

rather an everchanging ingredient in the universe. Thich Nhat Hanh explains the idea of interconnectedness well in his book “The Heart of Understanding”:

If we look into this sheet of paper even more deeply, we can see the sunshine in it. If the sunshine is not there, the forest cannot grow. In fact, nothing can grow. Even we cannot grow without sunshine. And so, we know that the sunshine is also in this sheet of paper. The paper and the sunshine inter-are. And if we continue to look, we can see the logger who cut the tree and brought it to the mill to be transformed into paper. And we see the wheat. We know that the logger cannot exist without his daily bread, and therefore the wheat that became his bread is also in this sheet of paper. And the logger’s father and mother are in it too. When we look in this way, we see that without all of these things, this sheet of paper cannot exist. (Hanh, 2009)

Thus, the self can also be described using this analogy. The self does not exist on its own separate from the rest of the universe, because the self would thus not be able to exist. Instead, the self has to be seen as the combination of all the different parts of the universe that have caused it to come into being.

Buddhism advocates for the constant awareness of the present state and of each of the 5 aggregates, rather than thinking about what our conceptual “ego” wants. It is difficult to understand this idea of “non-self” intellectually and logically, which is why the Buddha advocated for the experiential understanding of it through mindful meditation. The Buddha supported his argument by stating that we do not in fact own our body, emotions or even thoughts. During meditation he would advise Buddhists to only be aware of thoughts and not interact with them, and in such way the thoughts would eventually subside. We do not own our body, emotions and thoughts because they are independent of us, and we cannot entirely control what happens with them. When our body gets injured or sick it is independent of us and we cannot will it to change and become better, therefore it is only an aggregate in the entirety of the self (Bodhi, 2012). The ego is then just a byproduct of the aggregates rather than a central tenet, and to reach enlightenment one must in fact learn to get rid of the ego.

### **Merging Buddhism and Psychology**

How can the seemingly paradoxical idea of non-self be of any use to psychoanalysts and psychotherapists? First of all, we need to define the goal of psychotherapy. Although it differs greatly from patient to patient and even from practitioner to practitioner, the underlying goal of psychotherapy is to help individuals adapt better to society (Lichtenburg, 2018). Maybe they are depressed and thus need to change the way they view the world so that they can become productive members of society, maybe they are battling with loss and cannot function properly, etc. Psychotherapy as a practice is essentially in the business of



mentally rehabilitating people into “normalcy” by trying to improve and strengthen their self-image and the idea of their own self. The problem with this is that it essentially differentiates the “inner” world and the “outer” world and tries to help the patients to learn how to cope with the “outer” world.

According to Buddhism and the idea of non-self, it is not the outer world where the problems arise. The road to enlightenment in Buddhist thought is the fourth Noble Truth, that is, the path to the cessation of suffering. Since enlightenment then focuses on the cessation of suffering, we can look at the techniques used to achieve enlightenment as ways to end the suffering in psychotherapy patients. As stated earlier, one of the pillars of reaching enlightenment is that of accepting the idea of non-self and learning to get rid of the ego. Since ridding oneself of the idea of a permanent self helps lead to the cessation of suffering, we can draw the conclusion that much of the suffering is in fact caused by the idea of a permanent self. This means that the problems that cause this suffering are not external as we believe them to be but are in fact internal problems. Classical psychotherapy then is missing the mark by trying to teach patients how to deal with outside problems, because it is the problems within that are causing the suffering. It therefore becomes essential for psychotherapists to teach and introduce patients to the idea of non-self, since it would create a larger and more lasting impact on the mental health of the patients (Lichtenburg, 2018).

Usually, we tend to categorize reality, concretizing existence and in the process describing ourselves and emotional states in terms of fixed and permanent things, such as depression, sadness, or happiness. This leads to an attachment to these reified physical states, such as stating “I am depressed”, “I feel anxious”, or “I am not happy”. This is what is considered “wrong thinking” in Buddhism because it strengthens the idea of a permanent and independent self (Suler, 1995). The Buddhist way of describing the self is a non-dual way to see reality that denies both permanence and nihilism, stating that things both don’t exist and don’t not exist. The problem with any explanation is that it tries to define an undefinable non-conceptual awareness of reality.

### **Anatta In Psychotherapy**

How does one teach someone who is already suffering greatly an unexplainable way of viewing the self? Here we can once again turn to the Buddhist approach to the problem. In Buddhism, ideas are not described as taught, but either experienced or transferred. The most direct and beneficial way to experience these ideas is through meditation. Meditation has already been brought to the west successfully, but what it has been missing is the intention and the right conception of self. Currently, meditation in common knowledge is thought of as a way to decrease stress and to increase one’s awareness of what is going on in one’s surroundings. However, many western meditation practices do not include the idea of self. Vipassana meditation, which is what many “mindfulness” meditation practices are

based on, helps the meditator to become more aware of the problem of no self and impermanence, which could be useful for psychotherapy. By stating the goal of meditation as being the understanding of the non-duality of nature, meditation can then become a tool towards a purpose rather than just a habit/practice.

Meditation alone is not enough, just as introspection alone is not enough in psychotherapy, and thus a psychotherapist is essential. The psychotherapist, just as in normal psychotherapy, provides an outside perspective that can help with the introspection and help the patient through the process of self-improvement. However, in “Buddhist Psychotherapy”, the therapist acts more as a teacher and a guide than a simple social worker. The psychotherapist-patient relationship should be one where the patient is guided on a self-exploratory journey with the help of the psychoanalyst.

In the west, we commonly view religion as a rigid and defined structure that we must obey and follow. However, eastern religions are less rigid and defined, becoming an almost creative process of self-exploration and of intuition. Psychotherapy is similar, viewed in the west as a defined and rigid structure where the therapist helps the patients to reestablish themselves in society by trying to help them deal with their problems. It should on the contrary be an almost creative process, where the therapist is not trying to fix what is wrong with the patients, but rather help them on the exploration of what it means to be a self, which would be more beneficial to the patient than treating the problems. Since Buddhist thought sees the belief in a permanent self as the cause of suffering, the problems that may occur in one’s life are a side effect of this belief system. By trying to fix the problems, we are treating the symptoms rather than the disease. This is why the main focus of psychotherapy should be the developing of the ability to undo the false constructions and grouping involving the self that the mind has created. This is the essence of the new “Buddhist Psychotherapy”, which would be done using self-reflection, but also meditation and the teaching of the basic Buddhist principles of Anatta.

### **The Ethics of Buddhist Psychotherapy**

As is the case whenever an idea from one culture is absorbed into another, there is sometimes a backlash about the morality and ethics of taking an idea from within a culture and belief system and using it without context where it does not belong. This has occurred in the case of Yoga, where opponents from India argued that in the West it was being used improperly and without the necessary background. In the case of the idea of Anatta, it would not seem to be unethical to use it in western psychotherapy practices for the following reasons. First, Buddhism is a very personal religion and belief system that is based on personal experience rather than on outside teachings. Buddhists are also wary of labels, and thus often do not like being called Buddhists, because it is a form of conceptualization that runs counter to their beliefs. Thus, Buddhism is not a unifying rigid structure that holds a firm

set of beliefs, but rather a personal and flexible religion with many different branches and ideas. This personal aspect of Buddhism allows almost anyone to become a Buddhist without the need of a communion or baptism or formal ceremony. Being called a Buddhist is just a recognition of the beliefs that one holds. The use of beliefs from Buddhism, such as Anatta, is therefore not unethical because these ideas are normally changed and personalized, and therefore can be absorbed into a belief system without a problem.

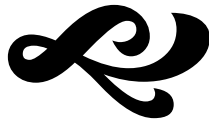
## Conclusion

Buddhism has been making a rise in western psychology, as the field is opening up to new ideas that may differ from its original theories. The Buddhist idea of self is one of the ideas that could be most beneficial to psychotherapy practices, because of the fact that an un-dualistic and conceptual notion of the self is better for psychotherapy patients than a systematic approach to solving their problems. Buddhist psychotherapy not only provides one with the tools to dismantle false conceptions and constructions, but with the use of meditation it can also improve moods, decrease stress, and overall improve the health and happiness of the patient. Buddhist Psychotherapy should become more widespread and used in the field of psychology as its benefits are obvious and, in my opinion, outperform the benefits of regular psychotherapy.

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# Creative Destruction in the Sharing Economy: Uber's Impact and Regulation

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## Abstract

This paper examines the relevance of "creative destruction" to modern businesses. Coined by Joseph Schumpeter, the term refers to the evolution of economic structures as a result of drastic innovation in technology or production methods. The research was conducted in two phases: the first being theoretical and the second being centered around Uber, a modern example of creative destruction in the sharing economy. The first section analyzes paradigms of creative destruction as presented in various sources, including Schumpeter's "Capitalism, Socialism and Democracy," to examine the potential effects the process has on consumers, producers, and the economy. The second section features a case study of how Uber has influenced the economic landscape so far and how it is being regulated by different governments. These explorations and a consideration of unconventional models of regulation proposed by Arun Sundararajan lead to the conclusion that Schumpeter's theory is relevant to today's businesses, and governments should relax regulations on products that cause creative destruction so long as health and safety standards are met.

## 1. Introduction

In justifying the evolutionary character of the capitalist process in "Capitalism, Socialism and Democracy", Joseph Schumpeter refers to the process of "creative destruction", which he describes as "industrial mutation...that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one" (84). This is not to be confused with simple innovation, for reasons that will be explained in this paper. Contemporary examples of products that have caused creative destruction include Uber, Airbnb, and Netflix—all of which

have made traditional modes of production obsolete, with Uber replacing taxis, Airbnb substituting for hotels, and Netflix superseding DVD rentals.

Government regulation can influence the creative destruction process in many ways. There are often protected industries in which the government essentially maintains a monopoly through licensing or allows an entrenched industry (like taxis) to be insulated from competition. In these cases, one may expect new enterprises to experience difficulty entering the industry, let alone revolutionizing it. However, counterintuitively, strict regulation may drive creative destruction because any firm that successfully enters the industry must circumvent existing regulations and hence be drastically different from the original modes of operation. In the process of doing so, the firm completely alters the economic landscape.

Creative destruction has numerous effects for various stakeholders, including the consumer, old and new firms, and the economy. Hence, while any regulations imposed on the new goods or services produced by creative destruction clearly limit creative freedom, the question of how and to what extent governments should regulate remains significant.

In this paper, I will first analyze theoretical paradigms of creative destruction as presented in various sources, including Schumpeter's "Capitalism, Socialism and Democracy", to examine the potential effects the process has on the economy and possible ways governments can regulate industries to maximize social benefit. I will then use Uber as a case study to explore what influences it has had on the economic landscape so far and how it is currently being regulated by different governments. Finally, I will conclude that Schumpeter's theory is relevant to today's businesses, and that governments should relax regulations on products that cause creative destruction so long as health and safety standards are met.

## **2. Theoretical Analysis**

### **2.1. Schumpeter's Account of Creative Destruction**

In "Capitalism, Socialism and Democracy", Schumpeter claims that capitalism is "by nature a form or method of economic change and not only never is but never can be stationary" (Schumpeter, 82), and that consequently the system must be examined over time instead of at any one moment to truly understand how the capitalist process works. He further argues that what causes incessant change in capitalist economies is not events such as wars and political revolutions, or population growth and changing monetary systems, but rather "the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates" (Schumpeter, 83).

Creative destruction, unlike innovation, which merely refers to the “creation” of new economic activity or the improvement of existing modes of economic activity and an addition to the existent economic landscape, must simultaneously “destroy” some portion of the current mode of economic activity. This implies that creative destruction is a type of innovation that fulfills two conditions. The first is that the new method of production is drastically different from the old so that the innovator gains “a decisive cost or quality advantage” over current competition, both price and non-price. The second is that this advantage gained by the innovator “strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives” (Schumpeter, 84). Effectively, the new enterprise would address consumer needs so much better that goods and services produced by current firms become obsolete, eliminating existing competition, and essentially establishing itself as a new monopoly. For example, innovation may be the implementation of dining services on steam locomotives, while creative destruction is the change from steam to electric locomotives.

While Schumpeter personally does not express this in his writing, Peter Thiel, in his book “Zero to One, Notes on Startups, or How to Build the Future”, states that “all happy companies are different: each one earns a monopoly by solving a unique problem. All failed companies are the same: they failed to escape competition”. In other words, only monopolists can earn economic profits in the long run, and since entrepreneurs are motivated by profits and successfully achieving creative destruction helps the innovator become a temporary monopolist, creative destruction drives innovation and economic revolution—confirming Schumpeter’s description of it as “the fundamental impulse that sets and keeps the capitalist engine in motion.”

## **2.2. Creative Destruction and Existing Regulation**

Governments may regulate industries for two main reasons: fair competition and the quality of goods and services provided to consumers (Schneider, 93). Regulations aimed at fair competition try to reduce the market power of large firms, while those aimed at product quality ensure that basic health and safety standards are met.

When regulatory policies aimed at fair competition are implemented, one may assume that resistance to creative destruction is minimal because: firstly, new firms do not usually become monopolies in the short-run so anti-monopoly laws are unlikely to influence startups negatively; and secondly, reducing the market power of dominating firms lowers barriers of entry and ensures that market size is large enough for new firms to earn enough revenue.

In industries where health and safety concerns are significant, such as transportation and health care, the government may sacrifice the goal of fair competition and focus solely on product quality—for instance, to prevent traffic

accidents and epidemic breakouts. In these cases, governments could choose to use occupational licensure as a tool to maintain, in a way, a monopoly. While the government itself may not be a producer, the firms who receive licenses become like monopolies, since barriers of entry into these markets are so high for new firms that innovation is suppressed. However, in the long run, existing firms that are protected from competition by these licenses tend to become stagnant, so it could actually be easier for new firms, who have to circumvent existing regulations by utilizing completely different methods of satisfying consumer needs, to drastically revolutionize the industry.

Hence, in different ways, and contrary to conventional wisdom, both types of regulation enhance the process of creative destruction before it occurs rather than impeding it.

### **2.3. Consequences of Creative Destruction**

#### **2.3.1. On the Consumer**

Consumers generally benefit from the creative destruction process, from both lower prices and improved quality. By making previous modes of production obsolete, creative destruction drastically reduces the market power of existing firms, including any monopolies and firms large enough to have market power tantamount to that of monopolies.

Despite constant pressures from the gale of creative destruction to lower prices and stay competitive, monopolies often use their market power to charge higher prices rather than competitive prices. Hence, creative destruction could lower prices for consumers, leading to increased consumer surplus, which can be defined as the welfare consumers gain when purchasing goods and services at prices lower than what they are willing and able to pay. As true monopolies rarely exist in the real world and most monopolies are regulated by the government, this effect is even more obvious because many high prices are results of increased costs of production for firms that must obtain licensure from the government and satisfy other regulatory standards.

How about after the economic landscape has altered and the new firm establishes itself as a monopoly due to its overwhelming advantage over other firms? Would prices not rise again as a result of the firm's market power? Most likely, no. The "decisive cost or quality advantage" the firm gains through the creative destruction process ensures that at the profit maximizing level of output where marginal cost equals marginal revenue (Blink and Dorton, 104), the price charged by the monopolist firm would be lower than the original price before creative destruction. This assumes that the demand curve faced by the firm does not shift, which should be true, given that the monopolist firm's demand curve is equal to the market demand curve, which does not



shift in the short run, and the market, both before and after, is dominated by a monopolist. For example, let the market of encyclopedias hypothetically be initially dominated by a monopoly before the emergence of Google Search, which is arguably now a monopoly. Consumer prices have dropped significantly from the original price of an encyclopedia to practically zero, as economies of scale and the internet have made it so cheap for Google Search to operate that Google can afford to provide encyclopedic services for free—not to mention the increased convenience and availability of information to consumers that comes with Google Search.

However, if the original market is not dominated by a monopoly, the transition to one may cause prices to rise, although “there are superior methods available to the monopolist” which are not available to a crowd of competitors, so in most cases prices should not increase (Schumpeter, 100). When they do, there would normally also be improved quality of output, which justifies the price change, as products of creative destruction should address consumer needs not only at a lower cost but also in better ways. This can be illustrated by the example of the steam locomotive. While the previous equivalent, horse-drawn coaches, offered cheaper transportation, the steam locomotive, albeit more expensive to ride, provided much faster and more comfortable transportation that more than justified the rise in price. Therefore, creative destruction generally benefits consumers, given appropriate regulations are implemented to ensure quality.

### **2.3.2. On the Firm**

For the firm that achieves it, the process of creative destruction itself almost always has positive consequences, with the amount of benefit reaped depending on how the firm is regulated. The firm would see either a decrease in its costs of production due to an efficient method of production, or an increase in its demand due to a large improvement in the quality of its product in comparison to that of preexistent competitors. Either way, it will earn more profits—“prizes offered by capitalist society to the successful innovator” (Schumpeter, 102)—than its competitors, allowing it to expand further. Also, the increased size of production enables it to achieve economies of scale, leading to further cost reductions. Through this process, the firm is very likely to evolve into a monopoly as its competitors experience the exact opposite: their costs of production increase due to reduced scales of production, and demand decreases due to the availability of a superior substitute.

However, this firm's status as a monopoly is only temporary. As the capitalist economy is a system of constant change, competition does not only occur at specific moments in time, but also over time through the “perennial gale of creative destruction” that constantly pressures firms to innovate in order to lower costs and improve product quality. Even though only three main producers remained in the USA automobile

industry by 1925, Schumpeter writes that if they did not improve prices and services, new competitors would enter and take away their profits (90).

For preexisting firms, the consequences of creative destruction are clearly detrimental. Revenues decrease, possibly to the extent that there is no longer economic incentive for the firms to continue operating. In some industries, firms may actually stop operations, leaving the new firm a monopoly, but in industries where the government intervenes heavily, it is more likely that old producers adopt new methods of production where possible to gain the same cost reductions as the innovating firm, with the exception of those that the innovating firm gained from economies of scale right after it achieved creative destruction. However, despite reduced costs, old firms are still at a disadvantage to the new firm, so they gain little benefit.

### **2.3.3. On the Economy**

In addition to charging high prices, monopolies also do not have incentives to maximize productive efficiency due to the lack of competition (Blink and Dorton, 118). When creative destruction eliminates preexistent monopolies, it reduces this deadweight loss by replacing old, inefficient modes of production with new, efficient ones. While the disruptive firm may lose incentives to maximize efficiency upon gaining significant market power, it would have no reason to revert to less effective methods of production, so even when efficiency is not maximized by this firm, resource allocation would still be closer to the socially optimal level than before the creative destruction occurred.

In “The Use of Knowledge in Society”, Hayek advocates that maximum allocative efficiency is achieved in a free market without central planning because individual participants in economic activity can most effectively “plan” their own consumption or production. They are able to do this because the equilibrium price reflects market conditions. When the government intervenes in certain industries by regulating them, it makes prices more rigid and prevents them from communicating information effectively, creating loss in social welfare because the “man on the spot” has access to local information unknown to the central government bureaucrat. Hence, in the process of reverting from artificially high prices to equilibrium prices as dictated by market forces of supply and demand, the creative destruction process increases allocative efficiency by allowing the price mechanism to fulfill its role as a signal to consumers and producers.

Moreover, especially in the sharing economy, creative destruction has enabled spare capacity to be employed and previously occupied resources to be used in more productively efficient ways. Therefore, in terms of allocative efficiency, creative destruction is beneficial to the economy.

On a macroeconomic level, creative destruction could lead to accelerated economic growth. This is supported by the contrast between the extended period of expansion of the United States' economy in the 1990s and the Japanese economy's stagnation due to its central bank's reluctance to liquidate stagnant firms that were not limited to financial firms, stifling creative destruction (Caballero, 4). One negative consequence of creative destruction is that since technological advancement is often involved, technological unemployment often results because labour, which is most likely less productive than capital, is replaced (Blink and Dorton, 213). However, Schumpeter characterizes alternating periods of "revolution or absorption of the results of revolution, both together forming what are known as business cycles" (Schumpeter, 83). When economic revolution first occurs, there is increased unemployment, but as economic efficiency rises, it leads to restored employment levels and economic growth in the long term.

A more worrying problem is the potential deterioration in the distribution of income. As creative destruction creates unemployment, the remaining firms gain significant advantages while the unemployed experience the poverty cycle and have less ability to invest and enjoy the benefits of creative destruction, possibly creating a more unequal distribution of income.

#### **2.4. Types of Regulation in the Sharing Economy**

A popular view of regulation advocated by Arun Sundararajan is that regulation is justified as "an intervention to correct market failure", which includes the previously discussed imperfect competition and corporate behaviour that is potentially harmful to consumers. Other types of market failure, especially in the sharing economy where transactions occur across peer-to-peer platforms, include information asymmetry and externalities. Information asymmetry refers to a situation in which one party knows more than the other, leading to lower economic activity than is socially desirable due to uncertainty or inefficient allocation of resources when one party chooses to exchange with another when better transaction partners are available. For example, borrowers know more about their creditworthiness than banks, so banks may increase the amount of paperwork that must be done before issuing a loan in order to ensure the loan will be repaid, lowering the number of loans and limiting economic activity. Externalities occur when the consequences of economic transactions are borne by a third party. The external costs and benefits for the third party in addition to the private costs and benefits for the producers and consumers indicate that the socially optimal level of output does not occur at the market equilibrium level. For example, in the case of Uber, consumers may be discouraged from walking and using public transit, possibly leading to congestion and air pollution. Hence, governments might decide to limit the usage of Uber services.

Another problem Sundararajan identifies that arises in the sharing economy is that, due to the “nonprofessional nature of supply” in the sharing economy, “applying a regulatory regime developed for full-time or large-scale providers...could stifle grassroots innovation”. However, a lack of regulation would result in new forms of market failure. In other words, traditional modes of regulation would not work in the sharing economy, but nor would the market be efficient without regulation at all. Rather, unconventional ways of thinking about regulation must be adopted. Sundararajan discusses three such regulatory models: peer regulation, self-regulatory organization, and data-driven delegated regulation.

In a peer-regulated industry, peers (the providers and consumers of goods and services) set standards for each other and collaboratively ensure that these standards are met. This model has the advantage of not having a single standard that must apply to every provider or consumer because, as the industry is semi-professional, it is impossible for all providers to offer the exact same services—which is perfectly acceptable because consumers also have different customer-specific needs. For instance, an Airbnb guest staying in a small artist studio would obviously have different standards from one renting out a luxury condo. While enforcing a set of rules for both hosts to follow (as traditional modes of regulation would) is unreasonable, peer-regulation would allow for different hosts to be regulated according to the needs of their respective guests. Hence, the existence of a review system like Airbnb’s where users can review publicly (to inform other peers of what quality to expect) and privately (to help providers maintain good quality) suffices to ensure product quality.

A self-regulatory organization refers to an association of companies, such as the Transportation Network Companies (TNCs) of California, which defines a set of standards individual providers must obey. The responsibility of ensuring that these requirements are met is given to the platforms on which transactions occur. Advantages of this framework include the high enforcement capabilities of platforms (they can simply disconnect providers who do not comply with standards) and the minimal government involvement (there is just enough intervention for self-regulatory organizations to have necessary legal power, but little tax revenue is spent). In the case of TNCs, instead of ensuring that the countless Uber, Lyft, and other ride-sharing company drivers follow the established set of rules, the association uses its government-given authority to require ride-sharing platforms to register as TNCs before assigning them the responsibility of confirming that each driver on its platform is compliant. If, for instance, an Uber driver disobeys the rules, Uber can simply disconnect the driver from its application, and he/she will no longer be able to get business.

Regulation delegated through data is when platforms (e.g. Airbnb) that are given by the government the responsibility of ensuring that individual providers (e.g. Airbnb hosts) follow a set of laws use operational data to analyze various patterns. For example,

Airbnb could monitor whether its African American hosts have lower pricing power than its white hosts, or whether guests of certain ethnicities are subject to unfair pricing. It could also observe whether there are quality issues of specific providers through review ratings and many other issues which the central government cannot deal with without the same information—the transfer of which from platforms to the government would be inefficient and could lead to privacy issues. Hence, data-driven delegated regulation has great potential to help bring regulatory standards to the sharing economy.

### **3. Case Study of Uber**

#### **3.1. Uber and Creative Destruction**

Uber, a peer-to-peer ridesharing company which connects drivers and riders by enabling transactions across its smartphone application platform, is a familiar example of a new product in the sharing economy that emerged from creative destruction. In contrast with taxi cabs, Uber's predecessor, Uber has created a new method of production (providing transportation with independent, nonprofessional contractors, most of whom serve as drivers of their own cars)—an aspect that Schumpeter describes as necessary for economic change. Uber fulfills both aforementioned conditions of creative destruction.

1. Uber has gained significant advantages in terms of cost and quality by revolutionizing the rider-driver relationship. Without needing to obtain occupational licensure and to hire labour to answer reservation calls as taxi companies do in many countries, Uber has lower costs of production using its online platform. Also, its services are much more convenient because pickups can be arranged spontaneously at any place with the aid of GPS, and the likelihood of getting a ride increases drastically because matching drivers and riders no longer depends on chance, as it did when a rider hailed a taxi passing down the street.
2. To use Schumpeter's language, Uber indeed "strikes...at [these traditional taxi companies'] foundations and their very lives", as consumers no longer have reason to use taxi services when a cheaper and much more convenient alternative is available. While Uber has not completely eliminated taxi cabs, it has forced them to adopt the same technological innovations that Uber developed. Hence, Uber has made the traditional method of operating taxi cab companies almost obsolete, achieving creative destruction.

The traditional taxi cab industry was, and continues to be, heavily insulated from competition by medallions—permits issued by the government which allowed taxi drivers to legally pick up passengers in response to hails. When Uber created a mode of operation which no longer required passengers to hail cabs, drivers could provide their services without medallions. It was able to escape the requirement of a medallion by claiming that it is not a taxi company (as it does not employ its drivers) but rather a peer-to-peer technology that connects drivers with riders. This illustrates the idea that new firms are able to drastically revolutionize strongly regulated industries by circumventing existing regulations and that strict regulation may counterintuitively enhance the process of creative destruction.

### **3.2. Consequences of Uber's Operation**

#### **3.2.1. On the Consumer**

Uber has, at least so far, benefited its consumers both in terms of price and quality, as one may expect from theoretical paradigms. Aside from reduced costs of production which enabled it to achieve creative destruction, Uber can afford to charge low prices due to its abundant supply of drivers. With the implementation of a real-time online platform, drivers can respond to rider requests much more promptly. Another reason for the increased supply is the fact that any experienced driver (the exact requirements vary depending on location) is eligible to provide Uber services, without needing to qualify for government certification as taxi cab drivers do. These characteristics of Uber's mode of operation have led a significantly larger supply than the supply of taxis, leading to lower prices and higher consumer surplus.

While USA taxi cabs charge on a per-mile basis when moving and switch to per minute when idle (for example, when waiting at a traffic signal), Uber charges riders per mile as well as per minute simultaneously, regardless of whether the vehicle is moving or stationary. Based on a hypothetical trip of 5 miles that takes 10 minutes with no idling, the fares in Figure 1 can be calculated, and clearly, as shown in Figure 1, the ratio of the taxi fare to the Uber fare is greater than 1 in almost all displayed cities, meaning Uber is cheaper in those cities. However, Uber engages in surge pricing, whereby it charges higher prices during peak times (such as rush hours, concerts or sports events, etc.), and if the surge rate exceeds the ratio of the taxi fare to the Uber fare, then Uber loses its price advantage. Nonetheless, in most occasions, Uber seems to be the cheaper alternative (Silverstein).

Some may argue that surge pricing is such a drawback that it offsets the benefits experienced by consumers because Uber raises prices precisely when its advantages (such as the almost constantly available supply of drivers) are needed the most. This

behaviour could be described as an abuse of monopoly power (which is discussed in the theory section), except in the case of Uber, the new monopoly prices are higher than the old, and the price hikes are not accompanied by quality improvements, resulting in consumers being harmed. There are also many potential health and safety issues which may arise, many of which have already occurred, including alleged kidnappings and assaults, or simply traffic accidents due to driver negligence. These incidents clearly illustrate that because of the semi-professional nature of Uber, regulation is especially important to ensure consumers are protected.

	<b>Uber</b>	<b>Taxi</b>	<b>Taxi / Uber</b>
<b>New York</b>	17.75	15.50	<b>0.9</b>
<b>Philadelphia</b>	15.25	14.20	<b>0.9</b>
<b>Portland</b>	15.05	15.00	<b>1.0</b>
<b>Cleveland</b>	13.00	13.95	<b>1.1</b>
<b>Dallas</b>	10.30	11.25	<b>1.1</b>
<b>Miami</b>	13.25	14.50	<b>1.1</b>
<b>Indianapolis</b>	11.65	13.00	<b>1.1</b>
<b>Phoenix</b>	11.00	12.50	<b>1.1</b>
<b>Minneapolis</b>	12.15	14.25	<b>1.2</b>
<b>Baltimore</b>	10.75	13.05	<b>1.2</b>
<b>Columbus</b>	10.20	12.85	<b>1.3</b>
<b>Denver</b>	10.35	13.75	<b>1.3</b>
<b>Detroit</b>	12.30	16.50	<b>1.3</b>
<b>Seattle</b>	11.70	16.00	<b>1.4</b>
<b>San Francisco</b>	12.30	17.25	<b>1.4</b>
<b>Chicago</b>	9.50	14.00	<b>1.5</b>
<b>Boston</b>	11.10	16.60	<b>1.5</b>
<b>Atlanta</b>	10.00	15.00	<b>1.5</b>
<b>Houston</b>	9.00	13.75	<b>1.5</b>
<b>San Diego</b>	11.35	17.80	<b>1.6</b>
<b>Los Angeles</b>	9.40	16.35	<b>1.7</b>

*Fare sources: Uber, TaxiFareFinder.com*

**Figure 1.** Table Showing Uber Fares Relative to Taxi Fares

### 3.2.2. On Uber and Its Competitors

Positive consequences experienced by Uber are evident. Uber drivers earn more per hour than taxi drivers do on average, so Uber in turn earns larger revenue than do taxi companies. For example, in San Francisco, Uber drivers earn an average of U\$23.87 per hour while the average income per hour of a taxi driver is only U\$12.96 (McCarthy). In addition, Uber's market share in ground transportation (which includes traditional taxi services, other ride-sharing platforms, and car rentals) was 52% in 2016, and this figure grew to 56% in 2017 (Goldstein)—suggesting Uber is very likely to continue benefiting from economies of scale and expanding into a monopoly-like firm.

In terms of pressure from creative destruction, Uber has yet to encounter a new enterprise that could render its services obsolete, but Lyft, Uber's biggest competitor in the market of ride-sharing services, has emerged, giving Uber the incentive to keep prices low to stay competitive presently in addition to the constant pressure to innovate to protect itself against future competition. So far, Uber has not shown signs of using its market power to raise prices, except for when it employs surge pricing. Although prices for various services have fluctuated, there is no overall upward trend.

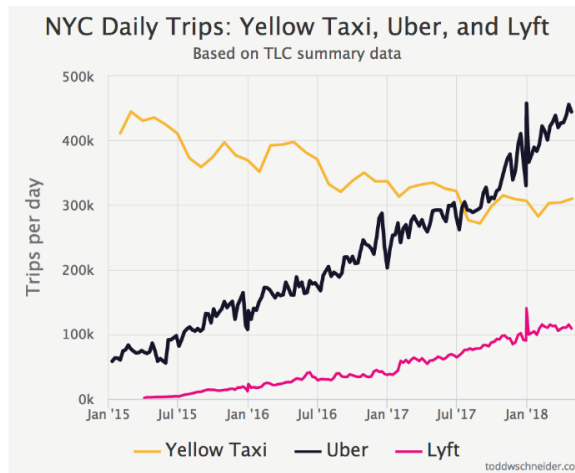
In terms of innovation, however, Uber has encountered problems due to new regulations on its services (despite preexisting regulations not impeding on its innovation, as discussed in the theory section). For example, California's Labor Commission ruled Uber as a transportation startup instead of a logistic software company (Schneider, 118). By placing Uber in the same regulatory realm as taxi cab companies, rulings such as this and other examples in European countries have led to stricter regulations on Uber, including higher barriers of entry for drivers and fewer services allowed (such as UberPOP, which was banned in France). Such regulations limit Uber's ability to realize technological innovation in the future, such as UberAIR, a potential new product whereby riders can hail people-carrying drones. Uber has four methods of dealing with regulation:

1. It can abide by regulation and make changes to its services to comply with existing as well as new rules and to satisfy protestors, such as taxi cab drivers who put pressure on legal institutions to limit Uber's creativity;
2. It can attempt to practice regulatory arbitrage (which it did at the very start but is now beginning to fail in many jurisdictions) by operating as a car rental service instead of a taxi service, for which regulation is stricter;
3. It can expand until it is too large or too significant to local employment and transportation for jurisdictions to ban, effectively guaranteeing its survival;
4. Upon becoming large enough and gaining political power to some degree, it can attempt to influence regulation in an advantageous way (Schneider, 122).



Notably, in none of the four possible tactics would Uber be engaging in innovation. In the first two strategies, Uber would simply be making administrative changes to its business model without making changes to how it provides services. In the third and fourth strategies, Uber can only expand into areas where regulatory burden is less. One example is Uber Eats, a food delivery service where Uber drivers now transport food instead of people, but the transaction system is exactly the same as ordinary Uber services. Essentially, it is a combination of existing products and hence not innovative (Thiel and Masters). Hence, Uber, unable to innovate due to new regulations imposed on its services, is bound to eventually fall victim to the creative destruction process.

For Uber's competitors, the destructive consequences of Uber are obvious. The US taxi medallion was once considered a safe investment that offered better returns than gold, oil, and even real estate, with its price peaking over US\$1 million per medallion in New York City at one point. However, with reduced demand for taxi services due to the emergence of Uber and other ride-sharing platforms, medallion prices have plummeted. For example, in Chicago, the median price peaked over US\$357000 in late 2013, and in 2015, this dropped to about US\$270000 (Madhani).



**Figure 2.** Graph Showing Number of Trips Per Day for Taxis, Uber, and Lyft

As shown in Figure 2, the number of trips Uber provides each day is rising rapidly, while the number provided by taxis is plummeting (Schneider). These trends clearly illustrate that Uber has destroyed the traditional taxi industry and made its services obsolete, while creating a new market for real-time ride-sharing services, as represented by the increased number of rides provided by Lyft. Another indicator of Uber's creative destruction is the fact that taxi cab companies are beginning to incorporate elements of Uber's service such as smartphone apps, driver ratings, etc., which illustrates that old producers have no choice but to adopt new, more efficient methods of production.

In summary, the destructive side of Uber is evident—it has rendered the previous norm of having to either call taxi companies to make reservations or hope an empty taxi cab would drive by obsolete. However, aside from the innovation that allowed ride-sharing to emerge initially, Uber’s creativity is restricted. Even if there is still substantial innovation to be made, regulation limits Uber’s ability to achieve innovation and Uber will be disrupted by the gale of creative destruction sooner or later, unless regulatory structures change.

### **3.2.3. On the Economy**

The theoretical conclusion that creative destruction increases allocative efficiency is indeed correct in the case of Uber. Not only is Uber’s mode of production far more efficient than that of traditional taxi cab companies, the fundamental principle behind its business model of connecting spare capacity (Uber drivers’ cars) with demand (riders) reduces resource underutilization and hence benefits the economy. Moreover, though harmful to consumers, the use of surge pricing during times when demand is high better reflects market circumstances than fixed fare rates of traditional taxis. In this case, the taxi companies have a similar role on the market as the central government bureaucrat in Hayek’s discussion of how rigid prices harm the market, while Uber functions as “the man on the spot” who, through data collected on its mobile platform, has access to local information regarding demand (how many riders are looking for rides on the platform) and supply (how many drivers are offering rides on the platform). As a result, the surge price system, which, as Uber claims, calculates prices based on demand and supply updated in real time, allows the price mechanism to fulfill its role as a signal to riders and drivers more than taxi fares do, hence increasing efficiency.

While the effect Uber has on economic growth is difficult to illustrate, its impacts on employment are clear. In addition to the replacement of administrative staff with automatic online operation systems, many drivers of traditional taxi cabs claim that they are losing business as more of them are becoming unemployed. This negative effect represents what Schumpeter characterizes as the initial increase in unemployment due to the economic revolution caused by creative destruction. However, the overall effect is not negative because Schumpeter’s theory of the following absorption of the results of creative destruction also appears valid. The labor supply of taxi drivers expanded by 10% while that of self-employed drivers surged by approximately 50%, meaning total employment has increased in cities where Uber has been adopted (Berger, Chen, and Frey, 10).

The potential problem of deterioration in the distribution of income is also unlikely to result from Uber’s operations. In order for the distribution of income to become more unequal, the poor or unemployed must continually suffer from a lack of economic opportunities, thus resulting in an increase of the income gap between the poor and the rich. However, the barriers of entry for an Uber driver are very low compared to those for a traditional taxi driver, since the former does not require a taxi medallion and there are fewer

license requirements for Uber drivers than there are in the traditional taxi industry. Uber does not even require its drivers to own their own cars and drivers can qualify for Uber's leasing program that allows them to lease a car by paying a percentage of their weekly earned income from driving for Uber. Hence, rather than worsening the distribution of income, Uber's mode of operation could actually improve it by providing economic opportunities to the low-income population.

#### **3.2.4. Overall**

Almost all of Uber's impacts are positive. Consumers generally benefit from lower prices and improved quality. Although surge pricing reduces consumer surplus, this demerit is partially offset by the positive effect that surge pricing has on allocative efficiency, which improves the economy as a whole. So even where Uber may have a negative effect, it may have a positive net contribution to the economy. By driving down the overall costs of production, Uber has gained significant revenue advantages compared to traditional taxi cab companies. However, while these traditional taxi cab companies are hurt as a result of Uber's emergence, the gain in productive efficiency and consumer purchasing power in the industry balances the damage. Furthermore, on a macroeconomic scale, Uber has created more employment and could even improve the distribution of income.

However, there remain two problems to be addressed: firstly, there must be a way to protect consumers from health and safety hazards, and secondly, regulation must achieve the previous goal without stifling Uber's innovation.

### **3.3. Regulating Uber**

As I emphasized in the theory section, Sundararajan shows that the problems in the sharing economy, as exemplified by Uber, cannot be solved using traditional regulatory structures. Currently, many jurisdictions attempt to ensure consumer safety by requiring Uber drivers to attain additional licensure or by reducing the number of different services Uber drivers can provide (for example, France banned UberPOP services) so that all services will be provided at a hypothetically higher standard. However, doing so would contradict the very reason Uber came into existence in the first place. Meanwhile, if the government were to not regulate Uber at all, it would indeed allow Uber to innovate in whatever way it can (for example, UberAIR), but then Uber would have no incentive to ensure its drivers maintain health and safety standards. Therefore, the nonconventional regulatory models proposed by Sundararajan must be considered and implemented in the sharing economy.

Most likely, a combination of the three discussed models would be the most effective in achieving the goals of protecting consumers from potential health and safety hazards and of enabling existing firms to continue innovating. This would involve the government

delegating the role of regulatory body to self-regulatory organizations, the members of which are required to transfer their operational data to said organizations, which is far more efficient than sending the data to the government. This way, individual firms such as Uber would have the incentive to follow standards because self-regulatory organizations have legal power as well as the data required to know which issues are prevalent in the industry. These organizations can now also grasp the situations of each of its members, and instead of setting the same rules for all of its members, can mandate certain criteria that its members must monitor and control using a peer-regulated system, therefore not restricting individual firms' ability to innovate. For example, the California state government could appoint TNCs as responsible for regulating the ride-sharing market, and Uber and Lyft, etc. would send their data to the association. Using this data, TNCs may hypothetically decide that Uber needs to improve the cleanliness of cars while Lyft must ensure their drivers are friendlier. These two ride-sharing platforms can then warn drivers who have low ratings in these respective regards and disconnect any who continually fail to comply. This approach combines the three regulatory models because a self-regulatory organization would operate by delegating responsibility through data to member companies, who monitor the quality of their products and services using a peer-regulated system. Indeed, this method would simultaneously ensure both product quality and innovative potential.

However, because of the progressive nature of the creative destruction progress, products are almost always changing, and regulations must adapt continually. Hence, while the government should in most cases keep intervention minimal, there are times when the combination of nonconventional regulations would not work. For instance, this is the case with UberAIR, which is such a new product that it cannot simply be managed by a self-regulatory organization. Since there are currently no other firms besides Uber that offer similar aviation services, this new service cannot be successfully managed through a self-regulatory organization. In this situation, government agencies, such as the US Federal Aviation Agency (FAA), must issue certification as in the traditional taxi industry, until the market is mature enough for the combined unconventional approach to regulation to be viable. In other words, as long as Uber is the only company offering this service, it will most likely be treated as participating in the aviation industry.

#### **4. Conclusion**

This case study of Uber clearly illustrates how Schumpeter's theory about the role of creative destruction in the capitalist system is very much relevant in the contemporary economy: Uber has created a drastically superior product and gained significant cost advantages, hence making the mode of operation of traditional taxi cab companies almost obsolete. Thus, although traditional taxi cabs still exist, they are operating increasingly like Uber services in important aspects, since they adopted many of Uber's innovations. There is

also evidence that Uber as a force of creative destruction has indeed led to contraction and expansion in the business cycle.

Both from theoretical analysis and empirical evidence, creative destruction has had largely positive effects on all stakeholders: consumers have benefited from lower prices and improved quality, the new firm has gained profits as reward for its successful innovation, and this has resulted in economic growth. In the case of Uber, surge pricing, although damaging to consumers, increases allocative efficiency, and the welfare lost by previous firms are offset by the gain in productive efficiency, with the additional bonus of a more equal distribution of income.

The remaining potential issues of protecting consumers from health and safety hazards and of allowing for the innovative potential of existing firms (effectively allowing them to protect themselves from the temporal competition resulting from continuous creative destruction) should be addressed with minimal government intervention. Hence, the unconventional regulatory frameworks of peer-regulation, self-regulatory organizations, and data-driven delegation should be combined as follows: the government delegates the regulatory authority to self-regulatory organizations, the members of which are required to transfer their operational data to said organizations, who can then formulate criteria for the members to monitor using peer-regulated systems.

Things may change from here onwards due to the innovation of firms which have already once achieved creative destruction. The impacts of new products such as UberAIR will probably be fundamentally different from the ordinary ride-sharing service, because at this stage, UberAIR is unlikely to replace any portion of the existing industry because of its relatively high price but is more likely to coexist with current taxi and ride-sharing services. It would also need to be regulated with more intervention on the part of government agencies such as the FAA than is desirable in the sharing economy due to the lack of similar services at the present time. However, to maximize benefits to stakeholders in the long run, the government should loosen regulation again once the market is mature enough and again employ the combined framework of the three unconventional approaches to regulation.

Creative destruction and the sharing economy are continuously altering the economic landscape, and regulation must also adapt perennially. Perhaps in the foreseeable future, new models of regulation will emerge that will replace the proposed framework. However, the fundamental principle that government should minimize its intervention in the markets of products of creative destruction will not change because otherwise consumers will not benefit from continuously improving goods and services. Also, Uber is more efficient than traditional taxi cab companies and should be allowed to earn long-term profits as reward for its successful innovation. If, instead, the government intervened directly and stifled Uber's creativity (for example, by preventing the release of new products such as UberAIR), Uber would lose its profit to new competition that achieves creative destruction. Eventually, entrepreneurs may realize that monopolies cannot be maintained under such a regulatory

structure and lose the incentive to innovate. This in turn would mean that the benefits of creative destruction on all stakeholders cannot be harvested.

Therefore, as creative destruction is a beneficial process that, as Schumpeter describes, drives the evolution of the capitalist society, governments should relax regulations on products that cause creative destruction so long as health and safety standards are met.

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## The RAISE Act: Shutting the Doors to the Land of Immigrants

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### Introduction

The United States has been traditionally welcoming to migrants with all skillsets, but recent immigration policy proposals reveal that the nation is planning to shut its door to low-skilled immigrants. Some policymakers believe that the continuous flow of unskilled labor is becoming a burden on native workers and threatening their hopes of fulfilling the "American Dream" – the idea that everybody has an opportunity to succeed through hard work and perseverance. As immigrant workers play an increasingly influential role in the United States' economy, developing an effective immigration policy has become an issue of paramount importance. In response to the overwhelming inflow of unskilled immigrants and the declining wages of native workers, Arkansas Senator Tom Cotton and Georgia Senator David Perdue have proposed the Reforming American Immigration for Strong Employment Act (RAISE Act). If implemented, the RAISE Act will reduce overall immigration by 50% in ten years and admit skilled immigrants through a point-based system. In this paper, I will analyze the economic impact of the RAISE Act to determine whether its changes will successfully fulfill the policy's objective of increasing workers' wages. To what extent will the RAISE Act affect the wages and tax burden of skilled and unskilled native workers? How will the act affect the United States' GDP and GDP per capita? Which group of people will benefit from the act? What are the economic externalities of the RAISE Act, such as equality, agglomeration, and brain gain?

The paper begins with a brief introduction of the specific conditions and objectives of the RAISE Act, followed by a review of current literature about the complex impacts of skilled immigration on the United States economy and labor market. Then, using traditional economic theory, statistical data on the U.S. immigration population, and the Penn Wharton budget simulator, the paper's economic analyses suggest that the RAISE Act will cause the income gap between skilled and unskilled workers to shrink, benefiting native unskilled workers while hurting capital owners. At the same time, the analysis also accounts for a number of externalities, and the effects of the RAISE Act on agglomeration, taxes, and brain drain suggest that the RAISE Act will likely decrease the nation's rate of overall economic growth.

## What is the RAISE Act?

The RAISE Act is an immigration policy that Tom Cotton and David Perdue proposed with the hopes of significantly reducing immigrant inflow to raise the wages of native workers.

Selected Visa Types	Number of visas issued at foreign service posts in 2016	RAISE Act
Extended family preference	215,498	Eliminated
Employment preference	25,056	Awarded with a skills-based points system
Diversity lottery	45,664	Eliminated
Refugee	85,000	50,000 cap

*Table 1. Changes in the number of visas issued annually after RAISE Act*

As shown in the table above, the RAISE Act will make several changes to the number of visa types issued annually to immigrants (Penn Wharton 2017). Firstly, the act will only “retain immigration preferences for the spouses and minor children of U.S. citizens and legal citizens” (RAISE Act). Adult children, siblings, and parents of U.S. citizens are no longer permitted to receive family visas. Secondly, immigrants hoping to receive employment-based visas will have to qualify through a skills-based points system. The points system favors immigrants who are between 26 and 30 years old, have received high levels of education, and are fluent in English, and even those who have received Nobel Prizes or Olympic medals (TIME 2017). Thirdly, the Diversity Visa Program, which offers up to 50 000 visas annually to randomly selected individuals from countries with low rates of immigration to the United States, will be removed (U.S Citizenship and Immigration Services, 2018). Additionally, the number of visas issued to refugees will be reduced from 85 000 to 50 000. In summary, the RAISE Act will significantly decrease the number of both skilled and unskilled immigrants to the U.S. while increasing the average immigrant skill level.

## Literature Review

During the past decades, the proportion of immigrants in the US civilian labor force has increased significantly, sparking debates over the immigrant workers’ impact on the nation’s economy and the welfare of its citizens. To see where the RAISE act fits in context of the bigger picture of the nation’s immigration policy trends, it is important to understand the prevalent existing views in the field of immigration economics. Economists have studied the effects of immigration on a country’s economy and labor market for many years, and while there is general agreement on the impact of immigration on some aspects of the economy, there is little consensus on which immigration policy is best for the United States.



The RAISE Act is grounded in the assumption that the majority of American immigrants are unskilled, but the consensus on the average skill level of United States immigrants is gradually shifting. In earlier studies, economists tended to share the common belief that immigrants are low-skilled in comparison to the native population of the United States. The argument that “immigrants do jobs that natives don’t want to do” is widely voiced (Borjas 2018, p332). Likewise, Bryan Caplan, Professor of Economics at George Mason University, stated that “educated Americans are primarily customers, and not competitors, of new arrivals” (Caplan 2012, p7). However, George Borjas, economist at Harvard Kennedy School, points out that people often overlook the fact that immigrants assimilate to new cultures, asking “if immigrants become just like us, who will do the jobs that ‘we’ do not want to do?” (Borjas 2018, p332). In recent years, more economists have noticed that the skill level of United States immigrants is rapidly growing. Stuart Anderson, Executive Director of the National Foundation for American Policy finds that “the skill level of immigrants is rising, and both recent immigrants and their children are more likely to graduate than native-born Americans” (Anderson 2017, p7). Giovanni Peri, Professor of Economics at University of California-Davis, also observed that the composition of immigrants into high-income countries, such as the United States, is more concentrated among highly educated immigrants than among lowly educated ones (Peri 2016, p7).

While the RAISE Act aims to increase American workers’ wages by reducing the influx of immigrants, there is heated debate over whether immigration actually has a significant impact on native wages and employment. Borjas’ earlier paper suggests that through a theoretical lens, immigration must lower the wages of natives (Borjas 2003). On the other hand, empirical studies conducted by economists show otherwise. Professor of Economics at UC Berkeley David Card argues that the impact of immigration on native wages are small – far smaller than other externalities of immigration (Card 2012, p215). Ottaviano and Peri also fall into this consensus, concluding that immigration has “very small relative wage effects” (Ottaviano and Peri 2012). Additionally, a study conducted by George Borjas and Lawrence Katz in 2005 reveals that immigration has no long-term impact on overall native wages (Borjas and Katz 2012). In fact, Bryan Caplan, Professor of Economics at George-Mason University, argues that an increase in immigration may actually increase native wages, assuming that American immigrants take on jobs requiring physical skills (Caplan 2012, p8). On the other hand, an analysis conducted by Borjas shows that “increases [in] the number of foreign-born doctoral recipients...have a significant adverse effect on the earnings of competing workers” (Borjas 2005, p60). Thus, while small, the effects of immigration on American workers’ wages depend on the skill level of incoming immigrants and vary based on the skill level of the native workers themselves.

The RAISE Act hopes to cut down the labor supply and increase American workers’ wages, but studies find that admitting less skilled workers may actually harm native workers and employers by halting agglomeration. Peri observes that immigrants have a tendency of agglomerating in large urban areas, suggesting that the demand for more skilled immigrants is

“likely to be a very important engine of growth in the long run” (Peri 2016, p27). However, the Penn Wharton budget model predicts that the RAISE Act could cause a loss of four million jobs over the next twenty years (Penn Wharton Budget Model 2016). As a result, this “engine of growth” will shrink if the supply of skilled immigrants diminishes. Furthermore, the reduced number of laborers not only hurts the ability of industries such as agriculture to expand, but also costs the economy “tens of thousands of jobs in related industries” (Anderson 2017, p 45). When employers in one sector are unable to find enough workers, other sectors will also experience job shortages (Anderson 2017, p9). Thus, economists predict that a decrease in labor supply will harm native employers at the expense of raising native wages.

One of the most heavily discussed aspects of immigration’s economic impact is taxes. Economists seem to have varied views on whether immigration exacerbates or reduces the nation’s fiscal burden. According to a report from the National Academy of Sciences, immigrants and their children generate a short-run fiscal burden (National Academy of Sciences 2017). Similarly, Gordon Hanson, Professor of Economics at UC San Diego, finds that “the major drain on government finances from immigration comes from public education”, implying that the children of immigrants significantly contribute to the government’s fiscal drain (Hanson 2012, p30). On the other hand, Caplan argues that immigrants have “minimal impact on the tax burden of American citizens” and may actually be a fiscal benefit (Caplan 2012, p10). Because immigrants tend to be young, Caplan states, they are more likely to support elderly natives than take away their benefits gained from welfare programs (Caplan 2012, p10). However, most economic papers among current literature suggest that the fiscal impact of immigrants depends primarily on their average skill level: Low-skilled immigrants contribute a fiscal burden while high-skilled immigrants reduce it. High-skilled immigrants are likely to pay far more in taxes than they use in public services (Hanson 2012, p26). Meanwhile, “unskilled immigrants are more likely to use many government services and pay lower taxes” (Borjas 1995, p18). The Center of Immigration Studies agrees, stating that “it is simply not possible to fund social programs by bringing in large numbers of immigrants with relatively little education” (Camarota 2013). Even so, economists cannot be certain that reducing low-skilled immigration will reduce the United States’ fiscal costs. Hanson points out that “if reducing immigration requires substantially higher levels of enforcement, the drain on government budgets could actually increase” (Hanson 2012, p30).

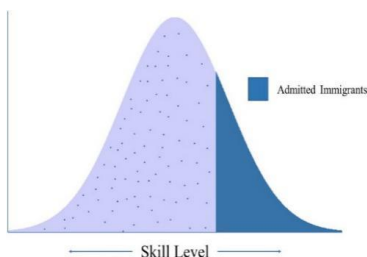
There is consensus among economists that immigration boosts GDP through a theoretical standpoint, but empirical studies predict that the RAISE Act will only have a minimal impact on per capita GDP. In “Lessons from Immigration Economics”, Borjas states that the traditional model of the labor market predicts that immigration increases the aggregate wealth of the native population (Borjas 2018, p337). This finding parallels Michael Clemens’ conclusion that removing world-wide immigration restrictions would create enough wealth to eliminate global poverty (Clemens 2011). But by reducing the number of incoming immigrants, the RAISE Act is predicted to cut two percent off GDP growth from now until

2040 (Penn Wharton Budget Model 2017). However, Borjas argues that the distributional impact of immigration is much greater than its impact on aggregating wealth (Borjas 2018, p340). Findings from the Center of Immigration Studies further highlights immigration’s redistribution effect: “97.8% of the increase in GDP goes to immigrants themselves in the form of wages and benefits”. Consequently, while immigration increases a nation’s GDP, there is no sign that it also increases the per-capita GDP of natives (Camarota 2013). The Penn Wharton budget model also predicts that the RAISE Act will create “very little change to per capita GDP, increasing slightly in the short run and then eventually falling” (Penn Wharton Budget Model 2017).

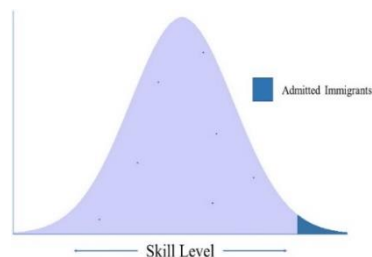
Economists agree that immigration is a significant contributor of brain gain in the United States, but a reduction in the number of skilled immigrants may impede the nation’s pace of innovation. Brain gain is the inflow of skills and ideas to a nation, and immigration supplies the United States with “talented scientists, engineers, and other technical personnel that boost innovation” (Hanson 2012, p26). In fact, 52.4% of founders of all engineering and technology companies in Silicon Valley were immigrants (Wadhwa 2012, p89). Additionally, a study by Hanson finds that US-educated foreign workers patent at a significantly higher rate than native- born workers, suggesting that immigrants fuel the nation’s technological development. Migration patterns of inventors from 2000 to 2010 show that the United States receives the most inventors from abroad by far (Pekkala, Kerr et al 2016, p91). However, Vivek Wadhwa, Vice President of Academics at Singularity University, recently observed that an increasing number of skilled immigrants are finding other countries more attractive than the United States, and the United States now “needs high-skilled immigrants more than ever” to maintain its global technological advantage (Vadhwa 2012, p89).

The following section includes extensive economic analysis of the RAISE Act. Using the traditional theories of supply and demand, I will predict the RAISE Act’s effect on immigrant skill level distribution, wages of skilled and unskilled natives, surplus of workers and capital owners, taxes, price of goods, agglomeration, and brain gain.

### The RAISE Act’s Effect on the Skill Distribution of Immigrants



**Figure 1.** Skill distribution of immigrants before RAISE Act

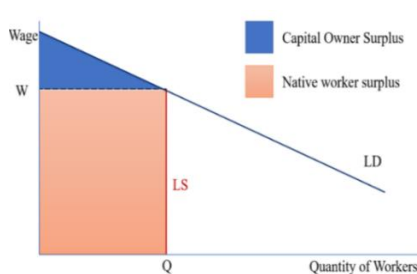


**Figure 2.** Skill distribution of immigrants after RAISE Act

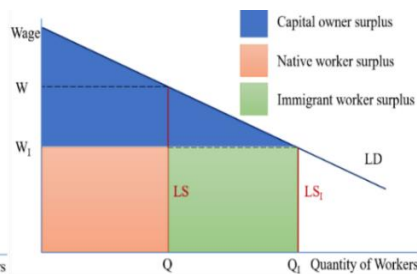
The RAISE Act will implement several changes in the number of visa types issues annually, significantly altering the skill distribution of incoming immigrants. Figures 1 and 2 depict the changes in the skill distribution of immigrants before and after the RAISE Act. The dark blue section in Figure 1 represents skilled immigrants, while the specks on the left side of Figure 1 represent the immigrants' extended family members and diversity lottery migrants. The specks are evenly distributed across the skill spectrum, as it is assumed that these groups are composed of immigrants of all skill levels. As shown in Figure 2, the RAISE Act will reduce the number of such skilled immigrants through a point-based system, allowing only the highest-skilled immigrants to enter the United States.

Additionally, the number of accompanying family members will also decrease, while the diversity lottery group will be eliminated. Consequently, the number of specks in Figure 2 is significantly lower than in Figure 1. It is likely that a portion of the approximately 250,000 eliminated family members and diversity lottery winners are skilled workers, meaning that the RAISE Act will further decrease the population of skilled immigrants. Additionally, because the RAISE Act does not require individuals to earn a certain value of points for each specific category, the overall skillset of admitted immigrants may be imbalanced, causing some industries or occupations to be favored disproportionately. In summary, the number of both skilled and unskilled immigrants will decrease, but the average skill level of immigrants will increase.

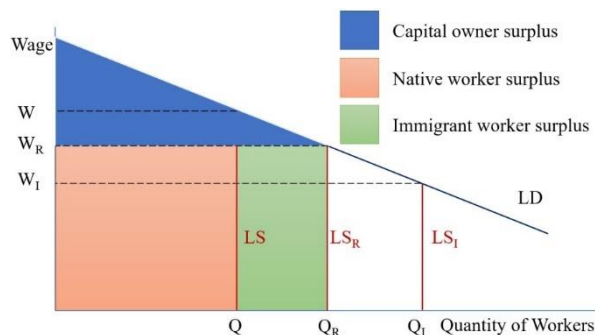
**Impact of Immigration and the RAISE Act on Wages and Surplus**



*Figure 3. Labor Supply and Demand Curve without Immigration*



*Figure 4. Labor Supply and Demand Curve with Immigration*



*Figure 5. Labor Supply and Demand Curve with RAISE Act*

From a theoretical perspective, the reduction of immigrant inflow and the shift in the average skill level of immigrants will have a profound impact on the wages and surplus of native workers, immigrant workers, and capital owners. Figures 4 and 5 illustrate the supply and demand curve of the labor market at regular immigration levels and immigration levels with the RAISE Act. I also illustrated the supply and demand curve of the labor market without any immigrants (Figure 3) to see the impact of the RAISE Act more clearly. Figure 4, and not Figure 3, is the status quo. Therefore, a comparison between Figures 4 and 5 will more accurately depict the economic impacts of the RAISE Act than a comparison of Figures 3 and 4. However, grasping the economic impact of regular immigration levels entail a better understanding of the RAISE Act's effects.

It is important to note that several economic factors are unrepresented in the following analysis. Firstly, because the labor supply curves (LS and LSI) are completely inelastic, the figures are not representing the various skill levels of the workers. Secondly, the figures are ignoring productivity changes and agglomeration. Realistically, agglomeration can potentially shift the labor demand curve. Thirdly, the figure is separating the population into distinct groups: capital owners and workers. However, individuals may serve as both capital owners and workers in the labor market. Most importantly, because data about the RAISE Act cannot be retrieved, these figures only portray the act's qualitative effects and are not to scale.

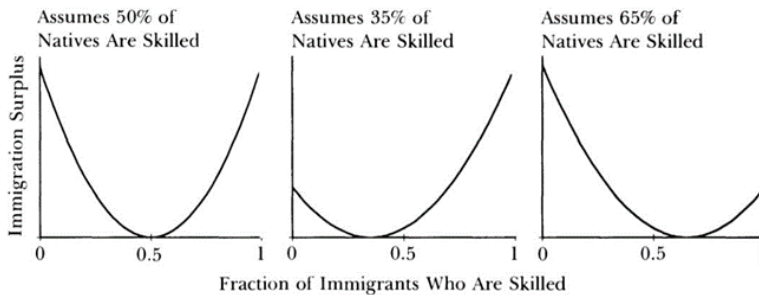
When immigrant workers arrive in the United States, its labor supply will shift to the right. The labor supply curves are inelastic, as it is assumed for simplicity that workers are willing to work at all wages. After the influx of immigrants, worker wages will decrease from "W" to "WI". As shown in Figures 3 and 4, the overall surplus of all workers and capital owners increase. However, the native workers suffer a loss in surplus. Meanwhile, capital owners receive surplus gains as a result of declining wages. At the same time, immigrant workers receive a portion of the gains in overall surplus.

Implementing the RAISE Act will dampen the overall effects of immigration on wages and surplus in the labor market. A comparison between Figures 4 and 5 reveals that native wages will increase from WI" to WR" but will not reach wage levels in the absence of immigration. Likewise, native workers will regain a portion of the surplus lost from immigration, but not all. Meanwhile, it is clear that the RAISE act will cause capital owners to lose surplus, since average worker wages are higher ( $WR > WI$ ). On the other hand, it is unclear from the above figures whether the RAISE Act will cause the net immigrant worker surplus to increase or decrease. While the width of the immigrant worker surplus area will decrease (from "Q to QI" to "Q to QR"), the height will increase (from WI to WR), making it difficult to determine the net change in immigrant worker surplus area.

## Effects of Immigrant Skill Level on Surplus

Unlike the analyses above, the following graphs address the fact that both the native and immigrant worker populations are composed of different skill levels. Figure 6 portrays the immigration surplus for different assumptions of native skill levels (Borjas Benefits 14). It is important to note that Figure A assumes a situation where labor is the only source of production.

### The Immigration Surplus and Immigrant Skills, in a Model Without Capital



**Figure 6.** Source – “The Economic Benefits from Immigration” George J. Borjas 1995

The surplus graphs suggest that skilled and unskilled workers are complements; a greater difference in skill level between native and immigrant workers creates a larger surplus. Thus, an influx of very high-skilled immigrants is more beneficial to the economy when the average skill level of native workers is relatively low. However, Figure 6 does not consider the fact that skilled immigrants generate a larger surplus than unskilled immigrants. In practice, skilled labor and capital are complements, whereas unskilled laborers are more so considered as substitutes of capital goods (Borjas 16).

### The Immigration Surplus and Immigrant Skills, in a Model With Capital (assuming 50 percent of natives are skilled)



**Figure 7.** Source – “The Economic Benefits from Immigration” George J. Borjas 1995

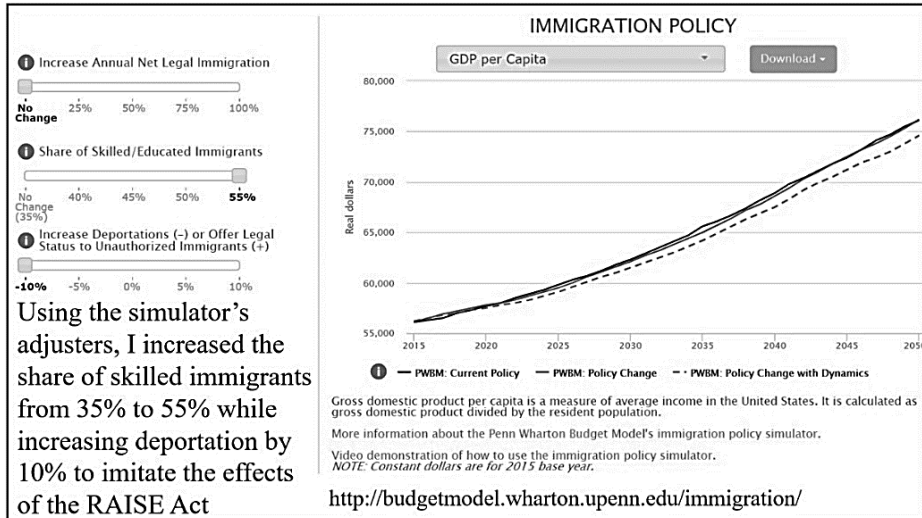
As shown in Figure 7, when assuming that 50% of native are skilled, very skilled immigrant workers generate more surplus than unskilled immigrants. In the context of the RAISE Act, increasing the share of skilled immigrants will likely increase immigrant surplus. At the same time, however, the RAISE Act is decreasing the number of skilled immigrants, which may have external effects that Figure 7 does not consider. Furthermore, a large amount of uncertainty is introduced when evaluating the effects of capital on the economy (Borjas 17). Nevertheless, the graphs suggest that increasing the share of skilled immigrants is a sound method of increasing net immigration surplus.

### **Surplus Per Capita of Native Workers, Immigrant Workers, and Capital Owners**

While the above figure portrays the effects of regular immigration levels and the RAISE Act on overall surplus, they do not reflect the surplus gained per capita. The effects on surplus per capita can be determined by taking into consideration the population changes of each group. Because there is insufficient numerical data, only the RAISE Act's qualitative effects of surplus per capita can be analyzed.

The surplus per capita is calculated by dividing the net surplus of a population by the population size. Because the number of native workers is unaffected by the RAISE Act, an increase in the net native worker surplus implies an increase in native worker surplus per capita. Similarly, in the short-term, the capital owner population is unchanged by the influx of immigrants admitted through the RAISE Act. Because the above figures show that the RAISE Act decreases the net surplus of capital owners, it can be inferred that the RAISE Act will also decrease the capital owners' surplus per capita.

The graphs do not provide substantial information to determine whether the RAISE Act will increase or decrease the net surplus of immigrant workers. Yet, considering that the RAISE Act will decrease the immigrant worker population, it is likely that the act will increase the per capita surplus of immigrant workers. However, if the loss in net immigrant worker surplus is very large, immigrant surplus per capita may also decrease despite a smaller population.



*Figure 8. Predicted GDP Per Capita of Policy Similar to RAISE Act*

Figure 8 shows the Penn Wharton Budget Simulator's prediction of different immigration policies' effects on the United States' GDP per capita from 2015 to 2050 (Penn Wharton 2015). The red line represents the policy's effect without dynamics, while the dotted line represents its effects after including "behavioral responses by economic agents and macroeconomic feedback effects" (Penn Wharton 2015). While the simulator cannot accommodate for the precise changes that the RAISE Act will implement, the sliders on the left can be adjusted to imitate the act's changes. In this instance, the graph depicts the expected changes in GDP per capita if the proportion of skilled immigrants increases from 35% to 55% and the number of deportations increases by 10%. Because it is difficult to determine the true changes that the RAISE Act will make in the share of skilled immigrants, I adjusted the skill level dial to the furthest option to observe the effects of immigrant skill level on GDP per capita as clearly as possible. Likewise, I did the same with the deportation dial to magnify its effect on GDP per capita. In reality, the RAISE Act will cut the number of immigrants by 50%, but the simulator's dials could not go beyond 10%.

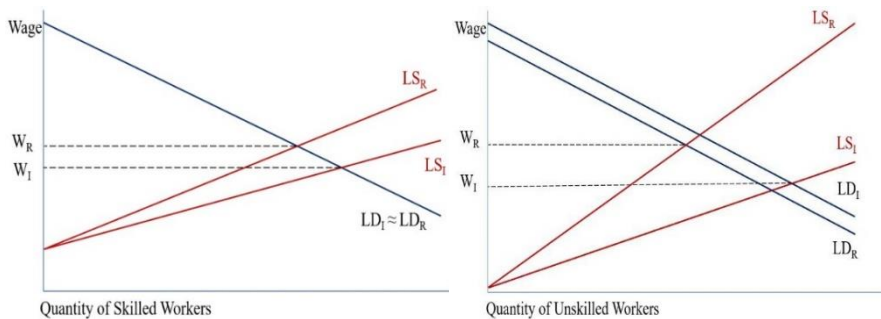
According to the simulator, adjusting the skill level and number of immigrants to imitate the RAISE Act would have minimal effects on the nation's GDP per capita. In fact, even by 2050, there is no noticeable difference in GDP per capita between the current policy and the RAISE Act. On the other hand, the simulator's prediction with dynamics reveals a visible decrease in GDP per capita. This effect can likely be explained by the fact that a decrease in the number of immigrants will reduce the nation's overall GDP. While the simulator's prediction with dynamics is likely more accurate than the prediction without it, the dynamic prediction will be more uncertain, as it is extremely difficult to accurately predict the precise impact of human behavioral responses and macroeconomic feedback.



Nevertheless, the simulator's results suggest that the RAISE Act will have a small negative effect on the United States' GDP per capita.

## Equality

Although GDP per capita captures the average wealth of all individuals in a nation, it does not reflect how the wealth is distributed among individuals. The figures below show a simplified supply and demand graph of the skilled and unskilled labor markets. It is important to note that several factors are ignored in the graphs. Firstly, the shifts in supply and demand do not account for effects of agglomeration and productivity changes. Secondly, the graphs imply that there are only two immigrant skill categories, but in reality, skill levels are continuous.



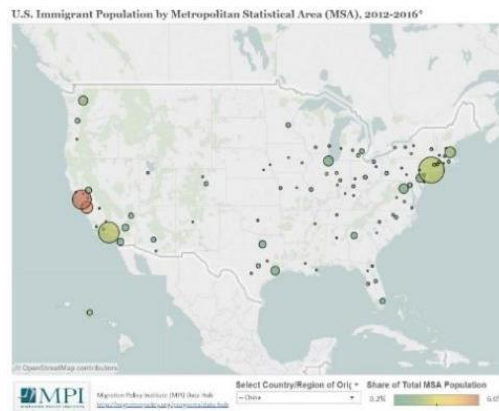
**Figure 9.** Supply and Demand Graphs of Skilled and Unskilled Labor Markets

Theoretically, a decrease in the number of skilled immigrants entering the labor market will increase the wages of other skilled workers. Although the decreased number of skilled workers may also lower demand in skilled goods, since immigrants also act as consumers of high-skilled products, the shift in demand is less noticeable than the shift in supply. This is because skilled immigrants are only a small portion of the entire population that is creating the demand for high-skilled goods. Thus,  $LD_1 \approx LD_2$ . Overall, the RAISE Act is expected to slightly increase wages of high-skilled workers.

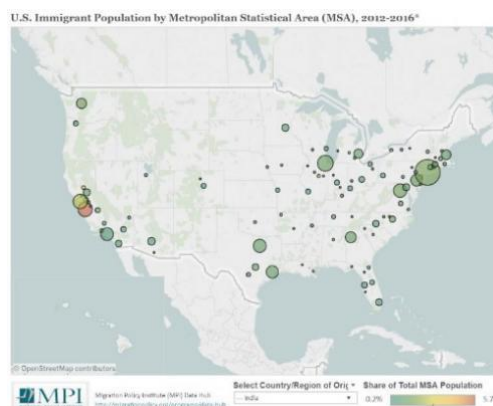
Meanwhile, the RAISE act will lower the number of unskilled immigrants much more than the number of skilled immigrants. Consequently, the decrease in unskilled immigrants will increase their wages (from  $W_1$  to  $W_2$ ), as shown in Figure 9. Simultaneously, since unskilled immigrants are also consumers of unskilled goods and services, a decrease in the number of unskilled immigrants will slightly reduce demand of unskilled products, but this effect is not as pronounced as the labor supply shift. It is likely that the wages of unskilled workers will increase more than the wages of skilled workers will, simply because the changes in population for unskilled workers is much larger than the population change of skilled workers. Thus, according to the laws of supply and demand, the RAISE Act will likely close wage gaps and reduce inequality.

## Agglomeration

Agglomeration is the phenomenon in which the presence of additional workers in the area causes other workers in the same area to be more productive. The increasing returns from the rise in worker productivity causes the location's labor demand to increase. Therefore, it is possible for an increase in the number of workers to actually raise workers' wages. Statistics and maps from the Migration Policy Institute Data Hub suggest that United States immigrants have a tendency of agglomerating in major cities. Both Figures 10 and 11 show that Chinese and Indian immigrants are concentrated in some of the most populated cities in the United States, such as New York City and Los Angeles (Migration Policy Institute, 2016). By decreasing the number of skilled immigrants, the RAISE Act will reduce the effects of agglomeration. The following figure presents an adjusted labor supply demand curve that accounts for the effects of agglomeration. See Figure 5 for the unadjusted figure.



**Figure 10.** U.S.-Chinese Immigrant Population by Metropolitan Statistical Area, 2012-2016



**Figure 11.** U.S.-Indian Immigrant Population by Metropolitan Statistical Area, 2012-2016

As shown in figure 12, decreasing the number of immigrant workers will reduce the effects of agglomeration and shift the labor demand curve downward (to LD\*).  $W^*R$  is the new average wage of workers. After the impact of agglomeration is weakened, the wages of workers appear lower. While the graph suggests that the RAISE Act will cause wages to plummet below expected wages without the RAISE Act ( $W_I$ ), that may not be the case in practice, depending on the severity of the RAISE Act's impact on agglomeration. It is difficult to predict how impactful the RAISE Act will be on agglomeration. The RAISE act is retaining the highest skilled workers among immigrants while eliminating the relatively less skilled ones. Therefore, the question to answer is: to what extent will eliminating the lesser skilled workers reduce agglomeration? Regardless of what the answer is, after taking into consideration the effects of agglomeration, it appears that the RAISE Act may not increase workers' wages as much as the laws of basic supply and demand suggest.

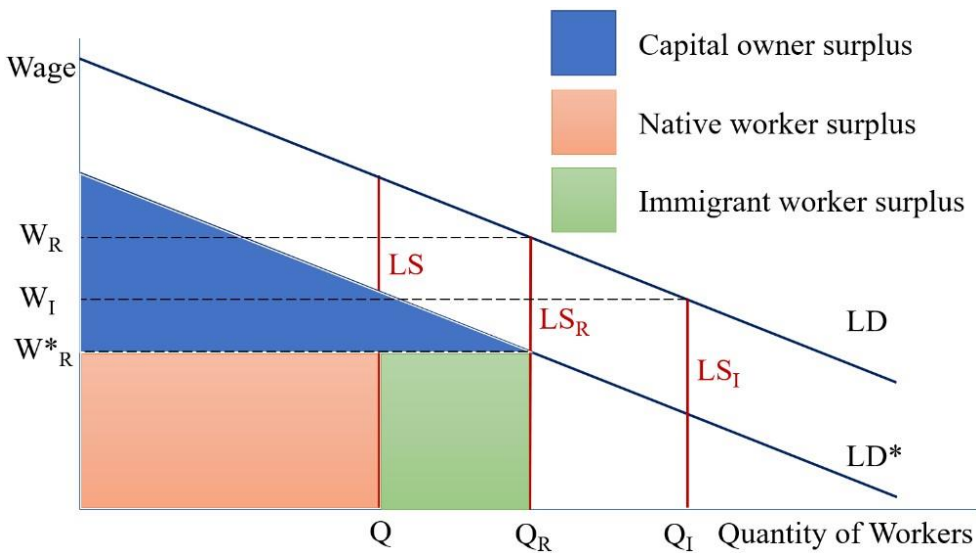
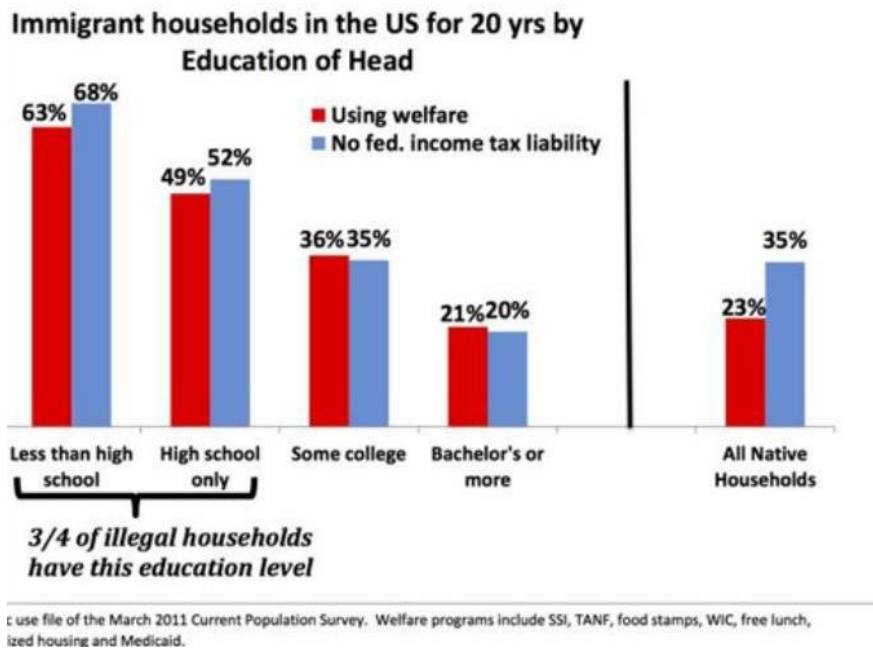


Figure 12. Adjusted Labor Supply and Demand Curve with RAISE Act

**Taxes**

The RAISE Act is expected to lower tax burden of the native population at the local and state level. By eliminating extended family preferences and diversity lottery candidates, the RAISE Act will decrease the number of people using public services, such as schooling and healthcare. Additionally, the RAISE Act is also increasing the share of high-skilled immigrants, who will pay more taxes than low-skilled immigrants. As shown in Figure 13, an immigrant's education level is inversely proportional to the likelihood that he or she will use welfare.

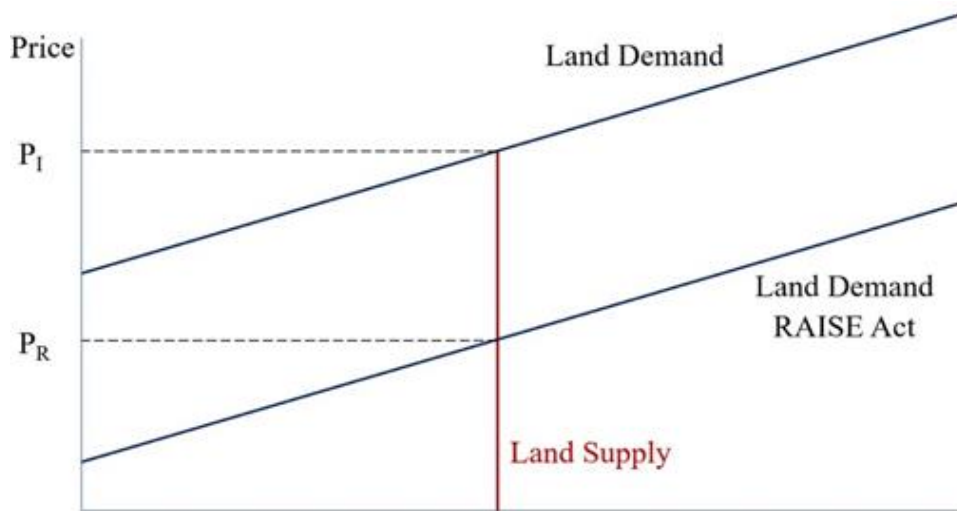


*Figure 13. Relationship between Education Level and Welfare Use*

On the other hand, the decreased number of total immigrants will increase the native population's federal tax burden. The costs of national defense and infrastructure are relatively insensitive to population changes, meaning each person must contribute more to these costs, since the RAISE Act will decrease the number of federal taxpayers.

### Price of Goods

Although the RAISE Act will have a major impact on the costs of skilled services, there are many certainties when attempting to accurately predict its effect. On one hand, decreasing the supply of skilled workers will increase the cost of the services those workers provide. On the other hand, decreasing the total number of immigrants will reduce demand and consequently lower prices. Furthermore, skilled, and unskilled immigrants may demand different goods and services. Thus, predicting the RAISE Act's effect on goods and services requires more information. Meanwhile, it is easier to determine the price changes of land, as the amount of available land is fixed. As shown in Figure 14, a decrease in the total number of immigrants will decrease the price of land. When demand for land decreases, the price of land is lowered.



*Figure 14. Supply and Demand Curve of Land*

### **Brain Drain and Brain Gain**

Brain gain is the flow of skilled immigrants, ideas, and technology from around the world into the United States. A significant portion of the rapid innovation and technological advancements in the United States can be credited to skilled immigrants. Aside from bringing new methods and ideas to the United States, skilled immigrants also boost the productivity of other skilled workers working alongside them. Figure 15 shows that a significant portion of individuals with tertiary education backgrounds and PhDs in many fields are foreign-born, highlighting that immigrants play a vital role in the United States' growth of technology and innovation. For example, 62% of computer software engineers with PhDs are foreign-born. However, by reducing the number of skilled immigrants, the RAISE Act will likely decrease brain gain. Although the act is increasing the average skill level of migrants, it is doing so by eliminating less-skilled immigrants rather than increasing the number of total skilled immigrants. In other words, some of the skilled immigrants who would have contributed to brain gain will be barred from entering the United States by the point-system. On the other hand, the RAISE Act is only eliminating those that are relatively less skilled in the skilled immigrant pool. The immigrants on the end of the skill spectrum who will be contributing most to brain gain will still be permitted to enter the United States. Therefore, the RAISE Act is expected to have a small negative effect on brain gain.

### Proportion of Immigrants among All U.S. Workers in Main Occupations for Educated Migrants

<i>Occupation</i>	<i>All tertiary educated</i>		<i>Individuals with Ph.D.s</i>	
	<i>Share who are foreign born</i>	<i>Share who are born in developing countries</i>	<i>Share who are foreign born</i>	<i>Share who are born in developing countries</i>
Computer software engineers	0.36	0.27	0.62	0.47
Registered nurses	0.14	0.10	0.22	0.17
Physicians and surgeons	0.27	0.20	0.32	0.22
Accountants and auditors	0.17	0.11	0.51	0.35
Postsecondary teachers	0.21	0.12	0.27	0.14
Managers, all other	0.12	0.07	0.35	0.17
Elementary and middle school teachers	0.06	0.04	0.16	0.09
Computer scientists and systems analysts	0.20	0.14	0.41	0.30
First-line supervisors/managers of retail sales workers	0.13	0.09	0.31	0.21
Computer programmers	0.23	0.16	0.52	0.43
Medical scientists	0.40	0.27	0.55	0.36
Physical scientists, all other	0.38	0.24	0.50	0.30
Engineers, all other	0.23	0.16	0.57	0.36
Chemists and materials scientists	0.25	0.18	0.39	0.27
All medical professionals	0.14	0.10	0.24	0.16
All computer specialists	0.23	0.16	0.53	0.39
All engineers	0.18	0.12	0.55	0.35
All teachers and academics	0.10	0.06	0.26	0.14
Scientists and social scientists	0.21	0.13	0.37	0.22

*Source:* American Community Survey 2008. See Ruggles, Alexander, Genadek, Goeken, Schroeder, and Sobek (2010) for the data.

*Note:* Table is restricted to employed individuals aged 25–65.

*Figure 15*

## Conclusion

The economic analyses provided in this paper suggest that the RAISE Act will benefit native workers at the expense of capital owners while reducing the income gap between unskilled and skilled workers, but overall GDP is expected to fall. Additionally, the RAISE Act will decrease taxes at the state and local level but increase federal taxes. Therefore, although the United States' accumulative wealth will decrease, the RAISE Act will help to lift the country's fiscal burden, while the reduced income gap and decreased taxes will satisfy many unskilled individuals. At the same time, however, the RAISE Act is decreasing competition among workers by lowering the number of immigrants and doing so may harm the nation's pace of technological growth, innovation, and development. It is

important to note that the conclusions arrived from the economic analyses are merely predictions of the RAISE Act's effect on the United States labor market and economy, as it is difficult to account for many uncertainties regarding externalities. For example, the analyses cannot accurately predict the RAISE Act's effect on agglomeration, neither can they predict its effect on GDP per capita or prices of goods with certainty.

This paper does not provide a judgment on whether the RAISE Act is "good or bad". Instead, it only sees the RAISE Act through a pure economic standpoint and serves as a predictor for what may happen to the economy if the act were to be implemented. After identifying the economic impacts of the RAISE Act, the next step is to consider whether the United States should allow these changes to occur. Then, it becomes necessary to evaluate the policy through an ethical perspective. Will allowing only those who we think are fit to live and contribute to American society increase overall happiness? Is refusing to provide visas to U.S. citizens' parents morally justified? Ultimately, economists cannot answer the nation's immigration questions alone, but their analyses and discussions provide vital pieces of the answer to a complex question that will shape the future of the United States and the rest of the world.

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## Reports on The Life and Communication Skills Among Down Syndrome Students in China

Banban Tan

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### Introduction

As one of the most common chromosomal abnormalities, Down syndrome (also called DS), also known as trisomy 21, is caused by the additional copy of chromosome 21. Since one of the possible reasons behind the dementia is the accumulation of protein plaques and neurofibrillary tangles (Portelius, 2015), it is difficult to treat Down syndrome with therapy or operation.

However, approximately 85% of students with Down syndrome possess an IQ (based on Wechsler Intelligence Scale) ranging from 50 to 70 (Turnbull, 2016), which is close to the socio-cognitive abilities of 8-year-old children and meets the basic demand for some life skills.

Education and proper care, such as occupational therapy (OT), the Ticket to Work and Self-Sufficiency Program, and the Office of Disability Employment Policy (ODEP), could help Down syndrome student gain the skills needed for later independence and the development of quality of life. According to the National Down Syndrome Society, related strategies developed for down syndrome students include physical therapy, speech and language training, and occupational training (NDSS, 2016). These strategies aim to promote Down syndrome students' grasp of literacy and life skills. The current definition of literacy includes the ability to use language, images, and other basic means to understand, communicate, and gain useful knowledge (UNESCO, 2014); life skills are abilities for adaptive and positive behaviors that enable someone to deal effectively with the demands of life (Unicef, 2014). The according speech and language training focus on developing down syndrome students' abilities in communication, and the occupational training aids in life skills needed for independence.

These devices are effective in many regions. E.g. in the United States, approximately 57% of adults with Down syndrome do paid work to live on their own (Kumin, 2015). This relatively high employment rate in the U.S. (the corresponding rate in Eastern Asia is lower than 5%) is built on a full-fledged special education system, which is famous for its high-level social

acceptance towards intellectually challenged groups: more than 92% of intellectually disabled students have attended regular classes at the school age (IDEA Data Center).

Different from some Down syndrome children having class with other students in inclusive schools, in China, students with Down syndrome are considered an abnormal group. In rural places, Down syndrome children may lose the chance to go to school; in urban places, they go to special schools from an early age (Liu, 2014). Nearly no official data of the career resources or employ rate of Down syndrome students could be searched on the most common portals (Baidu, Sohu, WeChat, Bing, Google Scholar). It's very rare to see adults with this kind of disorder do paid work. Children with Down syndrome become "invisible" as they grow up, which reflects the deficiency in strategies to help them become more independent and function in society.

There is still a huge gap between the educational practice for developing skills between the United States and China, not to mention the absence of related research on cognitive disabilities from educational perspectives rather than economic or medical angles. The various limitations may be caused by historical, cultural, and financial factors.

To further understand the educational devices for Down syndrome students, it is worthwhile to research DS students' performance in different skills as a reflection of current special education.

Based on the author's volunteer experience with children with Down syndrome, the current life abilities of local Down syndrome children were measured through life skills and communication skills. First-hand data came from the Guangzhou Rehabilitation Experimental School.

The situation and educational system in the U.S. and Europe are analyzed for reference. However, because of the lack of first-hand resources, this report is not a comparative study between U.S. and China, but rather it focuses more on the status of children with Down syndrome in China.

On account of various operational definitions, this research chooses the education strategies developed for intellectual challenged children with learning or cognitive disabilities as the definition of special education (Fidler, 2013)

### **Purpose Statement**

The purpose of this research paper is to investigate educational practices for developing life and communication skills among teenagers having Down syndrome in China.

### **Research Questions**

1. What are the historical and political reasons behind the absence of research on education of Down syndrome children in China? What causes the gap between related research regarding this topic in the U.S. and China?

2. What are the educational practices for developing communication skills among teenagers with Down syndrome in China?
3. What are the educational practices for developing living skills among teenagers with Down syndrome in China?

## Literature Review

### Research Question #1: History and Background

In this section, I will explore the context in the field of special education (especially for Down Syndrome) in the U.S. and China.

As the first piece of legislation defining the relationship between disability (including physical, modality, intellectual, and developmental), educational opportunities, and discrimination, passed in 1975 and enacted in 1977, the Public Law 94-142 (P.L. 94-142), also known as the Education for All Handicapped Children Act (EAHCA), appealed for a free and appropriate public education in the least restrictive environment (Shyman, 2013).

This law aims to evaluate the intellectually challenged children in advance, before they are placed in the special education program. According to the regular steps, a child's disability will first be assessed from his or her strengths and weaknesses to the special services that the child needs.

This estimation of the appropriate instructional placement for the child realizes a reasonable prediction of the child's academic, social and vocational potential. Once the child's evaluation is complete—that is, a place (or niche) for the child has been found in special education—an Individual Education Plan (i.e.p.) will be conducted by an interdisciplinary team (consisting of the local school district, and the child's teachers and parents) under P.L. 94-142 to meet the educational demands.

Later in 1990, a new act, the Individuals with Disabilities Education Act (IDEA), was adopted. It was designed to ensure a public access to free education, which includes protecting intellectually challenged students from discrimination based on disability and individual difference (Felicia, 2016). This statute provided an overview of the Response to Intervention (RTI) model, which overcame some limitations that traditional methods failed to break through, e.g. determining the special education eligibility and consequently addressing the disproportionality for diverse students.

In contrast, in China, there is no specific law set for special education.

There are two guidelines: *The Education Ordinance for Intellectual Challenged People*, which illustrates the partition of study stages and the standard of teacher for special-needs education; and *The Guidance of the Disabled*, which highlights the significance of protecting the education chance for intellectually challenged children, increasing the investment in

special-needs education, and enhancing the preschool enrollment rate of special-needs students. However, instead of the formal law, both of these are merely policies without comprehensive details.

Years	Title of Statutes
1957	Instructions in Running School for Blind and Deaf Children
1994	Outline of the Work for Disabled in China (1988 - 1992)
1994	People with Disabilities Act of the Peoples Republic of China
1994	The Education Ordinance for Intellectual Challenged People
2017	Interim Regulations for Special School
2017	Planning of Building Special School in Mid-West (2008 - 2010)
2017	People with Disabilities Act of the Peoples Republic of China (Revised) Guidance of Prompting the Enterprise of Helping Intellectually Disabled Children
2017	Opinions about How to Prompt the Development of Special Education
2017	12 <sup>th</sup> Five-year Plan of Enterprise of Helping Intellectually Disabled Children
2017	Project of Improving Special Education (2014 - 2016)
2017	Regulations for Disabled to Take the Gaokao (College Entrance Examination) (Interim)
2017	Criterion of Curriculum in School for the Blind
2017	Criterion of Curriculum in School for the Deaf
2017	Criterion of Curriculum in School for Retarded Children
2017	Project of Improving Special Education (the Second Version, 2017 - 2020)

**Table 1.** Guidelines for Special Education in China.

As shown in Table 1, there are 14 related policies adopted as principles guiding the development of special-needs education. However, none of these has been enacted in the national law.

### **Ideology and Strategies**

As a result of related policies such as *Criterion of Curriculum in School for the Blind*, in China, students with Down syndrome are isolated from society. Instead of sitting in

inclusive classes with non-special needs peers, they receive education in full-time special training course.

In the United States, however, many schools prefer inclusion philosophies, trying to ensure that students with Down syndrome receive normal education in traditional schools and have class with other children (Starr, 2006). This inclusion of intellectual challenged children into regular schools is partly based on the passage *Education for All Handicapped Children Act (EAHC)* in 1975 (Jellison, 2007).

### **Related Research**

Researchers in the United States have conducted many studies on children with learning disabilities who have routinely been educated in general education classrooms.

Darrow (2007) studied the attitudes from different fields and places towards intellectual challenged students. Atterbury (1983) investigated the differences between normally-achieving and learning-disabled young readers in their performances of rhythm patterns. Jellison examined (1993) the role of music in the therapy of intellectual disabilities, and McCord (2001) discussed the use of computer software in special-needs education. Smith (2007) surveyed 25 subjects who have at least one sibling with Down syndrome, and gained an ecological perspective on the development of communication competence.

At the same time, related investigations from biological perspectives also lay a solid foundation for further research.

In China, there are two features in the literature of special-needs education. Firstly, most studies focus more on biological or medical science theories, e.g., Wang and Ling's research of polymorphisms in genes in 2008, or Liu and Bian's investigation in the diagnosis of Down syndrome in 2014. Very few of them are contextualized within the field of education. Secondly, almost all of them are descriptive studies; the assessment instrument of psychology or special education are rarely utilized.

### **Research Question #2: Down Syndrome Students' Communication Skills**

This section will discuss the strategies in development for Down syndrome students to cultivate their communication skills.

According to Roberts (2007), in addition to mental retardation, due to the poor nonverbal cognitive and comprehension skills, individuals with Down syndrome often have defects in language, particularly in syntax and expressive language such as speech.

King (2013) claims that when compared to their typically developing peers, children with intellectual disabilities usually participate in fewer active-physical, skill-based, and

recreational activities. These differences may be caused by limited physical, cognitive and social skills, or a lack of supportive environments.

As a result, a lower level of participation in activities outside school may encourage the sedentary behavior and social isolation (Rimmer, Rowland, & Yamaki, 2007) that are commonly observed among children with intellectual disabilities.

Liu (2015) in Changsha, China discusses the effect of nursery rhymes on the development of Down syndrome children's communication skills, e.g. possessing more confidence in social contact than their peers with same genetic disorder.

Chen (2013) investigates the relation between phonetic consciousness and reading ability in special-needs education. She finds that parental care plays a significant role in Down syndrome children's literacy development.

In terms of home education, Ricci (2011) states that students' literacy skills are positively influenced by domestic literacy environments and parental beliefs in reading. The home literacy environment is typically defined as the nature and habit of literacy-related activities at home, such as shared parent-child book reading. Parents of children with Down syndrome, in particular, are advised on language and reading interventions in preschool education (Fidler, Lawson, & Hodapp, 2003).

Shen, in her 2006 research, analyzes the methods for Down syndrome family to foster their children's communicate skills (Shen, 2014). Her suggestions include contact with normal students, encouraging physical exercises, and cultivating self-care skills, etc.

### **Research Question #3: Down Syndrome Students' Life Skills**

This section will discuss the strategies in development for Down syndrome students to cultivate their life skills.

Research on 16–19-year-olds with Down syndrome in the Netherlands published by Gamere (2013) measured a wide spectrum of practical and social skills in a nationwide cohort of 322 Dutch adolescents with Down syndrome. They found that almost all of the subjects experienced serious problems in performing practical tasks. For example, only a small proportion (7%) was able to cook a simple meal without assistance or go shopping without help (12%). 35% of subjects needed intensive supervision 24 hours a day.

This research group in the Netherlands states that Down syndrome students' need for parental care may not diminish when they enter adulthood. Their limited skills may hinder the participation in extracurricular activities and social engagement.

According to Foley (2013), involvement in daily activities in the school life was related to post-school occupation. Furthermore, young adults with Down syndrome who engage more in social interaction are more likely to find self-supporting employment rather than those in sheltered programs.

When it comes to life skills, there is still a gap in research written in Chinese. Only one paper is related to this topic: Li (2015) affords some suggestions for families and schools

with Down Syndrome children to nurture students' life skills. The methods involve augmenting their self-consciousness, advancing their first-hand experiences, etc.

So far, related investigations on Down syndrome students' life skills are still limited worldwide. There are more theories or methods developed in the US, but specific research in this field is still not abundant.

### Current Study Method

Questionnaire data was collected and analyzed based on evaluation sheets which evaluate Down syndrome students' performance.

The author has worked as a volunteer in three special schools in Guangdong. Among the three candidates, students in the Huiling School in the Baiyun District are too young (5–8 years old) to finish a questionnaire; most of students in Longdong are not Down syndrome children. As a result, the author chose students randomly sampled in Guangzhou Rehabilitation Experimental School as subjects. All participants were aged 15–17 years and had received special education for more than 5 years (started earlier than 2013).

The Task Form (Appendix) designed according to the Criterion of Curriculum in School for Intellectually Disabled Children in China (2016 Version) consists of two sections: communication skill and life skill. In the Task Form for communication skills, there are 20 identification tasks. In the Task Form section for life skills, there are 25 tasks. Each participant was graded on a scale of one (poor) to three (excellent).

On weekdays, the students study in the parlor on the second floor at school. The test was conducted with individual students one by one in the parlour. Before the test, subjects were informed that they would get cookies as rewards after the test. In the process of finishing the questionnaire, the author read the instructions, showed students the questions, and afford modest guidance to help them understand the questions. It took 12–15 minutes for each student to finish the questionnaire.

Students' performances are evaluated in points (0–3) per task. The rubric for the rating scale is as follows in Table 2.

3 points	2 points	1 point
Verbally fluent without many grammar mistakes	Express basic meaning with some errors in the grammar	Fail to render clear information in speaking
Finish the complete task independently	Finish 40%–60% of the task with some assistance from researcher	Hardly finish the assignment or cannot interpret the instruction

*Table 2. Rubric of Rating Scale.*

## Report Findings

### Communication Skills

#### Self-cognition

Since all subjects involved in the research were over 15 years old, they had all received systematic special education for years. They were all able to discern and report their own names, genders, and ages (Table 3). Only a few of them lost Bi Hua (number of strokes, a structure in Chinese characters) in writing. One student could not understand the word for gender. However, when he was asked “Are you a boy or a girl?” he provided the correct answer immediately. Students performed better in Question 3 than in the other two questions, as age is simpler to learn by rote. Also, when asked about their grade, they provided the correct answer quickly.

Task	Performance ratings				
		1	2	3	Means
1. Discerns and reports his/her full name	M	/	3	17	2.85
	F	/	2	15	2.88
2. Discerns gender	M	/	2	18	2.70
	F	/	/	17	3.0
3. Reports his/her own age	M	/	/	20	3.00
	F	/	/	17	3.00

*Table 3. Self-cognition.*

### Comprehension of their Families and Schools

In order to ensure their security, parents and teachers required the research subjects to memorize and rehearse their family address, basic family details, and school address. So, it was not surprising to find that they were able to answer the first three questions fluently, without exception. However, according to the grading scale, nearly 50% of students could not write this information. When asked to write it down, they made many mistakes or omitted to write some components of the address. Additionally, they often made mistakes in spelling Chinese characters, and they did not have a concept of substitution. Namely, when they did not know how to express something, they would not use similar words to replace those they did not know. Rather, students would create a nonexistent character by adding Bi Hua unconsciously to finish the sentence.



Most of the subjects were familiar with the personal information about their parents, but they had no idea how to fill in the information for other relatives such as cousins. When it came to the location of the subway or bus station nearby, most of the students were able to report clearly; however, 1 to 5 students had a hard time recalling the precise details. When it came to the section of “recalling other students’ names”, only one student hesitated.

Most of the students were able to give an unequivocal answer in a short time. A few students could only use vague sentences slowly because of their shyness and lack of verbal dexterity; they would nod or shake their head while listening to the questions instead of providing a clear reply.

Test Content	Performance				
		1	2	3	Means
Reports his/her own family address in complete sentences (including province, city, zone, street, telephone number, etc.)	M	/	11	9	2.45
	F	/	6	11	2.64
Reports basic details in their own family (including parents’ or other family members’ names and corresponding relationships)	M	/	6	14	2.70
	F	/	7	10	2.58
Reports name and address of school in complete sentences	M	/	/	20	3.00
	F	/	/	17	3.00
Knows the bus station nearby	M	/	2	18	2.90
	F	/	/	17	3.00
Knows about the hospital near the school	M	11	9	/	1.45
	F	7	10	/	1.58
Knows about the name of his/her teachers	M	/	/	20	3.00
	F	/	/	17	3.00
Knows some of their classmates’ names (no fewer than three)	M	/	/	20	3.00
	F	/	1	16	2.94

**Table 4.** *Comprehension of their Families and Schools.*

### **Daily Use of Language**

Students were asked to read instructions for the EH-NE11 Panasonic hair drier, and nearly half of them were able to read the instruction fluently. When asked “What is an instruction?” or “What does this sentence mean?”, only two male students answered correctly.

In the test of “Tell the researcher the name of products,” there were 12 items in the picture: hat, glasses, ties, umbrella, watches, sofa, bus, Chinese national flag, violin, birthday cake, globe, and washing machine. No one was able to recognize all these items, but all of them could discern at least one. Among them, many children did not know about ties, the violin and the globe. They perceived those articles as other things or gave a “don’t know” answer.

In the test of “Discern the season and the element symbolizing different season,” the season showed in the picture was spring, the symbol included swallow, new born willow, ducks in a river, flowers on the bank, and a child flying a kite by the side of the river. Most of the children receiving the test discerned the symbol signifying spring and were able to spot the action the child was performing.

In the test of “Understand the Meaning of a picture,” a child in the picture was giving an old lady a relaxing massage. Each subject identified the possible relationship (a child and his grandmother) in the picture, but just a few of them understood what the characters were doing.

In the test of “Be familiar with famous cartoon characters,” all of the subject knew at least one cartoon. 5 students enumerated many well-known comic arts, e.g. Tom and Jerry, The big head son and little head father, Tutu with big ears, Armor Hero, Ultraman, etc.

In the test of “Being familiar with common traffic signs,” the researcher showed three common traffic signs to the subjects: Guangzhou Metro, cabin, and zebra crossing. Only one student distinguished all of the signs. All of them knew the sign of Guangzhou Metro.

In the test of “Being familiar with common brand logos,” the researcher displayed nine common logos: Nike, Apple, Adidas, Benz, BMW, Huawei, Chinese mobile, Li Ning, and Guangzhou Automobile. No one was able to label all the items correctly, and all of the students knew at least one of the logos. Most of the children recognized Nike and Adidas.

The student performed best in the test of “Read the simple sentences out loud in mandarin,” “Read the basic Chinese characters,” and “Rehearse classic ancient poems.” All of the sentences, Chinese characters, and ancient poems were chosen from the Criterion of Curriculum in School for Intellectually Disabled Children (2016 Version). Except one or two students who made mistakes, the rest of subjects finished their task satisfactorily.

Test Content	Performance				
		1	2	3	Means
Reads an instruction.	M	/	11	9	2.45
	F	/	8	9	2.53
Discerns and reports common items in a picture.	M	4	16	0	1.85
	F	3	13	1	1.88
Discerns elements symbolizing different seasons.	M	1	4	15	2.70
	F	1	1	15	2.82
Is able to understand the meaning of a picture.	M	14	5	1	1.35
	F	11	4	2	1.47
Reads out aloud simple sentences in Mandarin.	M	/	1	19	2.95
	F	/	/	17	3.00
Be familiar with famous cartoon characters.	M	/	1	19	2.95
	F	1	3	13	2.70
Be familiar with common brand logos.	M	2	16	2	2.00
	F	3	14	/	1.82
Reads basic Chinese characters.	M	/	2	18	2.90
	F	/	1	16	2.94
Rehearses classic ancient poems.	M	2	8	10	2.40
	F	1	1	15	2.82

*Table 5. Daily use of Language.*

## Life Skills

### Ability to Live Independently

Only 1 in 37 students could not go to the toilet or wash up independently due to physical disability (caused by cognitive disability). The other 31 students did well in these tasks. In the interview, the teacher told me that after some training, very few students still need others' help when going to the toilet or eating meals. The other children were able to arrange their tooth mug, fold their quilt, and sort out their school bag all on their own.

Test Content	Performance ratings				
		1	2	3	Means
Uses chopsticks to eat on his/her own and keeps table clean at meal.	M	1	2	17	2.80
	F	2	2	13	2.65
Is able to keep the clean of bathroom after being toilet trained	M	2	1	17	2.75
	F	/	2	15	2.88
Is able to have bath on his/her own.	M	1	/	19	2.90
	F	/	/	17	3.00
Is able to dress himself/herself.	M	1	/	19	2.90
	F	/	/	17	3.00
Is able to trim the nails.	M	2	2	16	2.70
	F	/	1	16	2.94
Is able to arrange his/her wash supplies.	M	1	/	19	2.90
	F	/	/	17	3.00
Is able to clean up the bed.	M	1	12	7	2.30
	F	1	5	11	2.58
Is able to put things in order.	M	1	15	4	2.15
	F	/	13	4	2.23

**Table 6.** Ability to Live Independently.

### Ability to Conduct Life Skills Tasks

As a public school, Guangzhou Rehabilitation Experimental School receives grants from government each year, and there are teachers or volunteers taking care of the students throughout the whole day.

As a result, students had no chance to do housework by themselves. In the interview, teachers stated that they know the housework would be beneficial to the development of students, but they did not train them in daily life due to security reasons. Mrs. Chen is a teacher who has worked in the research school for 12 years. She suggested that “the students’ manipulative ability is too limited, and they can hardly finish housework in given

time. Since there are many academic assignments for them to complete, if we ask them to clean the dishes on their own, it will cost too much time.”

However, though students had no chance to learn through challenging, a few parents taught their children to do some basic housework. When the author arrived to do the research, two children were sweeping the floor and arranging the toys in the playground.

Test Content	Performance				
		1	2	3	Means
Takes initiative to switch off the light.	M	20	/	/	1.00
	F	17	/	/	1.00
Takes initiative to clean table and chair after the meal.	M	19	/	1	1.10
	F	16	/	1	1.12
Takes initiative to wash the dishes after the meal.	M	20	/	/	1.00
	F	17	/	/	1.00
Takes initiative to take out the trash.	M	19	/	1	1.10
	F	17	/	/	1.00

*Table 7. Ability to Conduct Life Skills Tasks.*

### **Interpersonal Interaction Skills**

With respect to students’ abilities to have interpersonal interactions, all the observed students were able to understand the common language used in everyday life and follow adults’ directions. However, only two of them could convey their expectations for the future; the others had no concept of the future. When having simple conversation with others, only two students performed well: they chatted with the researcher fluently, with one of them asking whether the researcher would be their teacher. At the same time, there were three disabled students who did not interact with the others at all—the author learned from the teacher that these three subjects were always very introverted, with some expression barriers.

During the observation, students did not have an initiative to play. But when the teacher organized them for a game, a majority of the students were willing to participate, although some of them could hardly understand the rules. When it came to aggressive behavior, a few of them were apt to be violent on occasion, but the reason for this was unknown.

Test Content	Performance				
		1	2	3	Means
Is able to understand the meaning of daily conversations, such as “This way, please”.	M	/	/	20	3.00
	F	/	/	17	3.00
Obeys the adults’ instructions.	M	1	3	16	2.75
	F	/	/	17	3.00
Has future prospects and can express clearly.	M	8	10	2	1.70
	F	13	4	/	1.23
Has simple conversation with peers.	M	/	18	2	2.10
	F	3	14	0	1.82
Displays no aggressive behavior.	M	/	2	19	2.90
	F	/	/	17	3.00

*Table 8. Interpersonal Interaction Skills.*

### **Ability to Live in a Public Space**

None of the 37 students had experienced going out and taking public transportation by themselves. The teacher conveyed that when they have to go out, there would be adults to escort and take care of them.

One of the teachers, Ms. Chen, argued: “We do not dare to let our students go out alone. If there is some accident, who should be blamed? There is a 27-year-old student here—even he has to be looked after.”

Mr. Xu, a volunteer from school, contended: “All of the students shuttle with their parents every Friday and Monday. Their living places are limited to home and school. They do not have the chance or need to go out.”

The aim of special education developed for Down Syndrome is to help Down syndrome students back to society. According to this research, to some degree, those children are overprotected: their ability to live without a great deal of help is much lower than expected. Hence, there is indeed a huge gap between their current condition and the goal of returning to society.

Test Content	Performance				
		1	2	3	Means
Understands and obeys traffic signs.	M	6	10	4	1.90
	F	11	6	/	1.35
Crosses the intersection on his/her own.	M	20	/	/	1.00
	F	17	/	/	1.00
Takes the bus or cabin on his/her own.	M	20	/	/	1.00
	F	17	/	/	1.00
Goes to the hospital on his/her own.	M	20	/	/	1.00
	F	17	/	/	1.00
Goes shopping on his/her own.	M	20	/	/	1.00
	F	17	/	/	1.00
Buys tickets and takes train at station on his/her own.	M	20	/	/	1.00
	F	17	/	/	1.00

*Table 9. Ability to Live in a Public Space.*

## Data Analysis

According to the research, in the aspect of language usage, on average, females perform better than males.

In the section, “daily language use”, the average scores for female students is higher than male students from 0.04 to 0.42 except in the “Reads basic Chinese characters” and “Be familiar with famous cartoon characters” categories. That is partly because boys spend more time watching TV or engaging in other entertainment, but girls focus more on studying.

In the section of “daily life skills”, in some tasks, boys showed a greater tendency to finish the assignment. For example, in “Has future prospects and can express clearly” and “Has simple conversation with peers”, boys were more likely to talk with others and imagine a vision of the future.

Instead, although all of the female students were very friendly and were willing to participate, girls were always too shy to talk with the author. The points they got in the chatting task were 0.28 less than boys. Based on their language level, this is indeed a large gap.

According to the teachers in the special school, there were computer classrooms as occupational training in school. However, the author did not have access to the classroom. On account of their low grades (only 1.48 points) in “Has future prospects and can express clearly”, it can be inferred that most of students do not have the condition to perceive or ponder their future career.

In “Ability to conduct life skills tasks” and “Ability to live in a public space”, the average scores are around 1 point, the lowest level. It indicates that in a relatively affluent region in Southern China, the students with Down syndrome still lack the ability to commute or conduct some types of housework alone.

## **Discussion**

The analysis of data shows that except for very low functioning children, most students with Down syndrome perform satisfactorily in the section of communication skills. They possess the ability to interact with others through simple speaking, and can also take care of themselves most of time. When it comes to the ability of serving the others or living in public space, their performance is disappointing. A large number of them have no experience doing housework or cooperating with others, and they have no chance to go out alone, taking public vehicle by themselves. As the result of being overprotected, their life skills are far from self-supporting.

Compared to similar research undertaken in the Netherlands in 2013, a similar conclusion can be made: adolescents and young adults with Down syndrome have limited practical and social skills that are needed for independent daily functioning. They still depend on their parents and other sources of support in daily life (Van, 2013). The specific skills mastered by an individual with Down syndrome influence the degree of independence they can achieve and, in turn, highly affect the support they need in later life.

There is another strategy adopted in United States nowadays: most students with disabilities have to take the same tests as their non-disabled peers (Kauffman, 2014). People who question this expectation, such as Kauffman, point out that it is unreasonable and unfair. From the author’s perspective, it has some merits. To some degree, the standard test set a standard which makes a diploma or a license possible. If they were well trained and qualified, students with Down syndrome would have more opportunities to work on their own and be more independent.

## **Recommendations**

Based on the performance of the students with Down syndrome in this research, it might be worthwhile for the Chinese government to further develop efforts and strategies



for Down syndrome children, e.g. place them in the regular primary school to be routinely educated. Only in this way can the Down syndrome students be exposed to society and reinforce their life skills.

According to Link (1983), it is now far more commonly accepted that the concept of disability is more an interactive function of social, cultural, and environmental factors rather than merely a result of organic impairments (Link & McCormick, 1983). In view of this, it is the same in both the United States and China that related propaganda is supposed to aim at inspiring more tolerance within the public.

Standard tests with well-designed assessments coordinated with enough occupational training might be meaningful and effective in helping students with Down syndrome gain more independence. That is, when there exists a standard for the entrance of a future post, a clearer goal will arise for training Down syndrome students at school.

Based on Rimmer (2007), along with King (2013), encouraging students with Down syndrome to participate in extracurricular activities with other students may promote their physical, cognitive and social skills.

Based on the data analysis and literature reviews, the researcher recommends the following issues for future investigation.

More research is needed on the attitude from the public towards encouraging special needs children, like students with Down syndrome, to integrate into society. Most parents in China are not willing to let their children study with special-needs children. This is partly because of cultural environment: it is competitive for students in China to apply for the admission to secondary or tertiary school, thus the parents worry that the participation of Down syndrome children in class will lower the others' study efficiency.

More research is needed on the progression of methods to assist special needs children with learning by use of online courses or comic arts. Though this group possess a low IQ, they are still able to comprehend the outside world, and they need specialized material for entertainment as well.

More research is needed on the Down syndrome family and how the family members cope with it. Having the perspective from parents will help in investigating how to set proper policy to help those families lower their burdens.

## **Conclusion**

In this paper, the researcher utilized first-hand data collected from a special school in Guangdong, China, in conjunction with a literature review containing research done in the U.S. and Europe, and discussed the communication skills and life skills of Down syndrome students in China. Discussions of background, policy, and history are also included to further understand the current situation of Down syndrome children's skills.

Based on the literature review, it can be inferred that strategies for intellectually disabled children are more mature and well-rounded in the U.S. than in China. However, it is worth pointing out that specific research regarding occupational status of Down syndrome children after their graduation is limited worldwide.

On account of research data, the subjects' life skills are far poorer than communication skills: the average grade they got in the former section is approximately 30% of the latter section. This means that at least for students in the region researched, it is rare for them to have a paid job and live on their own after 18. Based on the similar research in the U.S. and the Netherlands, it can be hypothesized that the status of "the ability in literacy overweighs which in self-care" is a global question, not a national one.

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## Appendix

特殊儿童生活语言技能测试题

TASK SHEET\*

评估日期 Date	编号 Student ID	性别 Gender	年龄 Age	入校年份 Year of enrollment

一、请填写你的个人信息 Please write down your personal information.

姓名 Name: \_\_\_\_\_

性别 Gende: \_\_\_\_\_

年龄 Age: \_\_\_\_\_

二、请填写你的家庭住址 Please write down your home address.

\_\_\_\_\_省\_\_\_\_\_市\_\_\_\_\_区\_\_\_\_\_，

电话号码 Tel: \_\_\_\_\_

三、请填写你的家庭的基本情况 Please write down following information of your family.

父亲的姓名 Father's name: \_\_\_\_\_ 职业 Occupation: \_\_\_\_\_

母亲的姓名 Mother's name: \_\_\_\_\_ 职业: \_\_\_\_\_

家庭其他成员的姓名和称呼 Names or nickname for other relatives: \_\_\_\_\_

四、请填写你的学校的基本情况 Please write down following information of your school

你的学校的名称 School name: \_\_\_\_\_

你的学校的位置 School address: \_\_\_\_\_

你的学校附近的地铁站或者公交站的名称 Please write down the bus station nearby: \_\_\_\_\_

你的学校附近的医院的名称 Please write down the hospital nearby: \_\_\_\_\_

你的老师的姓名 Please write down the name of your teacher or counselor: \_\_\_\_\_

你的同学的姓名 Please write down the name of your classmates: \_\_\_\_\_

五、请仔细观察下面这些图，请写出或说出它们的名称 Please write down the name of following objects:



六、请仔细观察下面的图，然后写出或说出图中的小朋友正在做什么？ Please observe the following picture and describe: what's the possible relation between the people in the picture? What is the little boy doing?



七、请仔细观察下面的图，然后写出或说出图中所画的是什么季节？图中有哪些事物？这个小朋友正在干什么？ Please observe the following picture and describe: what is the weather in the picture? How many objects are there in the picture? What is the little boy doing?



八、请说出你知道的童话故事 Please tell the researcher a story or a tale you like.

\_\_\_\_\_

九、请说出你知道的动画片 Please tell the research a cartoon film you like.

\_\_\_\_\_

十、请辨认下列常见交通标志 Please write down the name of following traffic signs.



十一、请辨认下列常见的品牌标识 Please write down the name of following logos.



十二、请用普通话朗读下面这些句子 Please read out loud the following sentences in Mandarin.

1. 妈妈在洗手帕。
2. 我会唱国歌。
3. 我会穿裤子。
4. 我排队等候上厕所。
5. 我们要和同学团结友爱。

十三、请辨认常见字 Please read out loud the following characters.

八	草	刀	耳	风
爱	保	窗	蛋	服
病	菜	冬	非	刚
暗	边	臭	袋	饿

十四、请辨认常见词 Please read out loud the following phrase.

纽扣	拉链	贪吃	东南
关心	尊敬	洒水	扫地

椅子      上当      米饭      馒头  
桌子      找朋友      陌生人      剪指甲

十五、请诵读下列儿歌 Please read out loud the following rhyme.

全国人民共欢庆  
国庆节，真热闹。  
放焰火，观彩灯。  
你唱歌来我跳舞，  
全国人民共欢庆。

好朋友

两只小象河边走，  
翘起鼻子钩一钩，  
就像好朋友，  
见面握握手。

十六、请用普通话诵读下列古诗 Please read out loud the following ancient poems.

咏鹅（骆宾王）

鹅，鹅，鹅，曲项向天歌。  
白毛浮绿水，红掌拨清波。

静夜思（李白）

床前明月光，疑是地上霜。  
举头望明月，低头思故乡。

悯农（李绅）

锄禾日当午，汗滴禾下土。  
谁知盘中餐，粒粒皆辛苦。

\*All of the tasks are designed based on Criterion of Curriculum in School for Intellectually Disabled Children in China.







# Calibrating the Salt Concentration of Water Using Surface Plasmon Resonance (SPR) Technique

Elif Kulaksızoğlu

*Author Background: Elif Kulaksızoğlu grew up in Turkey and currently attends Hisar School in Istanbul, Turkey. Her Pioneer seminar program was in the field of engineering and titled “Engineering Photonic Materials”.*

## Abstract

The difference between water with salinities varying from 0.1% to 2% is detected using the surface plasmon resonance (SPR) technique. Detection of salinity is crucial since it can be of significant help in the protection of crops, fisheries, and livestock, in addition to the probing of Earth's water cycle and detection of global warming. 560-Å-thick silver (Ag) and gold (Au) films were placed on the hypotenuse face of a right glass prism. He-Ne laser beam (p-polarized) with a wavelength of 633 nm was incident through the prism on the metal film. The reflected beam was captured by the photodetector, and the plasmon angle corresponding to the salinity value was calculated. From this experiment, it was shown that the salinity of liquids can be quantified by tracking the plasmon resonance angle. As the salt concentration increased, greater change in the plasmon angle was observed. Due to its better resolvability, silver thin film was determined to be superior to gold. The progress of global warming can be detected through the fluctuations in the obtained values of salinity.

## 1. Introduction

### 1.1 Principles of SPR

SPR is a label-free detection method that allows the real-time monitoring of biomolecular interactions. It provides a platform for investigating different aspects of viral binding to functionalized surfaces. The fact that it is highly sensitive contributes to the analysis of relatively small quantities of bioparticles that no other technique is capable of recognizing. The technique does not require any fluorescent, magnetic or radioactive labeling of the molecules, which eliminates the possibility of labels interfering with the binding process. This way, accurate measurements of association and dissociation kinetics can be determined [1].

Other techniques that are commonly used for discovering and identifying biological samples include PCR, REA, and ELISA. However, while SPR is rapid, these techniques consume time. Moreover, they are capable of examining only small quantities, which limits the quantity of the analyzed material that can be studied. They also require specific sample preparation for making samples visible to the sensors, whereas SPR is a label-free method. The fact that SPR is also relatively cheap indicates that SPR is superior to other methods [2].

SPRi (imaging) is a modified version of SPR that allows visualizing binding events. While using the SPRi technique, the SPR sensor is replaced with a video CCD camera, which collects the reflected light and sends it to a computer to produce an “SPR image.” Data processing is performed with Image or MATLAB [3].

In an SPR biosensor system, suitable antibodies are immobilized and covalently bound onto the metal surface through thiol-metal interactions. The interactions increase the metal’s ability to hold onto the antibody. The sample (analyte) is delivered into contact with the biofunctionalized surface by a fluidic system. The surface plasmon is excited at the interface between a metal and a dielectric medium by a monochromatic, p-polarized light beam. The SPR sensor converts the interaction between the antibody and the analyte into sensory output. Detection is accomplished by measuring the changes in the reflected light obtained on a photodetector [3].

## **1.2 Previous Research**

As the interest in SPR technique has increased, new application areas have been discovered such as biomolecular interaction studies and cancer photo diagnostics. A study performed in 2018 detected the snake venom protein derived from an Indian cobra using a SPR measurement device with the integrated biosensor for studying antigen-antibody interaction. After the sensing element was constructed using amine coupling chemistry, the shift in the plasmon resonance angle due to the presence of conjugated material was calculated. Stronger antigen-antibody interactions were identified to cause a greater change in the refractive index near the sensor surface and consequently in the plasmon angle [4].

An experiment that was conducted early in 2018 used SPR for detecting the differences between coconut oil, corn oil, olive oil, and palm oil. The saturated acid component of oils was found to be the factor that distinguished oils by causing different shifts in the SPR angle. Coconut oil, which contains the highest fatty acid components, showed the biggest shift in SPR angle, while olive oil showed the smallest. This confirmed the suitability of SPR for characterizing materials [5].

Another article that benefited from SPR in order to characterize materials proposed carrying out protein synthesis using SPRi. The paper identified that the characterization of extracellular vesicles (EVs) is significant for differentiating vesicles from one another. EVs contain transferrable genetic information that can promote the progression of metastatic tumors in cancer patients. Thus, their confusion with other cellular vesicles can jeopardize

the patient's health. The paper highlights that in order to ensure correct diagnosis and treatment, a technology that can demarcate each vesicle regarding their physiological functions must be developed [6].

In addition to analyzing biological molecules, SPR can also be used for exploring materials that are visible to the naked eye. A research article that was published in 2017 documented the status of soil and water salinities across the coastal belt of Bangladesh. From fodder crops to higher gestational hypertension in women, various fields have been affected by increased salinity, including human health and agriculture. The study concluded that regular monitoring of water salinity levels would significantly help the protection of crops, fisheries, and livestock along the coastal belt of Bangladesh and in every coastal region in general [7].

This paper proposes a solution to the problem identified by the article mentioned in the previous paragraph. Though the consequences of salinity fluctuations are often underestimated, these fluctuations are one of the major environmental issues throughout the world.

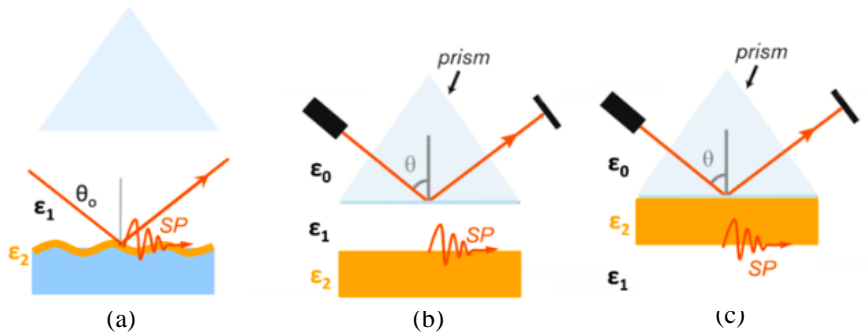
### 1.3 Salinity

The increase in salinity decreases the amount of dissolved oxygen in the water. As the concentration of salt increases, more salt ions attract water molecules, leaving fewer hydrogen and oxygen ions available for fish. The oxygen level of water influences fish's behavior, metabolic rate, swimming ability, viability, and normal development of larvae and eggs. In addition, most of the aquatic species are not capable of adapting to the salinity fluctuations, which requires them to migrate to different locations in order to maintain life. This leads to some species becoming extinct or being introduced into new waters, confusing the balance of the ecosystem.

In addition, sea salinity is directly connected to the progress of the climate change. Big shifts in salinity could be a warning of more severe droughts and floods, or even that global warming is accelerating. Thus, measuring salinity is one way to explore the Earth's overall water cycle as well as to ensure the safety of the inhabitant aquatic species. Due to the increasing importance of probing salinity, great interest is being devoted to the measurement of salt concentration using cheap and time saving methods. SPR is identified as to be a suitable technique for rapid, quantitative analyses of salinity. Instead of immobilizing biological molecules on the metal surface and flying the analytes in inside a fluidic system as stated earlier, water with different salt concentrations will be poured on top of the metal surface. The amount of surface concentration will be quantified by tracking the plasmon resonance angles [8].

## 2. Modeling and Theory

There exist three principal configurations that can be used to excite a plasmon with a laser.



**Figure 1.** Configurations of SPR: (a) Grating; (b) Otto; (c) Kretschmann

### 2.1 Grating Configuration

In the Grating Configuration (a), light excites plasmons through a grating coupler, which couples light from a fiber into a planar waveguide. The grating replaces the need for a glass prism in other configurations of SPR, and biomolecules are placed on top of it. A CCD camera is used for capturing the reflected light. One disadvantage of Grating Configurations is that since the light beam is incident through the sample solution, inaccuracies may appear if the sample is light-absorptive [8].

### 2.2 Otto Configuration

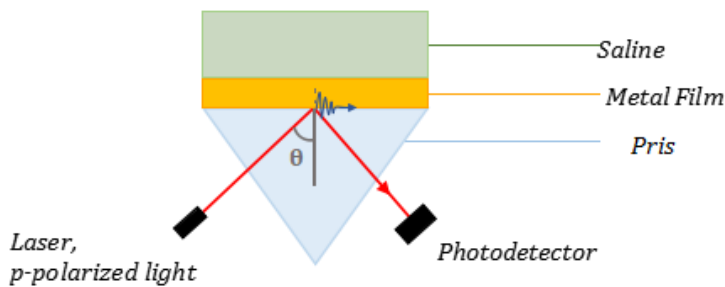
In the Otto Configuration (b), the metal surface ( $\epsilon_2$ ) is separated from the medium  $\epsilon_0$  by an additional dielectric layer that has a dielectric constant smaller than  $\epsilon_0$ . The resonance occurs at the metal-dielectric ( $\epsilon_2 - \epsilon_1$ ) interface. The width of the additional dielectric layer should be about  $1\mu\text{m}$ , which prevents the Otto geometry from being widely explored in SPR sensing [8].

### 2.3 Kretschmann Geometry

The Kretschmann Geometry (c) is the most commonly used configuration in the field of biosensor applications. Medium  $\epsilon_0$  is the prism, and  $\epsilon_1$  can be air or the solution of interest. A metal, usually gold or silver, is placed at the interface of the two media. The surface plasmon is excited at the interface between the metal and the dielectric medium by a monochromatic, p-polarized light beam [8,9].

## 2.4 Experiment Design

In this paper, Kretschmann Geometry was used. According to this geometry, a metal film is placed on top of the glass prism, and the analyte solution is placed on top of the metal film. In the experiment, the metal films were deposited on the hypotenuse face of the prism by thermal evaporation method at the rate of  $5 \text{ \AA/s}$  in a vacuum of  $7 \times 10^{-6}$  Torr, constituting a vapor stream. After the stream traversed the vacuum and hit the prism face, it condensed and coated the prism. The experiment was performed once with silver (Ag) and once with gold (Au) thin film. A drop of each saline solution was used instead of liquid films.



**Figure 2.** Orientation of the Surface Plasmon Resonance (SPR) Sensor

As the He-Ne laser beam propagates in the prism as shown in Figure 2 and encounters the interface of the metal film and the sample, total internal reflection (TIR) takes place. As long as the incident angle is greater than the critical angle, an evanescent wave forms. Under the circumstances of TIR, the reflectivity does not change depending on the changes in the incident angle values. When the incident angle exceeds the value of the critical angle, however, surface plasmon resonance occurs. SPR occurs when the incident light excites the plasmons on the surface of the metal film. At this specific angle, the reflectivity of light dramatically decreases [10]. This angle is referred to as the plasmon angle or the SPR angle, and it is the angle at which minimum reflectivity occurs.

The below formulas are used for calculating reflectivity, with the 12 and 23 subscripts for the glass-metal and metal-solution boundaries, respectively,

$$r_{12} = \frac{\epsilon^{1/2} \cos \theta_1 - n \cos \theta_2}{\epsilon^{1/2} \cos \theta_1 + n \cos \theta_2}$$

$$r_{23} = \frac{\cos \theta_2 - \epsilon^{1/2} \cos \theta_3}{\cos \theta_2 + \epsilon^{1/2} \cos \theta_3}$$

$$R = \left| \frac{r_{12} + r_{23} \exp(-2kd)}{1 + r_{12}r_{23} \exp(-2kd)} \right|^2 ,$$

where  $k$  is the absorption coefficient,  $\epsilon$  is the complex dielectric function of the metal,  $n$  is the refractive index of the prism, and  $d$  is the thickness of the metal film. The angles  $\theta_2$  and  $\theta_3$  are the angles in the metal and air, respectively, and are defined by

$$\cos \theta_2 = (1 - n^2 \sin^2 \theta_1 / \epsilon)^{1/2}$$

$$\cos \theta_3 = (1 - n^2 \sin^2 \theta_1)^{1/2} \quad .$$

The SPR angle is highly sensitive and dependent on the refractive index of the material near the metal surface. Consequently, when there is a small change in the refractive index of the sensing medium, plasmon can not be formed. Since resonance and minimum reflectivity occur at this angle, a dip in the reflectivity vs. angle of incidence graph is observed. Plasmon angle is the point at which the graph receives its smallest value. For angles that are slightly smaller than the plasmon angle, the corresponding y-values rapidly decrease until reaching the minimum value. Similarly, for the values that are slightly greater than the plasmon angle, the corresponding y-values rapidly increase from minimum to maximum reflectivity. For an ideal free electron plasma, the plasmon angle  $\theta_p$  is given by

$$n \cdot \sin \theta_p = [\epsilon / (\epsilon + \epsilon_w)]^{1/2} \quad ,$$

where  $n$  is the index of refraction of the prism,  $\epsilon$  is the complex dielectric function of the metal, and  $\epsilon_w$  is the complex dielectric function of the sample, which is water with different salinities [1].

For solving the equation above, a code was written in MATLAB. The code first got input values from the user for the variables in the above equation such as the index of refraction of the prism, the complex dielectric function of metal, and of the sample. Using the input values, the code automatically solved the equation for the SPR angle and printed it as an output value.

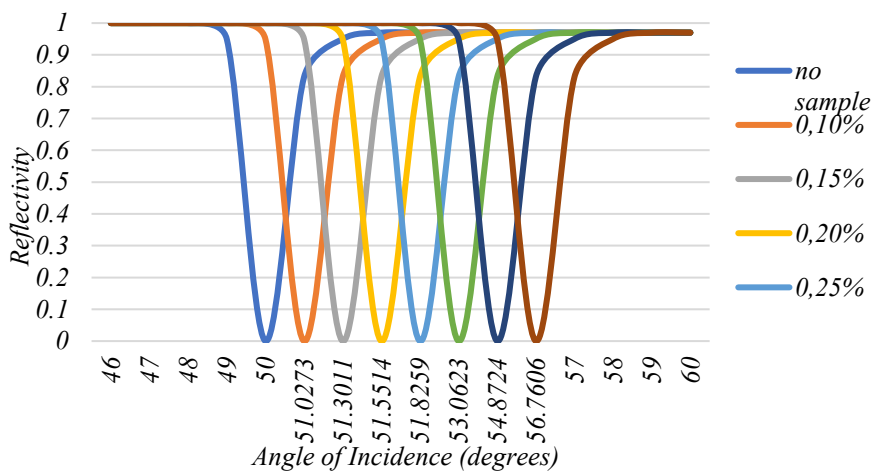
### 3. Results and Discussion

Using the plasmon angle equation, the corresponding plasmon angles of samples were calculated twice: once using silver and once using gold as the metal thin film. The index of refraction of the crown glass prism was taken to be  $n = 1.52$ . The complex dielectric constant of the silver film was  $\epsilon_s = -18.3 + 0.4i$  at the He-Ne laser wavelength, and that of gold was  $\epsilon_g = -11.6 + 1.2i$  [11].

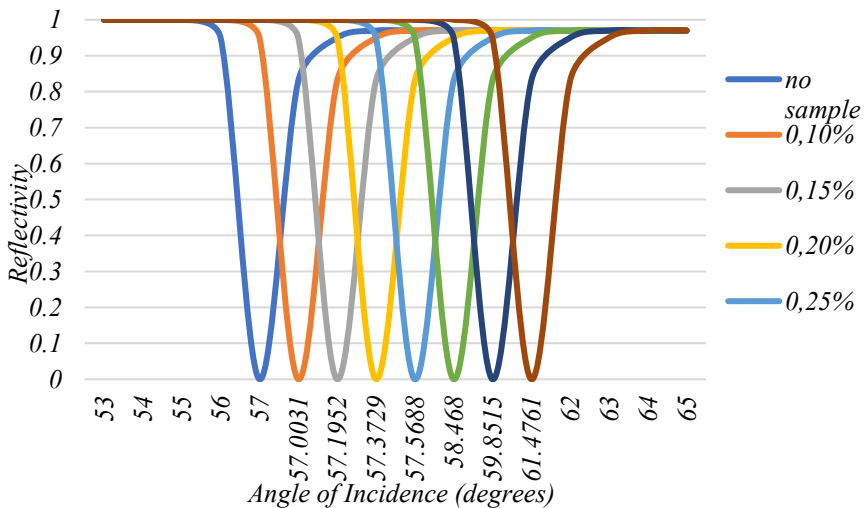
It is observed that the complex dielectric function value of the material decreases with increasing salt concentration, which is directly proportional to the plasmon angle. The salt concentrations that are demonstrated as percentages represent the mass of salt, in grams, that is

dissolved in 1 litre (1000 mL) of water. For instance, the sample labeled *water + 1.0% salt* contains 10 grams of dissolved salt (mostly sodium chloride) for every 1 litre of water.

Silver (Ag) and gold (Au) were selected for use as thin films because they are considered ideal for the excitation of surface plasmons. Their extraordinary properties such as efficiency in resonating conduction band electron at the suitable wavelength, inert nature, and biochemical and thermal stability make them preferable to other materials. Between these two metals, silver is more commonly used because of its lower cost. Also, the thin film of silver is reported to be more sensitive to the refractive index variation than gold, and produces the sharpest SPR signal [4].

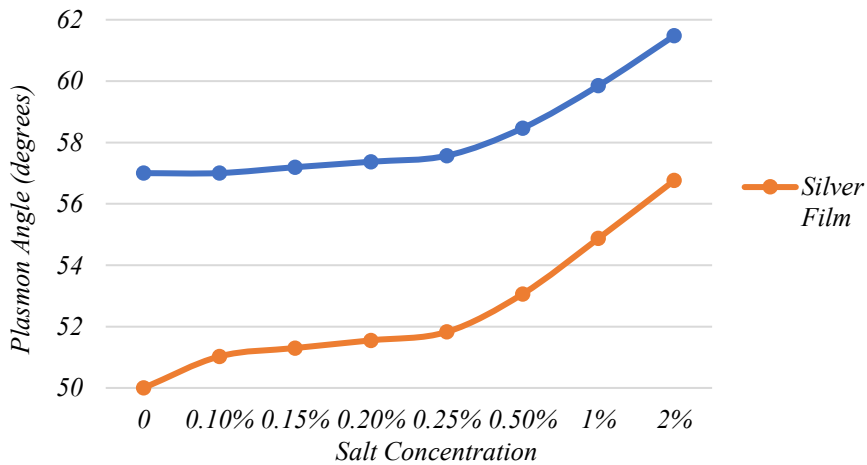


**Figure 3.** Reflectivity vs. Angle of Incidence Graph for Silver Film



**Figure 4.** Reflectivity vs. Angle of Incidence Graph for Gold Film

The reflectivity values for each saline solution were calculated using the reflectivity formula noted previously. Angle of incidence values and their corresponding reflectivity values for each one of the solutions were plotted. The plots for silver and gold film are shown in Figure 3 and Figure 4, respectively. The shift in the plasmon angle, angle of minimum reflectivity, can also be observed from the figures. While the angle values for gold film were greater than those for silver film, plasmon angle values increased with increasing salinity in both graphs.



**Figure 5.** Plasmon Angle vs. Salt Concentration Graph for Silver and Gold Films

Figure 5 summarizes the plasmon angle values found for solutions for both metal films. While the plots seem to have similar slopes for the first five points, silver film plot then exhibits a greater slope. Increasing salt concentrations yielded a greater increase in the plasmon angle values for the silver film than the gold film.

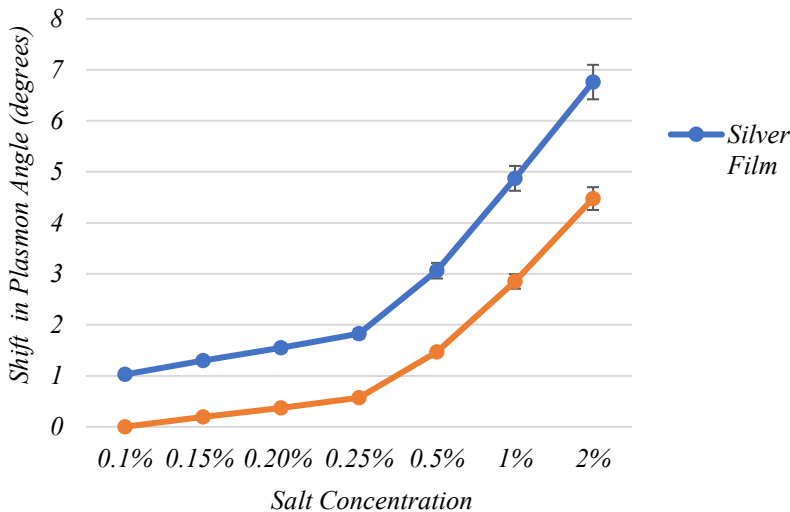
The  $\Delta\theta_p$  values in Table 1 show the plasmon angle change from configuration with no water. The dielectric values for the saline solutions are also shown in Table 1.

Sample Water	$\epsilon_w$	$\theta_p$ for silver film	$\theta_p$ for gold film
+ 0.1% salt	79.0 - 8.2i	1.0273	0.0031
+ 0.15% salt	78.7 - 9.9i	1.3011	0.1952
+ 0.20% salt	78.6 - 11.5i	1.5514	0.3729
+ 0.25% salt	78.6 - 13.3i	1.8259	0.5688
+ 0.50% salt	78.1 - 21.8i	3.0623	1.4680
+ 1.0% salt	77.3 - 37.2i	4.8724	2.8515
+ 2.0% salt	75.7 - 67.1i	6.7606	4.4761

**Table 1.** Change in Plasmon Angle Values for Silver and Gold Films



The plasmon angle and concentration values shown in Table 1 are used for plotting Figure 6. Though the silver film and gold film curves look alike, one of them is capable of providing more accurate results. The corresponding values of salt concentration for both of the films appear to be increasing at the same rate for the first four collected data. However, after the fourth point, the slope of the silver film curve increases and exceeds that of the gold film. Since the silver film plot increases with increasing slope for the following two points, the difference between two consecutive plasmon angles becomes larger in comparison to the gold film. This is also the reason that silver possesses a sharper SPR response curve than gold.



**Figure 6.** Shift in Plasmon Angle vs. Salt Concentration Graph for Silver and Gold Films

The wide separation between two plasmon angle values allows the graph to be more easily resolved. With better resolvability, results with better accuracy can be obtained. Since the plot of the silver film has better resolvability, it is concluded that silver is a more superior material than gold for use as a thin film. Furthermore, because better resolvability refers to better accuracy, the values that are read from the silver film plot are more likely to be error-free. By working with graphs that have good resolvability, possible errors can be minimized, and values that are closer to real (error free) ones can be obtained. This can decrease the error percentage of the calculated values, leading to theoretical yields that are very close to actual values.

Another element to consider for querying the errors of this experiment is the MATLAB code. The MATLAB code was used for solving the plasmon angle equation in order to calculate the SPR angles. The calculated values were complex numbers; they had a real part

and an imaginary part. In order to obtain a real value and not a complex one, real syntax was used. This syntax computed the real part of the complex value. However, while doing this, the imaginary part of the number was ignored. Instead of calculating the exact value of the complex number, the real syntax simply erased the imaginary part, and the real part of the complex number was printed as the result. Thus, the exact values of the complex numbers were not calculated. Even though this would probably cause a minor change, it can still be identified as a systematic error.

Moreover, the error bars on the graph indicate the error or uncertainty in the reported measurements. A short error bar means that the average value is almost certain, and the measurements are precise. However, a long error bar represents that the reported value might be far from the error free value. The deviation of the reported values increases with increasing bar length. In the experiment, as the salt concentration increased, the error bars got longer, which meant the values lost their accuracy as salinity increased for both of the graphs. The error bars on the gold film graph were shorter than that of the silver film, but the values for both of the graphs became more likely to be flawed as salinity increased.

One way to reduce these errors is to render the sample and the optical elements thermally stable. Because the refractive index is sensitive to temperature, it is important to conduct experiments at constant temperature. Error values of measurements are essentially influenced by temperature oscillations, which are caused by the temperature changes in the ambient medium or the chemical processes in the studied substances that absorb or release heat. The changes in the temperature in the refractive index  $n$  can yield to the thermal volume expansion of the metal layer, which conditions the density of charge carriers (electrons). Though tools for thermostatic control have been used in the past, they were neither capable of providing thermal data quickly nor ensuring cost-effectiveness. Today, thermal imaging systems are used for detection main sources for heat release. Thermo vision methods are applied for studying the spreading of the thermal field in an SPR system. Devices that are identified to release or absorb heat can be equipped with systems (e.g. cooling techniques) that will help them keep the set temperature with high stability [12]. This approach is useful for minimizing the error that is caused by changes in temperature in measurement results.

Though SPR is capable of analyzing relatively large quantities in comparison to other techniques, the amount it can examine may not be sufficient to generalize about large water bodies. No matter how large the quantity of the sample can be, this quantity will always be a very tiny piece of the actual water body. This would not be a problem if the salts were uniformly distributed among the water, and the salinity of each and every unit was equal. However, even the samples taken from the same water body with only a short distance difference might not share the same salinity. Thus, making generalizations of the whole of the water depending on the observations about a small quantity of it might not lead to accurate results. In order to expose this limitation, multiple samples from different part of the body of water must be collected, and assessments should be made based on the average of

these samples' results. It would be useful to work with small water bodies in order to ensure the accuracy of the results and eliminate potential problems. However, if there isn't a chance of collecting multiple samples, this issue can be neglected since the salinity of seawater is stable in most parts of the world.

The potential applications of an SPR system like the one used in this experiment can be significantly beneficial to the field of agriculture, fishing, and global warming. If an SPR mechanism that measures salinity regularly every one or two weeks is installed in a sea, river or ocean, the average salinity value of the water can be detected. This way, if a sudden increase or decrease in the value of salt content occurs, it can easily be spotted by looking at the values from the SPR mechanism. For instance, if a steady decrease in salinity is observed, it can be concluded that sea ice has melted or river inflow has increased during that period. The salinity patterns and fluctuations can even indicate changes in ocean circulation and climate. Furthermore, the results can also be used for explaining the potential causes of events that occur nearby. For example, if more than 10% of an aquatic species have disappeared, this can be explained by the changes in salinity. Similarly, if the farmers have had a dry season, the blame can be out on the high salt stress. Measuring the salinity of water using SPR before planning for cropping patterns can guide the farmers to choose the compatible and tolerant crops to cultivate.

The design of the experiment can be improved by experimenting a wider range of salt concentrations. In this experiment, salt content varying from 0.1% to 2% has been investigated. However, this range can be expanded in further research. On average, seawater contains 2% to 3.5% dissolved salt, so by working with samples with higher concentrations of salt, the number of seas that can be experimented can be increased. The range can even be increased until 4% salt in order to conduct experiments in the Atlantic Ocean, which is the saltiest ocean with an average salt content of 3.7%.

Features of water other than salinity can be tested using SPR for further investigating the quality of water. The SPR angles that water with different pollutant concentrations produce can be calculated. Then, the obtained values of angles can be used as criterias for specifying the content of unknown samples. It would be beneficial to extend the scope of the experiment in such a way, because water pollution is an increasing global concern. The pollutants in the water are not visible to the naked eye, so SPR provides a suitable platform for testing whether or not the water is contaminated or how contaminated it is.

Last but not least, SPR is a useful for method for studying gases as well. Gases, when inhaled, may have detrimental effects on human health such as burning the nose, throat, and respiratory tract. Determining the type of gas that is present in the environment is necessary for testing the safety of the environment and taking the necessary precautions. Most of the toxic gases are odorless and colorless, which prevents the use of traditional methods for their monitoring. However, since SPR focuses on the dielectric properties of materials, it is a suitable technique for detecting invisible materials such as gases.

#### 4. Conclusion

In this experiment, plasmon angles for samples with different salt concentrations have been calculated. Knowing these values, one can determine the salinity of an unknown sample by looking at the plasmon angle value the SPR system produces. It is proven that SPR is a suitable method for characterizing solids and liquids.

#### 5. Acknowledgements

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## **This Land is Their Land: How Indigenous Peoples Are Crucial to Modern Species Conservation**

Max Podell

*Author Background: Max Podell grew up in the United States and currently attends Piedmont High School in Piedmont, California, USA. His Pioneer seminar program was in the field of environmental studies and titled "Comparative Environmental Politics".*

### **Introduction**

In the last 50 years, land rights have arisen as a regular demand of indigenous peoples fighting for access to the land and resources that were historically theirs (Bauer, 2016). Indigenous peoples have been standing united to fight for these rights at international conferences on conservation. At the 2008 World Conservation Congress in Barcelona, an indigenous representative stated, "Our special relationship with Earth as stewards, as holders of indigenous knowledge cannot be set aside. Our special relation with her has allowed us to develop for millennia a particular knowledge of the environment..." (Doolittle, 2010, p. 287).

Despite possessing traditional knowledge relevant to the environment on their lands, indigenous people are consistently left out of political talks that pertain to their historic land despite never delegating any power to the environmental community (Redford, 1993).

The question I will be looking into is whether indigenous knowledge has a place in modern species conservation programs. I will argue that conservation efforts must incorporate indigenous knowledge in order to be successful because it supplements Western techniques of conservation with valuable information that is not widely known. It is also necessary to attain indigenous involvement in conservation efforts so that rules or regulations that are made will be upheld. While the rights of indigenous people are an important topic, the focus of this paper is not on human rights, but on conservation of habitats and biodiversity through the combination of indigenous and modern practices.

I will begin by highlighting the differing definitions of conservation, followed by two case studies focusing on the inclusion of traditional ecological knowledge in marine conservation plans. Then, I will go into another case study that took place in the Loma Alta watershed in Ecuador. Finally, I will end the paper by diving into the question of whether case studies that talk about indigenous knowledge generalize the acts of indigenous people.

## **What is Conservation?**

It is necessary to talk about the definition of conservation because the debate over whether or not indigenous conservation exists stems from a disagreement over what the term "conservation" means (Smith & Wishnie, 2000). According to Smith and Wishnie (2000), a common definition of conservation is the "long-term coexistence of a people or culture with a suite of other species in an ecosystem" (Smith & Wishnie, 2000, p. 500) A more specific definition of conservation that this paper will adopt is that the conservation effort should "prevent or mitigate resource depletion, species extirpation, or habitat degradation and be designed to do so" (Smith & Wishnie, 2000, p. 501).

On the indigenous side of the debate, there is an entirely different way of thinking about conservation. Indigenous conservation comprises a respect for, and reasonable understanding of the environment, something that is much less removed and more specific than the criteria Smith and Wishnie suggest to be the proper definition for conservationists (Smith & Wishnie, 2000). When I say that the indigenous definition of conservation is much less removed and specific, I mean that compared to the more scientific, Western definition, it is more all-encompassing and personal. For many indigenous people, the reason for conservation is not only to preserve species from a scientific standpoint, but out of respect for the environment that comes from their close relationship with and their traditional knowledge of it. Over the course of their tenure in their lands, indigenous peoples have gained knowledge, commonly referred to as "traditional ecological knowledge" or just "traditional knowledge," which they have developed over generations through trial and error. The definition of traditional ecological knowledge is described as "a cumulative body of knowledge, practice and belief evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes, Colding & Folke, 2000, p. 1252). This knowledge is culturally significant and can be useful in many conservation programs.

Evidence that supports the indigenous definition of conservation is "culturally expressed conservation ethics, animistic religious beliefs that conceptualize other species as social beings, the high levels of biodiversity found in the homelands of these peoples, and the environmental knowledge they possess" (Smith & Wishnie, 2000, p. 494). Indigenous peoples in many regions see the environment as one interconnected collection of living things and respect everything in it (Turner, Ignace, & Ignace, 2000). As Secwepemc elder Ida Matthew commented, "It was pitiful enough that we had to kill them. [My mother] instilled in us that we were not to waste the food, that we had to kill the poor animal. With any kinds of animal that we would hunt and eat, you have to respect them" (Turner et al., 2000, p. 1279).

A common theme that comes up in the literature pertaining to species conservation is that modern conservation programs should create or protect areas that are "untouched by

humans" (Redford, 1993; Kimmerer, 2000; Anderson, 2005). For many, "untouched by humans" means pre-European settlement conditions, but in reality, the conditions found by Europeans when they arrived in the Americas were altered by thousands of years of native influence (Redford, 1993; Kimmerer, 2000; Anderson, 2005). For example, Anderson (2005) cites the existence of desert fan palms in the Sonoran Desert, larger valley oaks throughout California, the largest sugar pines in the Sierras, and the presence of island foxes in the Channel Islands as "the product of deliberate human action" (Anderson, 2005, p. 155). Also, there is evidence that there is almost no area left in the Amazon rainforest that has not been influenced or affected in some way by human actions (Redford, 1993). When asked what one would think qualified as a "natural" disturbance, answers that could be expected would be fires or storms, but almost never would someone say native manipulation. Excluding indigenous practices from qualifying as natural comes from the Western belief that humans and nature are separate entities and any sort of human intervention ruins nature (Kimmerer, 2000). This Western definition is distinctly different than that of indigenous communities, which is demonstrated by the relationship indigenous people have with nature and how they view the actions they take in natural landscapes. If the goal of modern biodiversity conservation efforts is to restore landscapes to pre-settlement conditions, knowing the use and management practices that indigenous people utilized to influence biodiversity could help modern conservationists to recreate landscapes of the past today (Charnley, Fischer, & Jones, 2007). In the next two sections, I will go into three specific examples where conservationists completed projects with the help of local indigenous peoples.

### **Traditional Ecological Knowledge in Marine Systems**

After defining what conservation is and how indigenous people play into it, I will highlight specific instances where indigenous practices were mixed into species conservation programs. Drew (2005) provides an excellent case of traditional management practices utilized in a modern conservation effort in Kiribati. The I-Kiribati are an indigenous people from the small Pacific Islander country of Kiribati (Figure 1) and are known for their long history of customary ecological management practices. Originally a British colony, the customary management practices of the I-Kiribati were negatively impacted by imperial rule and progressively faded even after independence. The majority of the population of Kiribati live in its capital, Tarawa, along a lagoon. One of their most important sources of food is bonefish, but growing development along the lagoon reduced the populations of bonefish and other marine organisms. At the community's request, researchers came to help the I-Kiribati with their issue. The older I-Kiribati recalled the traditional system of marine tenure and realized they could help create management plans utilizing the old knowledge. Specifically, they remembered the locations of the productive

areas of the lagoon and the bonefish's use of specific habitat types and their vulnerability to certain fishing techniques before and after mating. The techniques used to create this program were originally used to increase food output in the lagoon rather than for species conservation, but they were still relevant to the new issue. This information was compiled with the help of the researchers into a community management program sponsored by the Kiribati government. The addition of traditional ecological knowledge to the management plan allowed it to thrive, and without it, the effort likely would have failed (Drew, 2005).

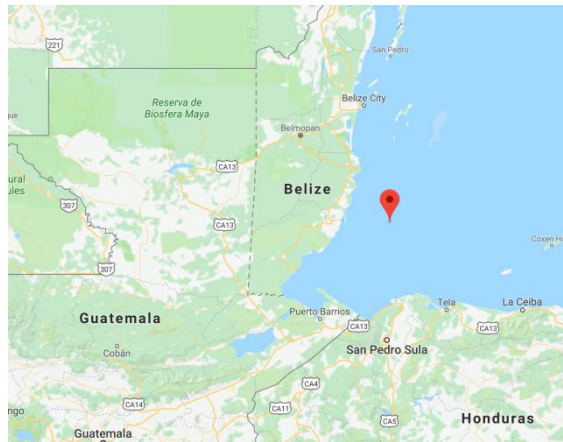


**Figure 1.** Location of Kiribati (Google & INEG, 2018)

In many cases, as is shown through the I-Kiribati example, indigenous people hold vast amounts of knowledge that, when combined with modern conservation practices, can create effective species conservation plans. The I-Kiribati already had the information they needed and the mindset for conservation—they just needed help to achieve their goals.

Another interesting case study that Drew (2005) writes about is Gladden Spit, a section of the Mesoamerican Barrier Reef off the coast of Belize (Figure 2). Fishermen who frequent Gladden Spit have known that it is a spawning site for mutton snappers since the 1920s, but the location was unknown by the scientific community until 2001. As a result of the spawning snappers, Gladden Spit is also the site of a seasonal gathering of whale sharks that feed on the gametes produced during the spawning. According to Drew, "it is difficult to observe whale sharks because of their largely pelagic lifestyle, and [Gladden Spit] is an ideal site for collecting data on whale shark migrations and social biology" (Drew, 2005, p.1290). Both conservation organizations from within Belize and international conservation organizations worked together to have Gladden Spit instated as a marine reserve (Drew, 2005).





**Figure 2.** Location of Gladden Spit (Google & INEGI, 2018)

Marine reserves, also known as Marine Protected Areas, are "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008, p. 8). Marine Protected Areas may utilize regulations to limit fishing with specialized gear that targets certain sizes and species of fish such as hand spears or traps, but can also be "no take zones" where removal of any organisms is prohibited (Ferse, Costa, Máñez, Adhuri, & Glaser 2010). When effective, they can lead to greater biodiversity and elevated population sizes of whatever species the Marine Protected Area was created for (Ferse et al., 2010). Techniques that are regularly used in Marine Protected Areas are indigenous management practices, otherwise known as customary management practices. Customary management is a form of traditional ecological knowledge that is defined as "local practices that are designed to regulate the use of, access to, and transfer of resources" (Cinner & Aswani, 2007, p. 202).

With the help of knowledgeable locals, the scientific community was able to find out about the whale shark aggregations that happen at Gladden Spit, an occurrence that is rare elsewhere. The instatement of the marine reserve at Gladden spit should help the fishermen there to keep their fishing practices sustainable and also help protect the spawning location of the mutton snapper. The local fishermen of Gladden Spit were able to share knowledge that they had developed through their practices with the scientific community who, without that location-specific knowledge, would have never known to protect the area. This did not ultimately harm the livelihoods of the fishermen, as their incomes were supplemented by serving as diving guides for tourists looking to see marine wildlife (Drew, 2005). As is seen in this case study, the cooperation of the scientific community with indigenous, local people can provide mutually beneficial situations that allow for conservation of important members of an ecosystem. In the next section, I will talk about the indigenous people of Loma Alta and their struggle with balancing the livelihoods of the community and the conservation of a unique habitat.

### Loma Alta Case Study

Another case of the successful combination of indigenous and Western knowledge in the name of species conservation is provided by Becker and Ghimire (2003), with the communally owned watershed Loma Alta in the Colonche Hills of Ecuador (Figure 3). In 1936, the indigenous communities in Loma Alta were given legal rights to the Loma Alta watershed under national law. They began to experiment with crops and create land allocation rules that worked with the microhabitats on the windy hills, which were heavily influenced by a phenomenon known as fog capture, where plants retain moisture by drawing it in through their leaves and other appendages. The tropical dry forests in the lowlands beneath the hills were cleared for settlements, roads, and subsistence and market agriculture. The area between 300 and 800 meters above sea level was not inhabited, but was used for resources such as timber, vegetable ivory, and game. On the slopes and peaks where fog capture is greatest, the indigenous communities grow Panama hat fiber. Clearing of moist forests for the cultivation of Panama hat fiber was substantial (Becker & Ghimire, 2003).



*Figure 3. Location of Loma Alta (Google, 2018)*

In 1990, biologists rediscovered the unique flora and fauna in the Colonche Hills and it was reported that more than 95% of the primary forest in western Ecuador, where the Colonche Hills are located, had been cleared. There were only four patches of moist forest left in western Ecuador, the largest of which was owned by the indigenous communities of Loma Alta. The community has legal property rights to 6,842 hectares, or about 26 square miles of one of the largest surviving moist forest patches in Ecuador. The patch is located in the Tumbesian Endemic Bird Area, which is home to at least 50 endemic bird species and is a top priority bird species conservation site for the world. For these reasons, by 1995, the

moist forest patch at Loma Alta received great interest from conservation scientists all over the world.

Containing 1650 hectares, or about 6 square miles of mature tropical forest, the Loma Alta watershed can be identified as a special type of cloud forest known as Garúa forest. Garúa forest is a collection of trees and other plants that live off of mist and fog. Fog-capture in forests is proportional to the surface area of trees and other plants, so areas with larger or greater quantities of trees trap more water than areas with crops or pasture (Becker & Ghimire, 2003).

Becker and Ghimire report that in 1994, a New York City non-governmental organization known as People Allied for Nature (PAN) was invited by the community at Loma Alta to work with the locals to protect wildlife and their habitats. With the goal of teaching locals about nature conservation, PAN organized an educational program at Loma Alta. Once a month, starting in 1995, PAN sent an Ecuadorian environmental educator to teach leaders and community groups about the value of forest and wildlife conservation in order to persuade them to create a protected area in the Garúa forest.

The Loma Alta case study provides a good example of indigenous people who had traditional ecological knowledge, but whose knowledge was not sufficient to conserve the biodiversity or habitat around them. After a year of environmental education, local leaders allowed PAN to give a presentation at the monthly community meeting to make their case. PAN talked about the importance of fog capture to their community and urged them to make a protected area around the Garúa forest. Although there were signs that the local, traditional ecological knowledge included some information about fog, the knowledge was not very specific. Farmers growing Panama hat fiber were normally given 10 hectares of land, but only used about 1-3 of those hectares to grow the fiber. The rest would be left for forest surrounding the crops to "attract rain," demonstrating that there was traditional ecological knowledge pertaining to the connection between the trees and moisture in the Garúa forest. People in the community did not have the same attitude towards the fog as the PAN scientists had, but they had enough traditional knowledge to know that fog capture was important. Approximately 75% of the families living in the Loma Alta community irrigated crops such as tomatoes and peppers in the lowlands and relied on the money they got from selling those crops, so they quickly recognized how important fog capture was to their livelihoods.

The community worried that the newly protected land would change the allocation and use of land and would negatively affect the livelihoods of those who owned land within the protected area. Also, traditional hunting and all timber harvesting would be banned in about 50% of the protected forest. The protected area was ultimately approved by the community because no one actually lived on the land within the proposed reserve and the existing hat fiber plots would be permitted to stay functioning on the reserve with the condition of not

being able to expand. Another detail that convinced the community to approve the preserve was the new opportunity of environmental tourism.

The traditional knowledge they had related to their issue was too vague, so it was necessary to get outside help. The community called in the foreign researchers because they knew they needed help if they wanted to leave anything for future generations in the forest, so at least the community was not as susceptible to being taken advantage of like other places where researchers came without permission of the locals. Including the community and not just the leaders in the creation of the preserve created incentive for the entire community to participate. No one wanted to miss out on new opportunities created by the preserve, and the preserve actually benefited them by ensuring a consistent source of water. Combining indigenous practices and information with more modern practices can create situations where both sides are satisfied and a healthy relationship is maintained.

### **Do Case Studies Generalize?**

Thus far, this paper has discussed three case studies of indigenous involvement in modern species conservation programs and how their knowledge aided the projects. But do these studies generalize the acts of indigenous peoples too much? This raises the question of whether indigenous people even have the conservation ethic that they claim to have. According to Kimmerer (2000, p. 7), the objective of Native Americans was to "manipulate successional processes to produce a sustainable yield of desirable foods and subsistence materials." The goal was sustainability, but sometimes conservation came as a beneficial side effect. On the other hand, there is evidence of Pacific Islanders creating and utilizing marine-based conservation techniques hundreds of years before the arrival of Europeans (Johannes, 2002). An island habitat is ideal for the development of conservation practices, since everything on the island is limited. According to Johannes (2002), "if a culture never exceeded the sustainable limits of its natural resources then we should not expect it to have developed a conservation ethic. Moreover, those cultures that did possess such an ethic must have overharvested their natural resources earlier in their history. How else could they have learned that their natural resources had limits? This is not knowledge our species is born with" (Johannes, 2002, p. 5). Any changes islanders made to the island itself most likely did not also take place in the surrounding water. Most likely, the limits encountered by Pacific Islanders were ones from birds living on land (Johannes, 2002).

Birds were the most important terrestrial food source for islanders, as other mammals were not introduced to the islands until the Europeans came (Johannes, 2002). Birds in Oceania evolved without the presence of terrestrial predators and did not exhibit any fear towards humans, so they were easily eliminated, probably so quickly that the islanders did not realize what happened until they were already gone (Johannes, 2002). Through the extinctions of birds on the islands, Pacific Islanders most likely developed marine species conservation practices so the same thing would not happen to their only other food source.

Critics of the idea of indigenous conservation point out practices that harmed the environment and cite archaeological and ethnohistoric evidence (Smith & Wishnie, 2000). Examples of the results of non-conserving tactics used by small groups throughout the world are faunal extinctions, habitat degradation, and subsistence activities that were changed in order to create more economic benefits. Hunters and fishermen would mostly choose maximizing short-term gains over the theoretical harvesting benefits of long-term resource conservation (Cinner & Aswani, 2007). Jackson (2001) cites the extirpation of the sea cow as a faunal extinction caused by indigenous people.

A great example of indigenous people using tactics that were not in the aim of species conservation was the use of fire in North America that Charnley et al. (2007) brings up. Using fire to disturb forest succession<sup>1</sup>, indigenous people of North America decreased the dominance of coniferous forests and created more open forests where food plants could grow. Utilizing fire, they removed useless shrubs and weeds that negatively impacted plant productivity, recycled nutrients locked up in old plants, and stimulated new growth (Charnley et al., 2007). Fire also controlled insects and the diseases they carried and prevented the collection of fuel on the forest floor that could lead to uncontrolled wildfires. Native fire usage "set back succession and promoted habitat heterogeneity by maintaining mosaics of vegetation types in different stages of succession" (Charnley et al., 2007, p. 19). Although fire was used to create an environment that had the qualities indigenous people wanted, according to Charnley et al., there are several researchers who believe that habitat and species diversity were increased as a result of burnings and their resulting mosaics. When anthropologist Jay Miller took a van full of Methow Indian elders into land on Whidbey Island that used to be taken care of by their tribe, the elders had an interesting reaction. Many of them had not seen the place in 50 or more years. This passage is taken from a letter from Jay Miller to Robert Boyd, May 28, 1996 (Shelvey & Boyd, 2000, p. 1):

*"When we had gone through about half the valley, a woman started to cry. I thought it was because she was homesick, but, after a time, she sobbed, 'When my people lived here, we took good care of all this land. We burned it over every fall to make it like a park. Now it is a jungle.' Every Methow I talked to after that confirmed the regular program of burning."*

Looking at this evidence, it is easy to see that taking one side or another in the debate on the existence of indigenous conservation necessitates generalizations. Not all indigenous people in the world had or have a conservation ethic, but there are many that do. Woven into the cultures of the countless populations of indigenous peoples all over the world, there is valuable knowledge that can be utilized in ways that never could happen without

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<sup>1</sup> The Encyclopedia Britannica defines ecological succession as "the process by which the structure of a biological community evolves over time" (Thompson, 2009).

relationships between modern conservationists and indigenous peoples. Looking past whether indigenous peoples had a conservation ethic or not, they still have valuable knowledge to contribute that is applicable in species conservation settings. Therefore, indigenous peoples should be included in the modern conservation community.

## **Conclusion**

Article 8(j) of the United Nations Convention on Biodiversity states "the knowledge and practices of indigenous and local communities... relevant for the conservation and sustainable use of biological diversity" should be respected, preserved, and applied (Convention on Biological Diversity, p. 6). In addition to this being the opinion of the United Nations, incorporating indigenous involvement into modern conservation efforts can have many benefits.

Indigenous people can offer location-specific knowledge (Drew, 2005). Often projects are in remote areas, so without the help of locals, foreigners will have little to no prior knowledge of the environment they are going into. Since in remote locations indigenous people may be the only ones with any ecological knowledge, any help from them can be very useful. For example, locals can also help researchers with information about species presence and distribution or juvenile habitats and spawning aggregations like in the Kiribati and Gladden Spit case studies (Drew, 2005).

Another benefit to including indigenous knowledge in conservation efforts is that locals feel included. According to Ferse et al. (2010), studies show that when locals think they are being fed rules or regulations that are against their personal interests, they are more likely to ignore or undermine them. Thus, including the interests of local peoples can decide whether a conservation plan fails or succeeds. The use of indigenous management systems, also known as customary management systems, is cited by resource managers, conservationists, and marine biologists as good ways to raise local acceptance and make conservation more effective (Ferse et al., 2010). In many projects, knowledge flows from indigenous people to conservationists and not the other way around, which creates an uneven power distribution (Drew, 2005). This is partially because of cultural factors, but creating research projects where indigenous people are as equally involved as scientists will cause indigenous people to develop feelings of ownership of that research project, and its goals and successes will become a source of pride for those involved (Drew, 2005).

In this paper, I have argued that in order for species conservation efforts to be successful, they must utilize indigenous knowledge. Traditional ecological knowledge supplements Western techniques of conservation, as seen in the Kiribati case study, provides location-specific knowledge, demonstrated by the Gladden Spit case study, and creates incentive for locals to follow rules and regulations made through a given conservation program, as is shown in the Loma Alta case study. Indigenous inclusion in modern projects is important,

not only for conservation programs, but for the people themselves. Although I have not emphasized the human rights side of the issue, it is an important part of the indigenous struggle for recognition in conservation circles. In the past century, indigenous peoples across the world have lost and regained many rights without much regard as to what is best for them. Stealing rights from indigenous people is a human rights issue and including them in some conservation efforts is not enough to set things right. Indigenous people must be seen as equal, not something to be pitied, and through this equality they can finally thrive again and hopefully contribute even more to the scientific community. Conservation of biodiversity and the environment is the goal, and indigenous people are closely tied with this subject and part of the solution.

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## Film Noir, Urban Space, and Human Agency: Three Case Studies

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Film noir is undoubtedly one of the most representative film genres. Although it does not adhere to the cinematic norms of other films, it is significantly influential and widely discussed. Scholars, both past and present, have explored the noir movie and its contexts in various approaches--from filmic ones such as its chiaroscuro style and unique mise-en-scene technique, to broader topics such as its implications for cultural ideology and the film market ecology of the time. In this paper, I will analyze three noir films (each representing a different stage of historical development) to prove that despite noir's usual pessimism and fatalism, its characters are often able to act decisively in the end to reach some positive goal.

A basic understanding of “film noir” is required for our discussion. However, film noir is difficult to define. For those unfamiliar with this subject, it may be frustrating to realize that even the classification of the concept itself can cause heated debate. In the previous paragraph, I introduced “film noir” as a “genre,” a common way of categorizing literary or cultural works. Researchers, however, usually find themselves unsatisfied with this convenient grouping and attempt to come up with their own classification. As James Naremore states in the first chapter of his book *More Than Night*, it has always been easier to recognize film noir than to explain what it means (9). While the book can be seen as a definitive introduction to film noir for viewers without a scholarly background, the author's wide-ranging discussion and thorough analysis of noir film and its context make his work also beneficial to professional researchers in this field.

Naremore points out several elements that can serve as cues for recognizing film noir while admitting the impreciseness of a term framed by critics rather than makers of the movies. Noir movies have significant visual features including low-key lighting, skewed composition, and wide-lens photography. These and other noir-like camera effects contribute to a kind of “visual iconography,” which Naremore argues is more essential in composing our memory of film noir than specific techniques (167-168). Besides technical characteristics, plot lines in film noir also share many similar traits. In classic noir films, the

protagonist is also the voiceover who unfolds his personal experience through sentimental narration. His story often relates to crime and detective themes, and he often encounters the femme fatale, a beautiful yet malicious woman, who would later lure him to make decisions that normal people would find unjust or immoral.

Another notable trait of film noir is its urban setting. In his book, Naremore explicates this formula by exemplifying some specific elements constantly appearing in the sets of noir films, such as “urban diners,” “shabby offices,” and “swank nightclubs” (1). The importance of an urban scene in noir is also emphasized by the examples he notes throughout his later discussion. By pointing out the locations where each story happens, Naremore introduces the city landscape as a signifier of film noir as well as an essential component of, or even an origin of, many characteristics through which the unique noir style is orchestrated.

Film noir has been the subject of research in many different disciplines. Psychologists have discovered that most of the noir films have suggested their application of Freudian theory through the presentation of blurred morality and the antihero, symbolizing the conflict between counterparts of humans’ mental apparatuses, id and superego. Papers focusing on cultural aspects relate film noir to racism, feminism and social status and examine how different attitudes towards each issue are conveyed through the medium of movies. My work here also deals with these two aspects of film interpretation, but in a way that relates one to the other and narrows the width of discussion. In this paper, I will analyze how the urban setting of film noir elicits emotions that influence character development and will pay special attention to the question of human agency.

Before further examination, I should first clarify my topic by defining the term “emotion” since it is a crucial source for any analysis of agency. In “Art Moods and Human Moods in Narrative Cinema,” Carl Plantinga makes a distinction between emotion and mood, two components of an affective film experience commonly conflated with each other. Plantinga points out that emotion is our response to a certain cause, and the responses have a specific reason. Mood, however, has “causes but not reasons” (459-460). In other words, mood is a more abstract experience than emotion. While the path leading to a kind of mood is difficult to route, emotion follows a logical process that can be traced backwards from a person’s feeling to the reason that leads to such feeling, then to the stimulus that provides the reason.

Experience in an urban setting can be an abundant source of stimuli of emotion. Broadly speaking, life in any place will automatically evoke internal feedbacks. An environment with crowded shopping centers, crisscrossed street arrangements, and colorful lights shining from different buildings at night will stand out because of its dominating role in modern history. Along with the development of technology, features of a city are also evolving, which leads to different ways for urban dwellers to react with their residences. Since the urban setting is one of the main characteristics of film noir, and since film noir also went through a historical transformation from its classical decades to the contemporary

era, my case studies of three different works, each representing a different period in the course of noir development, is aimed at drawing out the characteristics of cities in different times, and analyzing how noir filmmakers in different eras depict humans' capacity to adjust themselves to their living environment.

The suggestion that noir films bespeak human power may be counterintuitive since almost all elements that distinguish noir are related to humans' inabilities. In fact, it can even be argued that a pessimistic outlook on humankind is one of the key features of these movies. I agree that most noir films share an emotional exterior that can hardly evoke happiness or hope towards humanity. However, the statement that these works are filled with cynical suggestions is also too extreme to be accepted. Through my analysis of the movies *Double Indemnity*, *Taxi Driver* and *Chungking Express*, I hope to demonstrate that even in this artwork named after a word representing darkness, there is also the brightness of human nature reached by the characters' initiatives that help them control their own fate. By following the development from the classical noir era to the contemporary age, we can also see how filmmakers change from distrustful to confident in the agency of their main characters and of the entire human race.

### **Double Indemnity**

If someone unfamiliar with film noir wants to gain a quick comprehension of the term, *Double Indemnity* is undoubtedly a recommended place to begin. The significance of this work is emphasized in Naremore's book, where he leads his readers to imagine a video store with shelved collections of noir movies and says that *Double Indemnity* would be in the center. Along with other contemporary films, such as *The Maltese Falcon* and *Laura*, it inspires the birth of the term "film noir" and becomes a paradigm for film analysis in both its era and the periods after it.

*Double Indemnity* demonstrates the most distinguishing features of film noir. It has a murder-detective plot with romantic elements brought by a femme fatale. It employs expressionist cinematic techniques such as low-key lighting and oblique angles. It's rooted in an urban setting and involves mostly nighttime scenes. Although these three aspects are all worth analyzing, I want to focus first on another unprecedented feature of noir, namely its cynical attitude, that has a greater psychological impact on its viewers.

Such an approach has its own historical context. In the article "'Double Indemnity': Billy Wilder's 'Crime and Punishment,'" James M. Cain and Ruth Prigozy argue that the crime story was popular in America in the war years because it allowed filmmakers to record the devastating reality of war without explicitly relating it to the nation. According to Cain and Prigozy, "In film noir, the optimism of the previous decade was rejected, perhaps unconsciously, in favor of an overtly skeptical view of human nature and society" (162). This way of reflecting on ourselves and the environment is portrayed in movies by the

“antihero,” a classic element of noir conventions that goes against Hollywood’s usual formula of a righteous protagonist.

Walter Neff in *Double Indemnity* is a definitive example of the term. While showing a certain charm in his demeanor, most of his actions make him unqualified as a decent character. He is easily swayed by the lure of a pretty woman, uses his professional experience to help her gain improper benefits, and designs a plan to murder her husband. All these affairs are unjust and disgraceful for anyone with basic moral standards. However, although the audience can consciously identify the absence of integrity in these behaviors, they often find it difficult to conclude that Neff is a bad person. By using self-exposing narration throughout the movie, Billy Wilder, the director, succeeds in inviting his viewers to sympathize with the character and persuading them that even though he does participate in illegitimate acts, the reason behind them is more closely related to the environment than to the antihero himself.

In the movie, before Neff makes up his mind to help Phyllis Dietrichson (the femme fatale) kill her husband and receive money from insurance, he reveals the origin of his motivation to break the law. He confesses that his desire to betray his ethics emerged long before meeting Mrs. Dietrichson, and he uses the simile of a roulette wheel to illustrate his intent to practice fraud after keeping a lookout for the customers. From such introspection we understand that encountering the blonde Dietrichson is merely a trigger of his wrongdoing, not the main cause. It is his career, or broadly speaking, the way he lives, that makes him want to break off from social norms as a means of liberation and rebellion.

The movie shows only glimpses of Walter Neff’s daily life: he buys his breakfast from a food store across the street, shares a small and dark office with his co-workers, and travels to different places to sell various kinds of insurance. Those minor details are nonetheless vivid and accessible to the audience because they depict many representative elements of life in the city as well as the boredom and despair rooted in such a lifestyle. There are also signs suggesting that Neff is not the only one unsatisfied with his urban life. When Neff first meets Mr. Dietrichson, the latter mentions going to a class reunion in Palo Alto as the only enjoyable activity he had experienced in a whole year. When Lola, Mr. Dietrichson’s daughter with his ex-wife, complains about her game of Chinese checkers with Phyllis can also be interpreted as a subtle mocking at the destitute entertainment of the seemingly rich urban experience.

Urban dwellers also enjoy many benefits. As Erik Dussere in his “Out of the Past, Into the Supermarket” concludes, America after World War II experienced a development in consumer culture that made it possible for the masses in the city, not only the middle class, to afford consumer goods. With such insights on the historical background of *Double Indemnity*, we can now interpret from the film, especially the two scenes in Jerry’s Market, how urban environment have affected its residents. When the two characters first meet in the market, the movie uses wide lenses to suggest an overview of the plot. We can see cans in piles filling up every layer of the shelves and boxes laid on top of each other to

reach a height approaching that of Phyllis. Even when the camera focuses on Neff and Phyllis the sense of plentifulness is still lingering. The emphasis on commodity abundance or even excessiveness is contrasted with the void in the spiritual world of those enjoying it. With other customers' highlighted carelessness to their evil deal made in the market, it can also be argued that it is such profusion that makes urbanites distracted by material gratification so that they unknowingly cease to identify themselves beyond those tangible products.

There are more contrasts in the urban setting of the film. California is known for its bright and strong sunshine, but in the movie most scenes happen at night or in low-key lighting, symbolizing darkness in humanity. It is also a large state, but it imprisons those living in it as Neff's cage-like office imprisons his personality. On the surface, Neff appears as a fulfilled person with his glib speech-craft and confident manner. What is hidden behind this exterior is his insecurity and self-doubt, which explains why he is so eager to challenge the wit of his co-workers in order to prove his own intelligence, even to the point of risking discovery by the office's chief investigator Keyes. Throughout the movie Neff is continually affected by his personal defect that leads him to practice one misdeed after another. In this case the entire film has a pessimistic atmosphere that questions the capacity of human beings to defend against their manipulative surroundings and to make responsible choices for their own lives. The only twist comes at the end, where Neff kills Phyllis and saves Lola's boyfriend by stopping him from going to Phyllis's house and by telling him that Lola has always loved him. However, such a heroic act fails to overturn the general negative impression. In fact, it strengthens the tragedy by establishing Neff as a figure who has apparently defeated the life-denying society and who ultimately pays so high a price that it costs him the opportunity ever to appreciate his self-worth after gaining it.

### **Taxi Driver**

The historical period of film noir which *Double Indemnity* belongs to — namely the classic period— only lasted for two decades. After 1959, America entered its neo-noir era, where noirish aesthetics were applied to a new style of Hollywood movie. Though the cinematic style of those works reflects a nostalgic attitude towards the classical age, much of their content shows a distinctively strong concern over the present and is more preoccupied in recording how contemporary people respond to reality. In *Taxi Driver*, one of the most typical films demonstrating such a trend, the setting is at an unstable period of the country: the later and post-Vietnam War years.

The Vietnam War ended America's post-World War II economic prosperity and replaced it with a dramatic downturn. Such decline is addressed in the film by the character Charles Palantine, a senator running for the presidency, during his campaign speech, in which he vows to overthrow unemployment and inflation. At the same time, this war had a

cultural impact greater than any previous war experienced by this country. America's participation in this local war was considered unjust by its own citizens. This fact, along with the financial failure, cultivated a profound distrust among the people towards their government. Accumulated anger spreading over the nation gave birth to the antiwar movement, the drug epidemic, and the sexual liberation that drastically changed the society. However, even for those familiar with the historical context, certain kinds of behavior of Travis Bickle, the protagonist, remain somewhat bizarre in the film.

On the one hand, Travis's kindness and conscientiousness make him a potentially sympathetic figure. After encountering a girl who tried to run away by taking his taxi but was caught because of his hesitation, he is constantly reminded of this accident by the 20 dollars left by her "guardian" and offers to take her away after realizing that she is an underage prostitute because he feels guilty not to help her when they first meet. He is also friendly to other people at most times and works diligently as a driver without a fixed working schedule. On the other hand, his mental state is so volatile that it makes him appear extremely temperamental and even morbid. At the beginning of the movie, he falls in love with Betsy, an atypical femme fatale who keeps the element of beauty but is no longer vicious inside. Betsy works for Palantine at his campaign headquarters. When Travis sees her, he thinks of her as an angel in this filthy world. However, his offer to take her to a porn theater makes her realize the substantial difference between their characters and their social status. While this is an understandable reason to reject an admirer, Travis refuses to accept it and yells "you'll die in hell" to her at her office. As a result, his attitude towards Palantine also experiences radical change. Before Betsy angrily leaves the theater, he expresses full support for this candidate when he coincidentally has her as his passenger. However, after having been rejected by Betsy, Travis decides to shoot this man who has never done anything wrong to him.

While the attempt to murder is an even more unaccessible decision of the protagonist than his overall irrationality suggests, his recurrent monologues explain the root of his desire to counterattack the environment. In his sentimental narration his fury towards the dirty New York City is repeatedly reinforced. All kinds of people walking down the sidewalk are "garbage and trash" to his eyes. At night "all kinds of animals come out: whores, skunk-pussies, buggers, queens, fairies, dopers, junkies, sick, venal." Unlike other taxi drivers, Travis doesn't treat those ridiculous scandals which happen in the city as jokes. His profession forces him to meet different people everyday and thus witness various kinds of promiscuousness and craziness. The camera techniques recalling classical noir, especially the colorful, swaying lights on the taxi's front window mixed with jazz music, certify what he described as a disturbing environment. Physically Travis suffers from headache and insomnia caused by the stinky smell and the messy crowd of the streets, but a more serious problem to him is the lack of meaning and clear priorities in his boring, routine life.

After making up his mind to assassinate the senator, however, Travis becomes disciplined and organized. He burns up the dried flower he bought for Betsy, practices push-ups and pull-ups everyday, and makes himself well-designed gears for the convenience of using his guns and knife. According to his old profession in the marines, we can infer that his mastership of guns stems from to his military experience and provides him a way to appreciate his masculine power. From his reaction after shooting the black robber in a grocery store, it can also be analyzed that he is not particularly fond of “killing” itself but rather use it to prove his own worth. This contrast establishes him as a conflicting character who holds strong hatred towards society, but at the same time is striving to achieve a social identity. Travis’s assassination plan eventually fails because his conspicuous Mohican haircut and very palpable movement when reaching his gun are immediately detected by Palantine’s guard. After hastily running away, he comes to the building where the child prostitute works and shoots all the staff working in here, which later brings him fame and praise from the public.

The ending of the movie is relatively positive compared to its gloomy atmosphere that lasts throughout the previous parts. With Travis’s hair growing back and his life returning to normal, what he has been through may seem as a cycle without any gains from his experience. In order to refute that opinion, the director arranges a reunion between Travis and Betsy. Betsy reads about his heroic action of saving Iris in the newspaper and suggests that she has forgiven their bygones. She waits for Travis to offer her another personal invitation after getting out of his cab. But this time, Travis gently takes away her false hope by quickly saying “so long.” This difference in attitude marks his growth to have a sound personality that frees him from his mental dependence on an idealized woman. While in the beginning of the movie Travis leans on his angel-like Betsy to make sense of this world, it is predictable that from this point forward, he has a relatively calm state of mind when confronting the chaotic New York City.

Nonetheless, such positivity is lessened by a critical irony. Although having some concern over Iris, Travis’s real motive in killing the pimp members was to give vent to his bile from failing to kill Palantine. Unlike what the media has depicted, he is not a selfless hero but an especially self-centered person who uses other people’s lives to release his own emotion. The reason why he acts so brave in bursting into the prostitution building is not his nobleness that frees him from fear, but his insanity as a defense mechanism of long-lasting mental oppression. Travis’s indifference towards exaggerated propaganda reflects his attitude towards journalism, which is more concerned with entertaining than with revealing the truth. This insightful outlook of the society, along with his unusually mild attitude towards its absurdity, indicates the unfortunate outcome of his resigning as a cynical fighter and eventually compromising with the unshakable reality.

## Chungking Express

Besides *Taxi Driver*, representing the neo-noir phase of the 1970s and '80s, film noir includes many manifestations from more recent decades. This modern period of noir sees more and more international films, such as Wong Kar-wai's *Chungking Express*, show signs of earlier noirish style. Before focusing on details of *Chungking Express* that address the question of agency, I wish first to examine the general nature of this movie and demonstrate why it qualifies as a lens through which we can examine film noir in the contemporary age.

On the one hand, the movie certainly retains many hallmarks of noir. It employs a subjective narration in the voiceover. It has a story line that includes a blonde femme fatale killing her boss, who is also the lover who betrayed her. One of the most distinctive characteristics is its camera language, which makes it difficult not to relate this film to film noir. The shaky, disorienting shots in the beginning of the film depicting the messy streets, the high-contrast lights providing a vision closely related to classic black-and-white films noirs, and the focus on very specific details in the environment that has little effect on documenting reality, are all signs suggesting an expressionist style that sets noir film apart from other previous or contemporaneous works.

Nonetheless, there are also some elements in the movie that challenge, and even in some sense undermine, these noir features. One significant difference is that the latter half of the movie has no elements of violence or darkness. The movie is divided into two parts. While the first part contains drug-selling and murder, narrative elements that fit noir conventions, the second part, where an innocent, dreamy girl, Faye, has a crush on a recently heartbroken cop named Number 633, is better described as a love story than a noir one. What has been abandoned in this story is not only the crime-related plot, but also the high occurrence of an expressionistic outlook on the environment. Thus it is understandable why many scholars find themselves agreeing with Stephen Teo's classification of the movie: "a light romance with touches of noirous intrigue" (212). Acknowledging the thin distinction between film noir and films with noir elements in modern days, there are two integral characteristics that justify sorting it into the group of contemporary noir. One is the expressionistic style mentioned above. The other, relating closely to the topic of our discussion, is how its urban setting, Hong Kong, affects the thoughts and actions of those living in it.

While Wong Kar-wai provides no direct notice on when the story in *Chungking Express* happened, there are several hints, both in and out of the movie, that help us locate an approximate time period. The movie came out in 1994 with a wide range of local audiences amazed at its ability to make them sympathize with the characters and recall their own memories. In this case, we can argue that its time setting is located some decades before its screening date. At the end of the second story, where Faye returns to her past working place and meets Number 633 after their one-year separation, 633 mentions that her



uncle has a very acute business mind in running a Karaoke bar. Since Karaoke only starts to spring up after the 70s, one can infer that this conversation is set in the last ten or twenty years before the twenty-first century.

Hong Kong in both its pre- and post-colonial states was significantly impacted by the social changes that happened in earlier years. It had been a British colony since the Qing dynasty, and was returned to the English by Japan after World War II. As Jennifer Fay and Justus Nieland concluded in their book *Film Noir: Hard-Boiled Modernity and the Cultures of Globalization*, “as a result of its colonial status, Hong Kong modernized more rapidly than mainland China, and became a major trading hub of Western capitalism” (109). On the other hand, local citizens often find themselves lost in seeking a cultural identity. They listen to English pop songs while speaking Cantonese. They eat fish and chips for lunch and You Tiao for breakfast. At the same time, they have to adapt to a multi-faceted culture since British trade with the world has made Hong Kong a cosmopolitan city.

Unlike as is the case in *Taxi Driver*, 1900s Hong Kong held a welcoming attitude to all its immigrants as well as the increasing opportunity of economic growth that came with them. While the city embraces people with multiple skin colors as members working in different strata of its business system, local residents in Hong Kong have no choice but to suppress their objection to those new-arrivals, whether intentionally or unconsciously. Love affairs, in such cases, provide them an emotional outlet as well as a shortcut in finding self-identity. Viewers from other cultures may find it absurd how Number 223, another local cop, treats his romance experience in the first half of *Chungking Express*. He appears to be deeply in love with his ex-girlfriend, but when he talks to the femme fatale played by Brigitte Lin, his manner confuses the audience as he quickly replaces his sentiment. Moreover, he does not express any guilt or even doubt about his infatuation. In most affectional films, we would expect their main characters to enter their relationship gradually. First they have an encounter, show their temperament, share their past stories after some incident, and then find themselves attracted to each other’s personality. *Chungking Express*’s attitude in treating the love story is texturally different. With Number 223’s famous line “57 hours later, I fell in love with this woman,” the movie skips all the grounding process and spoils its outcome to the audience, who are forced to acknowledge the affection as 223 forces himself to enter another romance right after ending one. Since similar suggestions can be drawn from the action of other characters, such as how the restaurant owner keeps setting 223 up to help him recover and the ex-girlfriend’s ridiculous reason for breaking up (that she looks like Yamaguchi Momoe but 223 does not look like Miura Tomokazu), it can be inferred that such instant love is not a personal habit but a social phenomenon, a tacitly-accepted ideology resulting from the turbulence of Hong Kong as a rapidly developing city.

Besides his fast romance, what is equally emphasized in 223’s story is his sense of privacy. In the movie, he constantly mentions running as a way to express sadness. It is reasonable to view this hobby as his way of self-protection, since during the talk between

him and his friend on the phone, 223 said directly that running ought be a highly private activity that mustn't be disturbed by others' presence. His habit of running only after a break-up also suggests that after having his "self" damaged in a relationship, he needs to use running to repair it. This particular exercise is thus symbolic, representing a temporary harbor for urban dwellers lost on the way to finding the meaning of their existence.

Number 633's symbol of "self" is a more common one. In the second story, only when in his house can he fully express his individuality. The parallel between him and his residence is made clear by his talking with homely objects such as soap and a towel and advising them to "stop crying," "be strong" and "forgive her"—counsel that is directed to himself. With his concept of self-projected to his living space, it is understandable that Faye's childish and yet very romantic action of sneaking in to 633's apartment, cleaning and redecorating his house, eventually erased the traces of his former girlfriend and replaced them with her own presence, both in his house and in his heart. The other crucial criterion for their romance is their separation, during which both 633 and Faye changed their profession. What is worth noting is how their new respective jobs reflect the influence the other character had on them: 633 becomes the owner of the fast food restaurant, and Faye becomes an airline stewardess like 633's ex. With one year apart from each other, they both develop a mature personality and are prepared to enter a reciprocal relationship. The freedom to adjust one's career path is the benefit of living in a prosperous city. While an urban environment deprives its residents of their ego, it also ensures their opportunity to discover it by themselves.

Compared to 633 and Faye's reunion, the finale of the first story is not very promising, but it also implies the idea that residents in the city are entitled to make decisions that suit them best. Because of the many chances to meet different people, urbanites are granted the right to place them in various social positions, namely, acquaintance, friend, lover, etc. The relation between 223 and the blonde woman falls to none of these categories: they are complete strangers and will never meet again after that one night they spent "together." The distance between everyone in the city is a buffer zone that is either to be stepped through or to be kept. While people with more intimate relationships will find their mutual curiosity gradually fading, the occasional encounter between the two characters can stay forever fresh in both of their memories. They are free from responsibility and thus needn't feel burdened. This unexpected breakthrough from the normal interval of different people, on the other hand, will make this experience valuable and memorable.

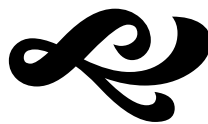
The Cantonese name of the movie is "Chung Hing Cam Lam." "Chung Hing" refers to Chungking Mansion, an architectural structure in Hong Kong known for its complex demographic composition and high crime rate, and is the place where both stories of the film take place. "Cam lam" means forest and is commonly understood as a metaphor for the clamorous, disturbing and doleful city. However, a forest is also the place different kinds of plants grow vibrantly due to nutrition guaranteed by the soil. Urban dwellers, seemingly

suffering from the severity of their habitat, are enjoying the variety of possibilities that enables them to design their life and livelihood.

Such presentation of humans' capabilities is a very positive outlook towards their agency, especially when compared to the other two movies that were previously analyzed. *Double Indemnity* demonstrates the consequence of being mentally weakened by the overwhelming pressure of urban space; *Taxi Driver* offers a seemingly satisfying outcome in its protagonists' struggles to find a meaning of life but remains skeptical about the worth of the gained "meaning" and reveals such skepticism through irony in the story line. From these three movies listed in a chronological order, it can thus be concluded that noir-filmmakers' attitude in concerning humans' agency follows a developing arc: first having an overtly negative stance and insistence that human beings cannot defeat the environment, then becoming slightly positive with some lingering doubt, and finally turning to a very positive conclusion on how humans are empowered to control their fate to a great extent in today's urban society.

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# Stakeholder Analysis: An Explanation of the Botswana Paradox

Mrinalini Sisodia Wadhwa

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## 1. Introduction

The Republic of Botswana’s current HIV/AIDS crisis presents a compelling policy-making paradox. On one hand, 21.9% of Botswana today are HIV-positive.<sup>1</sup> This reflects a failure of the government of Botswana’s 1990s HIV/AIDS prevention policies to achieve their purpose; the disease proliferated during this decade despite them. On the other hand, Botswana’s 1993 National Policy on HIV/AIDS – the framework for its HIV/AIDS policies for most of the 1990s – seemed destined to be effective. At the time, Western epidemiologists had arrived at a “policy consensus” that governments should approach HIV/AIDS prevention through sweeping national campaigns that provided education on HIV and other STDs, promoted condom-use, and provided STD treatment.<sup>2</sup> The 1993 National Policy endorsed all three of these recommended measures.<sup>3</sup> Botswana, moreover, had relatively advanced medical facilities and healthcare coverage, a result of

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<sup>1</sup> “Botswana” is the collective term for nationals of Botswana.

This is the third-highest HIV/AIDS prevalence rate in the world. See Joint United Nations Program on HIV and AIDS, *Ending AIDS: Progress towards the 90-90-90 Targets*, publication no. JC2900E, 87, 2017, accessed July 7, 2018, [http://www.unaids.org/sites/default/files/media\\_asset/Global\\_AIDS\\_update\\_2017\\_en.pdf](http://www.unaids.org/sites/default/files/media_asset/Global_AIDS_update_2017_en.pdf).

<sup>2</sup> For a discussion of this Western policy consensus, see Suzette Heald, “Abstain or Die: The Development of HIV/AIDS Policy in Botswana,” *Journal of Biosocial Science* 38, no. 1 (January 2006): 29-31,

<https://www.cambridge.org/core/journals/journal-of-biosocial-science/article/abstain-or-die-the-development-of-hivaids-policy-in-botswana/63AAF5D1D30843B5F36C7D2E0DEB6AE8>.

<sup>3</sup> Ministry of Health, *Botswana National Policy on HIV/AIDS* (Gaborone, Botswana: Republic of Botswana, 1993), 4.

government investment in previous decades.<sup>4</sup> The government of Botswana (GOB) issued its prevention policies rapidly, beginning two years after its first reported case of HIV, and a decade before the its neighbor, South Africa.<sup>5</sup> Why, then, despite Botswana's extensive medical resources and the GOB's use of epidemiological research, was the 1993 National Policy ineffective?

Research suggests that the 1993 policy failed because the GOB ignored the roles of Batswana religious leaders and traditional healers in preventing HIV/AIDS, instead prioritizing the roles of Western health experts and Batswana business and industry. In attempting to craft what seemed to be the most efficient policy response – one that harnessed the financial power of international and public-private partnerships and applied an epidemiological model – the GOB undermined the policy's effectiveness, neither fully recognizing nor mobilizing the social power of these two key cultural forces. This paper profiles both the favored and the disfavored stakeholders in Botswana's HIV/AIDS epidemic, proposes policy measures that could have mobilized each stakeholder without rebuffing the others, and assesses the extent to which the GOB was successful in balancing the interests of these different groups in its 1993 National Policy.

## **1.1 History and Demographics of Botswana**

The Republic of Botswana is a nation with a government, history, and series of socioeconomic demographics that set it apart from much of the developing world. Botswana is sparsely populated and ethnically homogenous, located in Southern Africa, as can be seen in Figure 1.<sup>5</sup> The Tswana people have long been the largest ethnic group of Botswana, making up nearly eighty percent of the population.<sup>6</sup> The majority of the Batswana have been Christian since European contact; the remaining twenty percent of citizens include those who follow traditional spiritual beliefs, or other minority religions.<sup>7</sup>

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<sup>4</sup> Heald, "Abstain or Die," 32.

<sup>5</sup> Heald, "Abstain or Die," 32.

<sup>6</sup> Less than seven percent of Batswana are of European descent. For the ethnic composition of the Batswana populace, see "Africa: Botswana," in *CIA World Factbook*, last modified June 6, 2018, accessed June 27, 2018, <https://www.cia.gov/library/publications/the-world-factbook/geos/bc.html>.

<sup>7</sup> "Africa: Botswana."

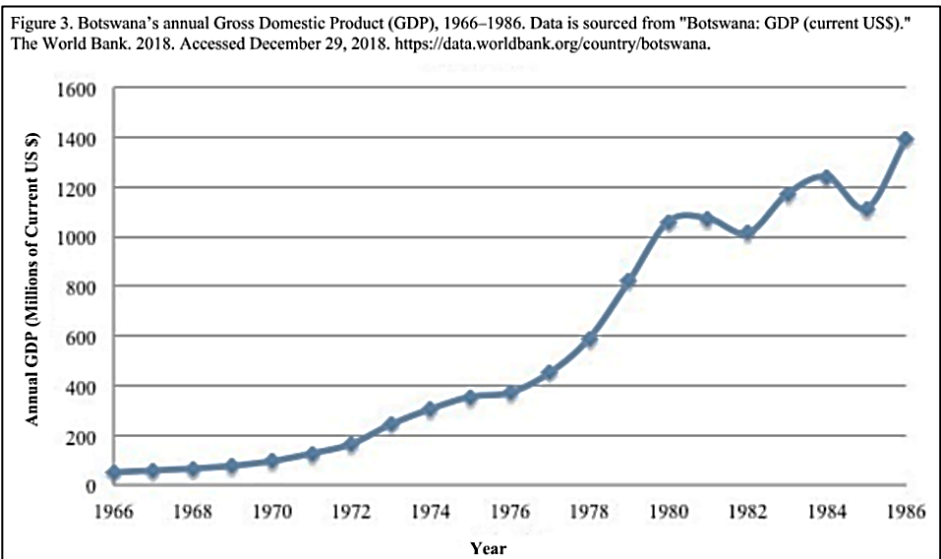
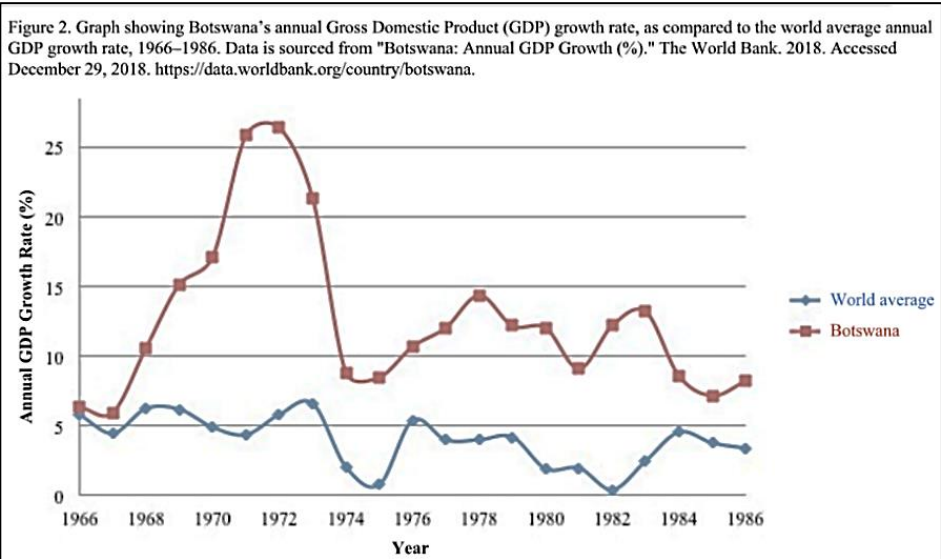


Between 1885 and 1966, Botswana was a British protectorate. There was little white settlement in what was then called the Bechuanaland Protectorate; as such, British colonial leaders allowed Tswana chiefs to maintain their authority in matters of local governance.<sup>8</sup> Amidst rising African nationalism in the twentieth century, the Batswana founded the autonomous Republic of Botswana in 1966.<sup>9</sup> As a British protectorate, Botswana was neither prosperous nor developed.<sup>9</sup> After 1966, however, with the discovery of diamonds and implementation of GOB plans for economic development, Botswana soon had the world's highest rate of economic growth, which it sustained for over three decades.<sup>9</sup> The nation's substantial economic gains in the period after its independence can be seen in Figures 2 and 3 below.

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<sup>8</sup> Georgia McPeak, "Identifying the Causes of the Rate of HIV/AIDS in Botswana: Implications for Foreign Policy" (master's thesis, University of Georgia, 2007), 26-27, [https://getd.libs.uga.edu/pdfs/mcpeak\\_georgia\\_200708\\_ma.pdf](https://getd.libs.uga.edu/pdfs/mcpeak_georgia_200708_ma.pdf).

<sup>9</sup> Daron Acemoglu, Simon Johnson, and James A. Robinson, "An African Success Story: Botswana" (working paper, MIT Department of Economics, Boston, MA, November 14, 2001), 2, <http://dx.doi.org/10.2139/ssrn.290791>.



The GOB, which has ranked as the least corrupt government in Africa since reporting began in the 1990s, invested its surplus into infrastructure development and public welfare.<sup>10</sup>

<sup>10</sup> Transparency International Secretariat, *Corruption Perceptions Index 1998*, Annual Corruption Perceptions Index 4 (Berlin, Germany: Transparency International, 1998), [https://www.transparency.org/research/cpi/cpi\\_1998/0](https://www.transparency.org/research/cpi/cpi_1998/0). Heald, “Abstain or Die,” 32.



Currently, the public sector provides inexpensive health care to most Batswana, operating 98% of the health facilities.<sup>11</sup>

## 1.2 Public Health in Botswana

Well before the 1990s, the GOB had successfully begun to decrease the maternal mortality rate (MMR) and offer accessible treatment for tuberculosis (TB) patients.<sup>12</sup> Even though the HIV/AIDS epidemic reversed some of Botswana's public health gains in the mid-1990s and early 2000s, the GOB's public health policy successes before the 1990s were notable for a new government in an industrializing nation. The GOB's failure to successfully address its HIV/AIDS epidemic in the 1990s therefore appears to be an aberration from its record of successful public health policy.

Botswana's first recorded case of HIV/AIDS was in 1985. Researchers believe that HIV began to spread rapidly by the mid-1980s, and prolifically by the 1990s, as can be seen in Figure 4.<sup>13</sup>

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<sup>11</sup> World Health Organization, "Botswana: The Health System," African Health Observatory, last modified 2018, accessed July 7, 2018,

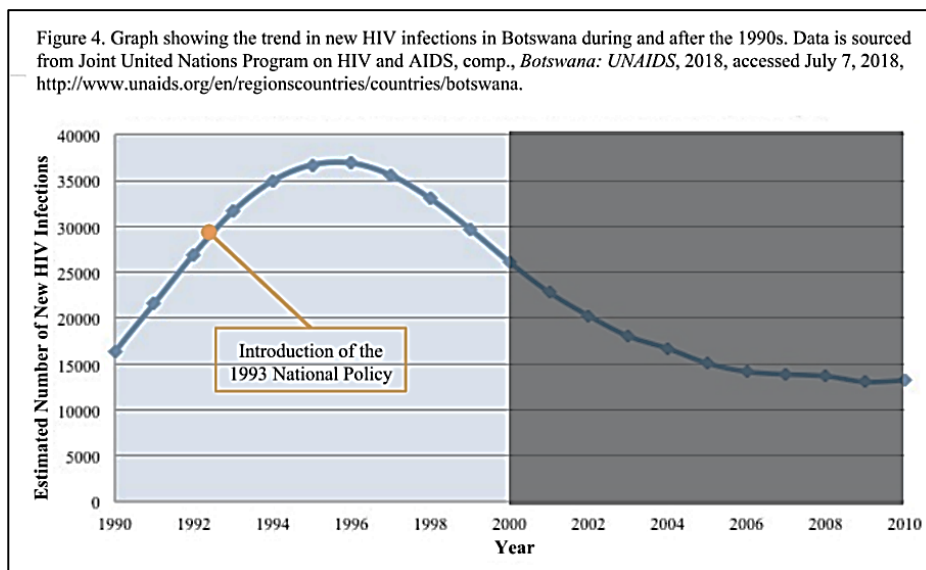
[http://www.aho.afro.who.int/profiles\\_information/index.php/Botswana:The\\_Health\\_System](http://www.aho.afro.who.int/profiles_information/index.php/Botswana:The_Health_System).

<sup>12</sup> For data on Botswana's MMR, see WHO et al., *Maternal Mortality 1990-2015: Botswana*, Maternal Mortality Country Profiles 21 (Geneva, Switzerland: World Health Organization, 2018), 1, [http://www.who.int/gho/maternal\\_health/countries/bwa.pdf?ua=1](http://www.who.int/gho/maternal_health/countries/bwa.pdf?ua=1). For a discussion of maternal and infant healthcare provided in Botswana, see Keitshokile Dintle Mogobe, Wananani Tshiamo, and Motsholathebe Bowelo, "Monitoring Maternal Mortality in Botswana," *Reproductive Health Matters* 15, no. 30 (November 2007): 164, <http://www.jstor.org/stable/25475345>.

For data on Botswana's rates of TB, see World Health Organization, *Botswana: Tuberculosis Profile*, Tuberculosis Country Profiles 21 (Geneva, Switzerland: World Health Organization, 2018),

[https://extranet.who.int/sree/Reports?op=Replet&name=/WHO\\_HQ\\_Reports/G2/PROD/EXT/TBCountryProfile&ISO2=BW&outtype=html](https://extranet.who.int/sree/Reports?op=Replet&name=/WHO_HQ_Reports/G2/PROD/EXT/TBCountryProfile&ISO2=BW&outtype=html). For an appraisal of Botswana's TB policies before the 1990s, see the following: J. A. Kumaresan and E. T. Maganu, "Case Holding in Patients with Tuberculosis in Botswana," *The British Medical Journal* 305 (August 8, 1992): 340, <https://doi.org/10.1136/bmj.305.6849.340>. Jacqueline Glennon and David Fegan, "Treating Tuberculosis in Developing Countries," *The British Medical Journal* 305, no. 6859 (October 17, 1992): 954, <https://www.jstor.org/stable/29717329>.

<sup>13</sup> Ministry of Health, *Botswana National*, 3.



The GOB's first two HIV/AIDS policies were the Short Term Plan (STP; 1987-1989) and First Medium Term Plan (MTP-I; 1989-1993).<sup>14</sup> Both policies' purpose was increasing HIV-testing and reducing HIV transmission, yet neither introduced a strategy to mobilize and coordinate the efforts of Botswana political leaders and local civic organizations in its HIV/AIDS programs and campaigns.<sup>15</sup> Botswana policy experts attribute STP and MTP-I's inability to prevent HIV transmission in these early years to its failure to comprehensively focus on marshaling these key political and civil actors.<sup>15</sup>

Botswana had the highest HIV prevalence rate in the world by the mid-1990s, a rank it maintained for the next decade.<sup>15</sup> In 1993, the GOB issued the National Policy on HIV/AIDS that outlined a new framework for preventing HIV transmission and minimizing the epidemic's damage on the nation's economic, educational, social, and political institutions. The policy's aim was to organize a "multi-sectoral national response" to the HIV/AIDS epidemic, creating roles for civic organizations and the private sector in supporting prevention campaigns and instituting internal HIV/AIDS policies.<sup>16</sup> The initiative had little success, however, in mobilizing this collective power to curb the growing epidemic: HIV infection rates continued to rise until 1996, and numbers of Botswana living with HIV and

<sup>14</sup> For a review of the STP and MTP-I, see Gape Kaboyakgosi and Keneilwe P. Mpule, "Beyond Public Administration? HIV/AIDS Policy Networks and the Transformation of Public Administration in Botswana," *Journal of Public Administration and Development* 28, no. 4 (September 28, 2008): 303-304, <https://doi.org/10.1002/pad.505>.

<sup>15</sup> Kaboyakgosi and Mpule, "Beyond Public," 302-304.

<sup>16</sup> Ministry of Health, *Botswana National*, 10.

dying as a result of AIDS increased steadily into the 2000s.<sup>17</sup>

By the end of the twentieth century, the new Botswana President Festus Mogae put HIV/AIDS at the forefront of Botswana's national agenda and called for foreign aid.<sup>18</sup> With newly acquired funding from both international organizations and multinational corporations, Mogae's administration instituted Africa's first program to distribute Antiretroviral Drugs (ARVs) freely, providing these to all infected Botswana.<sup>19</sup>

### 1.3 Literature Review

Researchers have developed a variety of explanations for the GOB's unforeseen failure to prevent HIV/AIDS proliferation in the 1990s. Two schools of thought predominate: one group of experts concurs that HIV/AIDS spread because the GOB adopted flawed policies, while the other argues that external cultural and social factors, rather than government policies, allowed the epidemic to spread in the 1990s.

Experts including Helen Epstein and Suzette Heald claim that Botswana's HIV/AIDS policies and programs did not do enough to impact the Botswana at a personal level, and therefore failed to beget the necessary behavioral changes to stop the transmission of HIV – that is, protected sex and commitment to one sexual partner. Epstein, an acclaimed writer, public health consultant, and molecular biologist, noted that the GOB's HIV education campaigns, despite being “well organized,” did not focus on convincing ordinary citizens that “HIV was everyone's problem.”<sup>20</sup> As a result, the majority of citizens remained unconcerned by the epidemic, and continued having unprotected sex and multiple simultaneous sexual partners; these behaviors, in turn, allowed HIV to spread.<sup>21</sup> Heald, a former professor of social anthropology with research experience in Botswana and other countries in Southern Africa argued that the early 1990s policies did not consider public perception of risk: Botswana citizens did not believe a fully-fledged domestic AIDS

<sup>17</sup> Joint United Nations Program on HIV and AIDS, comp., *Botswana: UNAIDS*, 2018, accessed July 7, 2018, <http://www.unaids.org/en/regionscountries/countries/botswana>.

<sup>18</sup> Festus G. Mogae, "Republic of Botswana Address at the Twenty-Sixth Special Session of the United Nations General Assembly on HIV/AIDS," speech, June 25, 2001, United Nations General Assembly, last modified 2018, accessed July 7, 2018, <http://www.un.org/ga/aids/statements/docs/botswanaE.html>.

<sup>19</sup> ARV drugs, developed in the mid-1990s, prolong the lives of HIV patients and prevent mother-to-child transmission of HIV/AIDS and “needle-prick” HIV infection (where health care providers accidentally come in contact with the fluids of an HIV patient); see Helen Epstein, *The Invisible Cure: Africa, the West, and the Fight against AIDS* (United States: Farrar, Straus, and Giroux, 2007), x-xi. For more particulars on the development of the ARV policy and an assessment of its impact, see Heald, “Abstain or Die,” 35-38.

<sup>20</sup> Epstein, *The Invisible*, 168-169.

<sup>21</sup> For a discussion of the impact of these sexual behaviors on Southern Africa's HIV/AIDS epidemic, see Epstein, *The Invisible*, 54-58.

epidemic was imminent, or even likely, in the early 1990s. Consequently, government efforts to educate citizens about condom-usage and HIV in the STP and MTP-I were premature, if not unwelcome; policy makers did not grasp the need first to convince the public that a nationwide HIV epidemic was a real possibility before discussing HIV prevention.<sup>22</sup>

Like Heald, Cambridge University professor John Iliffe claimed that this lack of public concern allowed HIV/AIDS to spread in Botswana during the 1990s. In contrast, however, he did not attribute this indifference to an inadequacy in Botswana's HIV/AIDS prevention policies. Rather, Iliffe contended that citizens were unconcerned about the epidemic because Botswana's epidemic came very early in the "sequence" of events leading to the global AIDS crisis.<sup>23</sup> The only HIV/AIDS epidemics preceding Botswana's were those in Western countries. Thus, with the West being their only point of reference, many Botswana in the late 1980s and early 1990s concluded that HIV/AIDS mainly affected a few groups engaging in relatively aberrant sexual (and other) behaviors: homosexuals, prostitutes, and intravenous drug users.<sup>24</sup> Before Botswana and Southern Africa, there had never been nations where *any* citizen, engaging in what were considered normal sexual relations (which in Botswana included the widespread practice of having concurrent sexual partners, something uncommon in the West), was at a high risk of acquiring HIV. As such, the Botswana's perception of the epidemic gave them little cause to change their own sexual behaviors so long as these followed their cultural norms.

Diane M. Kim attributed the spread of HIV/AIDS in Botswana to another external factor: rampant gender inequality. Kim viewed Botswana policies supporting HIV prevention, education, and healthcare – many of which were first introduced by the 1993 National Policy – as "promising" in themselves.<sup>25</sup> She argued that deep-rooted issues in Botswana's culture, legal code, and past legislation that had disempowered women were behind the proliferation of HIV/AIDS in the 1990s. This unresolved gender inequality

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<sup>22</sup> Heald, "Abstain or Die," 33.

<sup>23</sup> John, *The African AIDS Epidemic* (Woodbridge: James Currey, 2006), <https://itunes.apple.com/us/book/the-african-aids-epidemic/id1206581544?mt=11>, 17.

<sup>24</sup> Iliffe quotes a Botswana government official claiming " 'AIDS is primarily a disease of homosexuals and there is no homosexual in Botswana,' " reflecting this common perception of HIV/AIDS based on the West's experience of it: that it was confined to those engaging in sexual behaviors which seemed aberrant relative to the local culture. See Iliffe, *The African*, 99. The extent to which this understanding of even the Western epidemics is true can, of course, be contested, given that an individual infected through any of these purportedly aberrant behaviors could then pass the virus on through heterosexual relations or a contaminated hospital needles – that is, more 'ordinary' means.

<sup>25</sup> Diane M. Kim, "The HIV Epidemic in Botswana and Gender Inequalities: A Way Forward" (master's thesis, Boston University, 2014), vi, <https://hdl.handle.net/2144/15376>.

perpetuated rape and a culture of patriarchy, leaving women unable to avoid risky sexual encounters and causing HIV infection rates to rise.<sup>26</sup>

Together, both schools of thought appear to agree on one insight from their many examinations of Botswana's HIV/AIDS crisis: policymakers were contending with a multifaceted crisis that involved culture, inequality, and even history as much as it involved medicine and epidemiology – and subsequently, that they had to understand these various aspects of the HIV/AIDS crisis, some within their control and some outside of it, when creating a policy response.

## 2. Stakeholder Analysis

In evaluating the GOB's approach to HIV/AIDS, it is critical understand the many parties involved in the public health crisis and analyze them in relation to one another. This argument, therefore, draws on stakeholder analysis, a model that aids policymakers in mobilizing all critical parties, or "stakeholders," in their attempt to address a public issue.<sup>27</sup> Policymakers first identify the most important stakeholders within the context of a public issue, and then assess each stakeholder's interests, beliefs, and resources. Finally, they create a policy, which, based on their understanding of each stakeholder's relationship with the crisis – their perception of it, interest level, and influence over it, – endeavors to harness the collective power of the stakeholders, maximizing the efficacy of their policy. Public health organizations recommend stakeholder analysis as a means of creating a comprehensive policy response to epidemics such as HIV that have "social, political, legal and economic implications" along with medical ones.<sup>28</sup> Researchers, moreover, have

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<sup>26</sup> Kim, "The HIV Epidemic," v.

<sup>27</sup> This paper defines a stakeholder as an entity with interest in and influence over Botswana's HIV/AIDS crisis, drawing on the definition proposed by Larry W. Smith, "Stakeholder Analysis: A Pivotal Practice of Successful Projects" (paper presented at Seminars and Symposium, Houston, TX, September 7, 2000), 2, <https://www.pmi.org/learning/library/stakeholder-analysis-pivotal-practice-projects-8905>.

<sup>28</sup> World Health Organization, "Policy, Advocacy and Stakeholder Mobilization," *World Health Organization*, last modified 2018, accessed July 7, 2018, <http://www.who.int/hiv/topics/vct/toolkit/components/policy/introduction/en/index2.html>.

developed frameworks for stakeholder analysis specific to public health settings.<sup>29</sup> Some have also applied it to recommend HIV/AIDS policy steps for certain nations.<sup>30</sup>

This argument applies stakeholder analysis retrospectively to Botswana's HIV/AIDS crisis in the early 1990s, replicating a process Botswana's policymakers might have undertaken in 1993, prior to drafting the National Policy: identifying, understanding, and appealing to the interests of relevant stakeholders. There is also a critical fourth element to this analysis: assessing the extent to which the 1993 Policy *actually* engaged the stakeholders, and the gap between the policy measures recommended by a stakeholder analysis and the measures Botswana actually implemented in the 1993 Policy.

## 2.1 Identifying the Stakeholders

Four stakeholders had a particularly significant national presence in Botswana: religious leaders, Tswana healers, Botswana industry and business, and the "international community" (defined as Western donors and the United Nations). As opposed to reviewing specific local or regional initiatives, this paper reviews Botswana's overarching policy framework for the 1990s (i.e. the 1993 National Policy); it was therefore necessary to choose stakeholders with a consistent *nationwide* presence, rather than those operating only in certain localities.<sup>31</sup>

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<sup>29</sup> Kammi Schmeer, *Guidelines for Conducting a Stakeholder Analysis*, Health Reform Tools Series (Bethesda, MD: Partnerships for Health Reform, 1999); US Department of Health and Human Services, "Introduction to Program Evaluation for Public Health Programs," Centers for Disease Control and Prevention, last modified May 11, 2012, accessed July 7, 2018, <https://www.cdc.gov/eval/guide/step1/index.html>.

<sup>30</sup> Papua New Guinea National AIDS Council, *HIV/AIDS Stakeholder Mapping in Papua New Guinea*, comp. Australian Agency for International Development, Papua New Guinea National AIDS Council, and UNAIDS (Papua New Guinea: UNAIDS, 2004), <http://www.hivpolicy.org/Library/HPP000675.pdf>; Svetlana Ancker and Bernd Rechel, "HIV/AIDS Policy-Making in Kyrgyzstan: A Stakeholder Analysis," *Health Policy and Planning* 30, no. 1 (February 2015): <https://doi.org/10.1093/heapol/czt092>.

<sup>31</sup> More 'local' stakeholders could include women's and children's Non-Governmental Organizations (NGOs), Botswana universities, and labor unions. The 1993 National Policy did expressly mention NGOs as a category, rather than in reference to specific NGOs or kinds of NGOs; see Ministry of Health, *Botswana National*, 4. While the GOB recognized organized labor, it encouraged – and even expected – labor unions to follow government guidelines during times of crisis. Since HIV/AIDS was a growing public health crisis, it is likely that, by application of this principle, the GOB would have expected labor's compliance with its HIV/AIDS policy. For a discussion of the GOB's relationship organized labor, see Seretse Khama, "Trade Unions in Botswana," speech, July 10, 1971, <https://www.jstor.org/stable/4185228>.

Botswana's religious leaders – primarily Protestant Christians – took interest in HIV/AIDS primarily because heterosexual sex was the primary means of local transmission. The Christian faith has traditionally placed emphasis on faithfulness within a marriage and opposed casual sex.<sup>32</sup> HIV/AIDS presented an opportunity for the Church to exercise and expand its moral authority during a time of cultural modernization and economic growth by shaping the public education message about what constituted acceptable and safe sexual behaviors. In a Christian-majority nation, Botswana's churches were a powerful cultural force: members, by virtue of their faith in their religion, trusted church leaders.<sup>33</sup> Research has found that such trust gives an organization or entity credibility, forming the basis of a successful public education campaign – one that causes people to change their behaviors.<sup>34</sup> As such, the Church had an influential platform in the HIV/AIDS crisis, and one central to creating an effective awareness-raising campaign.

For traditional Tswana healers and doctors, the HIV/AIDS crisis was, similarly, a chance to disseminate traditional wisdom adapted to a modern crisis. Not only did most Botswana originate from the Tswana ethnic group, but also, in the 1990s, many still lived in homogenous tribal communities, allowing them to maintain local traditions despite the effects of European contact and the cultural changes begotten by globalization.<sup>35</sup> Thus, Tswana healers, like church officials, had the scores of citizens' trust and respect – and subsequently, the ability to catalyze behavioral change.

Botswana business and industry was a stakeholder with a more limited, indirect interest in Botswana's 1990s HIV/AIDS crisis. As in any nation, the main objective of Botswana corporations was maximizing profit in order to sustain economic growth. This objective did not directly concern itself with Botswana sexual practices and medical care, but it did concern the private sector's access to a productive labor force. Therein lay the private sector's "stake" in HIV/AIDS in Botswana: the epidemic would likely result in a reduced and less productive labor force, which would gradually have a "negative effect" on

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<sup>32</sup> Tim Allen and Suzette Heald, "HIV/AIDS Policy in Africa: What Has Worked in Uganda and What Has Failed in Botswana?," *Journal of International Development* 16, no. 8 (November 8, 2004): 1150, <https://doi.org/10.1002/jid.1168>.

<sup>33</sup> "Africa: Botswana."

<sup>34</sup> For a discussion of the role of trust and credibility in HIV/AIDS public education in regard to religious and cultural leaders, see Allen and Heald, "HIV/AIDS Policy," 1144.

<sup>35</sup> "Africa: Botswana." Peggy Gabo Ntseane and Julia Preece, "Why HIV/AIDS Prevention Strategies Fail in Botswana: Considering Discourses of Sexuality," *Development Southern Africa* 22, no. 3 (September 2005): 349, doi:10.1080/14797580500252910. Many of the Botswana whose families converted to Christianity during Botswana's time as a British protectorate continued to honor Tswana customs and traditions; see Frederick Klaitz, "Faith and the Intersubjectivity of Care in Botswana," *Africa Today: Special Issue on Christianity and HIV/AIDS in East and Southern Africa* 56, no. 1 (Fall 2009): 5, <https://www.jstor.org/stable/pdf/10.2979/aft.2009.56.1.2>

Botswana's economy.<sup>36</sup> Business and industry leaders had the capital to support HIV/AIDS prevention programs. Furthermore, Botswana's corporations – especially its mining companies – directly engaged with the labor force on a regular basis. Thus, the Botswana private sector was in a position to disseminate information about the epidemic amongst Botswana youth (comprising a significant portion of the nation's labor force), although citizens would not have the same faith in companies that they had in their religious and cultural institutions.

When compared to the other three stakeholders, the international community had the lowest degree of interest in and influence over Botswana's HIV/AIDS. In the early 1990s, the international response to the epidemic was still largely uncoordinated and underfunded; it was later in 1996 that the United Nations, with the support of powerful Western nations including the United States, founded the Joint United Nations Program on HIV and AIDS (UNAIDS).<sup>37</sup> The founding of UNAIDS reflected Western interest in addressing the HIV/AIDS epidemic in the developing world – and, by extension, Botswana – based on the growing realization that the epidemic threatened global development and stable governance. Yet within the developing world, Botswana itself was a relatively stable, peaceful, and prosperous country, considered a “model” African nation in the 1970s and 1980s.<sup>38</sup> The HIV/AIDS epidemic, consequently, did not threaten to immediately destabilize its government or cripple its economy. Thus, researchers have observed that foreign leaders were less interested in addressing Botswana's nascent HIV/AIDS crisis in the early 1990s than they were in addressing crises in countries with preexisting political, economic, and social upheaval.<sup>39</sup> The international community possessed enough wealth to support overseas education campaigns, STD treatment centers, and condom distribution, as

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<sup>36</sup> Franklin Simtowe and Florent M. Kinkinginhoun-Medagbe, "The Impact of HIV/AIDS on Labor Markets, Productivity and Welfare in Southern Africa: A Critical Review and Analysis," *African Journal of Agricultural Research* 6, no. 10 (May 2011): 1, [https://www.researchgate.net/publication/289171342\\_The\\_impact\\_of\\_HIVAIDS\\_on\\_labor\\_markets\\_productivity\\_and\\_welfare\\_in\\_Southern\\_Africa\\_A\\_critical\\_review\\_and\\_analysis](https://www.researchgate.net/publication/289171342_The_impact_of_HIVAIDS_on_labor_markets_productivity_and_welfare_in_Southern_Africa_A_critical_review_and_analysis). Quote is sourced from Nesim Tumkaya, "Botswana's Labor Dynamics: The Influences of Entries, Exits and Deaths on Manpower Size and Composition," *Botswana Notes and Records* 20 (1989): 125, <http://www.jstor.org/stable/40979818>.

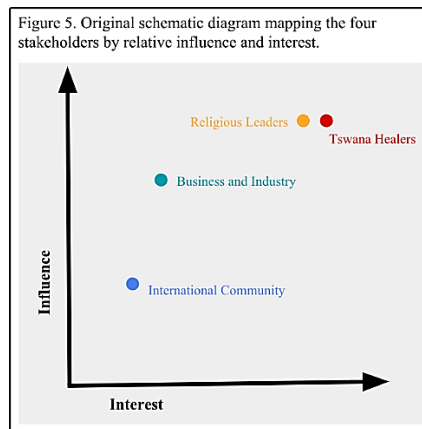
<sup>37</sup> Marlise Simons, "H.I.V. Is Still Spreading Rapidly, U.N. Says," *The New York Times* (New York, NY), June 7, 1996, World, accessed June 1, 2018, <https://www.nytimes.com/1996/06/07/world/hiv-is-still-spreading-rapidly-un-says.html>.

<sup>38</sup> Jane Perlez, "Is Botswana a Model for Democracies in Africa?," *The New York Times* (New York, NY), May 15, 1990, Archives, accessed July 7, 2018, <https://www.nytimes.com/1990/05/16/world/is-botswana-a-model-for-democracies-in-africa.html>.

<sup>39</sup> Allen and Heald, "HIV/AIDS Policy," 1145.



evidenced by its well-funded campaigns in the 1990s and early 2000s in African nations.<sup>40</sup> Leading Western nations and organizations regularly accessed some of the world's most advanced research facilities, and therefore, were aware of the newest medical and epidemiological findings regarding the HIV/AIDS epidemic. However, the international community by itself could not have direct, personal influence on the Batswana; it did not naturally command the trust of Batswana people.



The schematic diagram in Figure 5 synthesizes these research findings, mapping the four stakeholders relative to each other based on the level of interest they had in Botswana's HIV/AIDS crisis in the early 1990s, and the degree of influence they had the ability to exercise.<sup>41</sup>

## 2.2 Religious Leaders

One of the most influential stakeholders in Botswana's HIV/AIDS crisis, Batswana religious leaders drew on two relevant Christian doctrines in their response to the epidemic. The first was an articulation of the Church's principles on sexual behavior: that sex should

<sup>40</sup> For more information on the UN- and Western-funded HIV/AIDS prevention and treatment campaigns in the 1990s and early 2000s, see Epstein, *The Invisible*, 202-209.

<sup>41</sup> Like any other society, the Batswana trusted their Churches and cultural leaders more than local corporations, and certainly more than Western-led organizations. Given that this trust was the most critical means to bring about the behavioral changes necessary to address HIV/AIDS, religious leaders and Tswana healers ranked higher for influence than the other two stakeholders. The private sector ranked higher than the international community in influence because of its being in direct contact with the labor force in addition to having access to capital. Stakeholders with more personal or direct involvement with the HIV/AIDS crisis, moreover, ranked higher for their level of interest in preventing the HIV/AIDS crisis.

not be practiced recreationally (including pre- and extra-marital sexual relations).<sup>42</sup> The second doctrine was one of compassion, which urged Christians to unite in times of crisis and serve the vulnerable and suffering in whatever capacity they could.<sup>43</sup>

The possible applications of these doctrines to Botswana's HIV/AIDS crisis were powerful. Faithfulness to one partner – a corollary to the first Christian doctrine regarding sexual behavior – was the antithesis to concurrent sexual relations, the risky behavior that had allowed HIV to spread so rapidly in Botswana in the first place. Moreover, researchers found that community-based HIV/AIDS care and counseling, both of which were reasonable applications of the second doctrine, effectively reduced the dangerous stigma and silence surrounding the epidemic.<sup>44</sup>

One could also understand the Church leaders' skepticism of the merits of condom-usage as a means to prevent HIV/AIDS by considering its first doctrine of faithfulness in sexual relations. Condom-promotion campaigns rarely portrayed married couples using condoms to prevent one partner from spreading the virus to another, a behavior which Church leaders might have considered to be more appropriate. Rather, in their aggressive marketing, these campaigns could inadvertently suggest that extramarital and premarital sexual relations were acceptable so long as those involved used condoms. To the Church, such messages associated condoms with immorality; supporting condom-usage in such a manner was akin to endorsing behaviors the Church frowned upon for being excessively promiscuous.<sup>45</sup>

While most Botswana religious leaders would not actively support all condom-promotion initiatives, they did not oppose strategies to address HIV/AIDS that stressed faithfulness and community. Policymakers could have recognized the Church's unique role in the epidemic by encouraging Church leaders to address HIV/AIDS through their discourse and community service. For instance, Church leaders could have used sermons and publications to reinforce the importance of commitment to one sexual partner, and to foster compassion for those suffering from HIV/AIDS. Moreover, the GOB's policy framework could have recognized and supported the role of these religious leaders in organizing initiatives within their local churches to provide home-based care for HIV/AIDS

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<sup>42</sup> James N. Amanze, "Covenant with Death: The Attitude of Churches in Botswana towards the Use of Condoms by Christians, and Its Social Implications," *Botswana Notes and Records* 32 (2000): 204, <http://www.jstor.org/stable/40980279>.

<sup>43</sup> Moji Ruele, "The Diaconal and Liberation Role of the Church in the Fight against HIV/AIDS in Botswana," *Botswana Notes and Records* 35 (2003): 142, <http://www.jstor.org/stable/40980346>. Klaitz, "Faith and the Intersubjectivity," 5.

<sup>44</sup> For a discussion of the impact of community-based care, see Busisiwe Purity Ncama, "Models of Community/Home-Based Care for People Living with HIV/AIDS in Southern Africa," *Journal of the Association of Nurses in AIDS Care* 16, no. 3 (May 2005): 33, doi:10.1016/j.jana.2005.03.006.

<sup>45</sup> Allen and Heald, "HIV/AIDS Policy," 1144

patients. Reconciling these religious beliefs with the need to promote protected sex would have been the most challenging aspect of mobilizing the Church for the GOB, but there were means to address promote condoms without repudiating Church doctrine entirely. Indeed, The GOB's condom-promotion campaigns could have emphasized the role of condoms in personal safety and responsibility, rather than in facilitating unrestrained sexual behavior.

In practice, evidence suggests that the 1993 National Policy both overlooked and antagonized these religious leaders. The GOB defined the policy's purpose as "describ[ing]" and coordinating "the [roles] of national leaders, various government ministries, the private sector, non-governmental and community-based [organizations], Persons Living With HIV/AIDS, and individual community members, in the national response" to the epidemic.<sup>46</sup> Religious leaders, despite their significant national presence, are absent from this list of key actors the policymakers considered in creating Botswana's framework for HIV/AIDS prevention. Moreover, the policy's public education message is centered on condom-usage, not expressly mentioning faithfulness as a means to obviate the risk of concurrent sexual relationships.<sup>47</sup> In practice, government condom-promotion campaigns, perhaps in an attempt to appeal to the youth, often portrayed unconstrained and even aggressive sexuality, rather than good judgment and safety.<sup>48</sup>

The repercussions of these decisions go beyond hypotheticals of what positive results the 1993 Policy *could* have attained had the GOB included the Church in its policy framework; they include the soon manifest repercussions of the GOB's having antagonized the Church by ignoring its role in and contradicting its position on the epidemic. Church leaders' vehement opposition to the GOB's condom promotion undermined the trust many Batswana had in the government's HIV/AIDS education campaigns at large.<sup>49</sup> Consequently, neglecting the Church weakened the 1993 National Policy's ability to encourage behavioral change, and thereby, to prevent HIV transmission.

### 2.3 Tswana Healers

The Tswana healers, another cultural force, had in past years developed medical practices that placed special emphasis on determining the origin of a disease in order to prescribe treatment. Healers would attribute diseases to "witchcraft, ancestor's anger, [or] pollution through breaking of [behavioral] taboos."<sup>50</sup> Applying their model to the

<sup>46</sup> Ministry of Health, *Botswana National*, 1.

<sup>47</sup> Ministry of Health, *Botswana National*, 5.

<sup>48</sup> Epstein, *The Invisible*, 145-146.

<sup>49</sup> Heald, "Abstain or Die," 34.

<sup>50</sup> For a discussion of the various kinds of Tswana healers and their background and role in Batswana communities, as well as Tswana medical practices, see Benedicte Ingstad, "The

HIV/AIDS crisis, Tswana healers hypothesized that individuals contracted HIV/AIDS after having broken sexual taboos, and then spread it to other individuals through sexual contact.<sup>51</sup> While there were a variety of Tswana sexual taboos and customs that differed among tribal communities, these shared a common focal point: sex being a means of procreation.<sup>52</sup> Sexual behaviors that the Tswana believed would inhibit procreation were taboo, and Tswana communities' sexual mores emphasized fertility and childbearing.<sup>53</sup>

In themselves, Tswana sexual customs had a number of potentially negative implications in Botswana's HIV/AIDS crisis. Some of these customs, such as *Nkazana* (permitting a man to pursue sexual relations with his wife's younger female relatives), exacerbated existing gender inequality, which research has linked with HIV proliferation.<sup>54</sup> *Nkazana* and other sexual customs also encouraged individuals – primarily men – to maintain concurrent sexual relationships, a behavior which placed them and their various partners at a high risk of contracting HIV.<sup>55</sup> Moreover, the lasting emphasis Tswana culture placed on procreation led to Tswana healers' regarding condoms and other barrier methods (which, like Tswana sexual taboos, inhibited procreation) with skepticism. However, the Tswana healers' convictions were not rigid, but rather “under a constant influence from religious and cosmopolitan medical sources,” because these leaders wanted to remain relevant in modern times.<sup>56</sup> That the Tswana healers were interested in investigating the source of HIV/AIDS (instead of solely identifying traditional treatments for the various medical conditions HIV/AIDS causes) was a testament to the curiosity and reason with which they approached the new health crisis.

Mobilizing the Tswana healers was a crucial – and challenging – step for the GOB in drafting its HIV/AIDS policy framework, requiring the GOB to connect their interest in procreation with the objective of HIV/AIDS prevention. Campaigns advising against behaviors that propagated HIV/AIDS (concurrent sexual relationships and unprotected sex) had to emphasize that these behaviors inhibited procreation just as much as other “taboo” behaviors did, as they cut short the lives of many Batswana at a reproductive age. Linking the Tswana value of procreation with these behavioral changes would have allowed the

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Cultural Construction of AIDS and Its Consequences for Prevention in Botswana," *Medical Anthropology Quarterly* 4, no. 1 (March 1990): 31-32, <https://www.jstor.org/stable/648521>.

<sup>51</sup> Ingstad, "The Cultural," 33.

<sup>52</sup> For a discussion of the emphasis Tswana culture has traditionally on procreation, see Heald, "Abstain or Die," 6.

<sup>53</sup> Ntseane and Preece, "Why HIV/AIDS," 352.

<sup>54</sup> For a discussion of Tswana sexual customs including *Nkazana* in relation to both HIV/AIDS proliferation and gender inequality, see Ntseane and Preece, "Why HIV/AIDS," 351-355. For a discussion of the relationship between gender inequality and HIV/AIDS in Botswana, see Kim, "The HIV Epidemic," 30-37.

<sup>55</sup> Ntseane and Preece, "Why HIV/AIDS," 357.

<sup>56</sup> Ingstad, "The Cultural," 28.

GOB to assure Tswana leaders that the changes they were bringing to Botswana would not weaken Tswana culture. Moreover, as a part of its public education campaign, the GOB could have empowered Tswana healers to act as HIV/AIDS counselors in their local communities. Given that they had been initially receptive to the Western medical understanding of HIV/AIDS, these healers could have played a role in disseminating information about the epidemic and preventative behaviors, while continuing to prescribe their own treatments involving herbs and other traditional tools.<sup>57</sup>

There is a significant gap between what the GOB could have done, and what they actually did, in terms of mobilizing this stakeholder. The 1993 National Policy did not discuss Tswana culture or outreach to tribal communities in rural locations when outlining its public education program.<sup>58</sup> Furthermore, the National AIDS Council, established by the 1993 Policy, did not provide representation for Tswana healers.<sup>58</sup> The Tswana healers' initial response to the epidemic did not explicitly contradict Western medicine's understanding of it: healers believed that individuals acquired HIV as a result of risky sexual behaviors, and could spread it through sexual intercourse, a description which encompassed the majority of HIV/AIDS transmissions in Botswana.<sup>59</sup>

In disregarding Tswana healers in its policy framework while simultaneously embracing the views of Western medicine, the GOB, perhaps unwittingly, placed medical and epidemiological findings at odds with Tswana culture. As the 1990s progressed, Tswana healers responded by changing their position on the epidemic by seeking to reinforce tradition by *opposing* the common medical understanding of HIV/AIDS and its prevention. Healers, and, consequently, many Batswana, became convinced that HIV/AIDS was a collection of old diseases, not a new epidemic, which was striking the nation with a new severity because citizens had neglected Tswana customs.<sup>60</sup> In this attempt to reinforce cultural authority, Tswana leaders opposed the behavioral changes the 1993 Policy supported, particularly condom-usage, linking these changes with cultural disrespect. As such, these leaders fostered distrust of government HIV-education campaigns amongst the Batswana, enabling misconception and ignorance about HIV/AIDS to prevail.

## 2.4 Botswana Business and Industry

In understanding the position of Botswana's business and industry leaders on the HIV/AIDS epidemic, one must first note that their primary focus was profit, not human welfare. Batswana corporations could not have been oblivious to the damaging economic implications of HIV/AIDS in the early 1990s: the epidemic would render many adults "of a

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<sup>57</sup> This is based on suggestions discussed in Ntseane and Preece, "Why HIV/AIDS," 360-361.

<sup>58</sup> Ministry of Health, *Botswana National*, 10.

<sup>59</sup> Ingstad, "The Cultural," 33.

<sup>60</sup> Allen and Heald, "HIV/AIDS Policy," 1144-1145.

productive age” unable to contribute to the economy due to death and illness, reducing economic productivity and growth.<sup>61</sup> Yet they were aware that epidemic would not lead to immediate economic collapse: individuals and households suffered the immediate effects of the epidemic, while the resulting damage would reach companies gradually and indirectly.<sup>62</sup> Because the epidemic was not an immediate threat to their profits, corporate leaders were not ready to *actively* address HIV/AIDS by investing much of their own time and capital in the early 1990s, even they did not oppose the GOB’s public health initiatives.

To efficiently mobilize the business and industry when the epidemic was in its earlier stages, Botswana policymakers had to ensure that it would be financially viable for these aspects of the private sector to become involved in its programs. The Ministry of Health, for instance, could have published guidelines and offered consultation services to assist companies in disseminating information about the HIV/AIDS epidemic, rather than expecting them to take initiative to do so themselves. Additionally, policies could have encouraged companies to invest in developing internal condom-distribution and HIV/AIDS education campaigns – an investment that would both supplement government prevention efforts and be in the company’s self-interest. At its core, the policy framework should have recognized that *relying* on corporate initiative, and making it a focal point of its policy framework, was not feasible. Given that HIV/AIDS was not, at that time, a pressing threat for Botswana’s economy, business and industry leaders could defer most of the responsibility HIV/AIDS prevention to the government and other entities devoted to human welfare.

Yet Botswana’s 1993 National Policy attempted to establish business and industry leaders as key actors in HIV/AIDS prevention. Research suggests that this strategy did not yield much benefit during most of the 1990s. The policy encouraged the private sector to fund HIV/AIDS education campaigns and

develop and implement policies and [programs] for the management of HIV/AIDS, in line with national policy guidelines, ... [including] the implementation of HIV/AIDS and STD prevention education for workers, condom distribution, as well as protection of the rights of HIV-infected workers.<sup>63</sup>

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<sup>61</sup> Ministry of Health, *Botswana National*, 3.

<sup>62</sup> For a discussion of the economic implications of the epidemic for Botswana’s private sector, see Allen and Heald, “HIV/AIDS Policy,” 1145; Heald, “Abstain or Die,” 35; Patricia Farrow, “An Overview of the HIV/AIDS Pandemic and Its Impact on Botswana,” *Botswana Notes and Records* 31 (1999): 147, <http://www.jstor.org/stable/40980247>. US Agency for International Development, *The Economic Impact of AIDS in Botswana*, by Lori Bollinger and John Stover (USA: Policy Project, 1999), 4, <http://www.policyproject.com/pubs/SEimpact/botswana.pdf>.

<sup>63</sup> Ministry of Health, *Botswana National*, 9.

Such policy initiatives were clearly cognizant of areas of influence of the corporations: financial capital and contact with the labor force. Yet, in expecting the private sector to develop internal HIV/AIDS education programs without direct incentives or assistance, Botswana's policymakers appear to have overestimated these leaders' desire to address HIV/AIDS actively in the early 1990s.

This misjudgment of the level of business interest in the epidemic rendered a significant portion of the 1993 Policy ineffective, for Botswana's corporations did not immediately take up an active role in HIV/AIDS prevention despite this policy framework. Not until the late 1990s did some companies begin initiating internal programs to address HIV/AIDS; even then, many of these initiatives were limited, hardly resembling the comprehensive internal programs outlined in the 1993 National Policy.<sup>64</sup> It was only at the turn of the century that a public-private partnership in addressing HIV/AIDS began in earnest – *after* the economic repercussions of Botswana's HIV/AIDS epidemic were increasingly manifest because of the epidemic's growing severity.<sup>65</sup>

## 2.5 International Community

Before and during the 1990s, Western leaders had formulated and subsequently advocated for an epidemiological policy model to address national HIV/AIDS crises. This model included surveillance (HIV-testing), treatment (for STDs, as in the early 1990s mainstream medical treatments for HIV/AIDS were nonexistent), and, most importantly, prevention (providing public education on the epidemic and encouraging condom-use and monogamy).<sup>66</sup>

Western nations and international organizations encouraged Botswana (among other nations) to use this model to guide its own HIV/AIDS policies, a position with both favorable and detrimental implications within the context of Botswana's HIV/AIDS crisis. On one hand, the model was neither based on, nor actively propagating, untruths about HIV/AIDS transmission: an individual who was abstaining from sex, or using condoms and committing to one sexual partner, theoretically should have been at a far lower risk of acquiring HIV than one who had frequent, unprotected sexual encounters with multiple partners. However, by encouraging confidence in the efficacy of this *sole* model, the West –

<sup>64</sup> Farrow, "An Overview," 147.

<sup>65</sup> For a case study of the public-private partnership between Debswana (Botswana's leading diamond-mining company) and the GOB that emerged in the late 1990s and early 2000s, see African Natural Resources Center, *Debswana Diamond Company and the Government of Botswana: An HIV/AIDS Public-Private Partnership Programme* (Abidjan, Côte d'Ivoire: African Development Bank, 2016), [https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/anrc/DEBSWANA\\_EN\\_G\\_HR\\_PAGES.pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/anrc/DEBSWANA_EN_G_HR_PAGES.pdf).

<sup>66</sup> Heald, "Abstain or Die," 33.

perhaps unwittingly – encouraged “tunnel vision” amongst policymakers.<sup>67</sup> By following this model alone, policymakers could easily overlook cultural forces unique to Botswana that were equally relevant to its HIV/AIDS crisis: the local attitudes to sex, for instance, or the public’s concern (or lack thereof) about the epidemic.<sup>68</sup> Furthermore, given Botswana’s relative prosperity, there was little cause in the early 1990s to believe that foreign organizations would agree to fund the GOB’s HIV/AIDS initiatives or lead sweeping foreign interventions. These agencies, such as the United Nations, decided that “their [financial] resources could be better deployed elsewhere” where the scourge of poverty, conflict, and inequality was more conspicuous than in Botswana, which many still remembered as Africa’s “model democracy.”<sup>69</sup>

Considering the West’s financial, medical, and epidemiological resources, Botswana policymakers would have been rash to ignore the West entirely, and yet similarly imprudent to allow the West’s model alone to define its policies.<sup>70</sup> The GOB needed to engage with Western leaders in order to access their resources without rebuffing its own domestic leaders. It could have brought in Western experts as policy consultants, and encouraged wealthy nations and international organizations to provide financial assistance. Yet in every stage of its HIV/AIDS policy, the GOB should have delegated an equal, if not larger, role to local actors. For instance, the GOB could have discussed applications of the Western model of surveillance, prevention, and treatment specific to Botswana, considering how to frame an HIV-prevention message that was culturally sensitive, or which local leaders to involve in establishing accessible HIV-testing centers.

The 1993 National Policy did not directly call upon foreign leaders and organizations for funding; rather, its purpose was to delineate the roles of various domestic entities in Botswana’s HIV/AIDS crisis. However, the policy continually reinforced Western findings – in particular, Western support for condom usage as a central element of HIV prevention – while overlooking Botswana culture, making the two appear at odds with each other. From its outset, the policy affirmed that “the guiding principles underpinning this policy [were] based on current scientific, epidemiological and medical knowledge about the ... transmission of HIV and other sexually transmitted diseases (STD), and proven effective interventions in prevention and care.”<sup>71</sup> The policy, thus, tacitly endorsed the Western

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<sup>67</sup> Heald, “Abstain or Die,” 30.

<sup>68</sup> Suzette Heald, “It’s Never as Easy as ABC: Understandings of AIDS in Botswana,” *African Journal of AIDS Research* 1, no. 1 (2002): 1-10, doi:<https://doi.org/10.2989/16085906.2002.9626539>. Heald, “Abstain or Die,” 30.

<sup>69</sup> Allen and Heald, “HIV/AIDS Policy,” 1145.

<sup>70</sup> As an example, many researchers charge Thabo Mbeki’s administration in South Africa with rashness for denying the findings of mainstream Western medicine entirely in its initial approach to the HIV/AIDS epidemic. For a discussion of the Mbeki administration’s HIV/AIDS policies and their repercussions, see Epstein, *The Invisible*, 105-125.

<sup>71</sup> Ministry of Health, *Botswana National*, 2.



perspective on HIV/AIDS, emphasizing the value of “proven effective interventions” such as condom-promotion messages that the West had initially pioneered.<sup>72</sup>

The GOB’s receptiveness to Western research in itself was hardly a harmful measure. However, one must note that nowhere in the policy did Botswana’s policymakers discuss, with equal depth, the relevance of the domestic actors and cultural background specific to *Botswana’s* epidemic. When the GOB moved to implement this more Western-oriented policy framework, citizens were wary of the government’s HIV/AIDS initiatives and calls for behavioral change. They saw these as more Western than Botswana.<sup>72</sup>

### 3. Conclusion

The failure of Botswana’s 1993 National Policy on HIV/AIDS reflects, perhaps, a larger paradox in the field of public policy. It is not that governments have never faced intricate crises with competing stakeholder interests before in the field of public health, or in any other area of public policy. Yet with the depth, scope, and availability of scientific and psychosocial research having expanded so rapidly in the mid-to-late twentieth century, one would think that the GOB would have had the resources to prevent HIV/AIDS efficiently and effectively. At minimum, one would assume that its response to HIV/AIDS would have been more efficient and effective than the *previous* public health initiatives it undertook to prevent the MMR from increasing, or TB from continuing untreated.

Yet the opposite is true. Paradoxically, Botswana’s crisis suggests that the more access policymakers have to these officially sanctioned resources – science, financial capital, and so on, – the more they risk overlooking the unofficial, and yet influential, cultural and religious sources of knowledge in developing a policy response. This is not to discount the vital role of Western medicine in treating an illness that *can* be medicated or cured. However, Botswana’s 1993 National Policy focused almost exclusively on disease prevention. In the early 1990s, no straightforward treatment for HIV/AIDS existed, and the virus still remains incurable. These gaps in the medical and epidemiological knowledge on the HIV/AIDS crisis highlight the need for policymakers to consider cultural perspectives with as much care when planning disease prevention policies.

Indeed, evidence from other nations’ HIV/AIDS policy triumphs suggests that mobilizing critical domestic stakeholders is perhaps the most effective component of any HIV/AIDS prevention policy, even if this produces some unorthodox policies under the larger framework. In Thailand, where prostitution caused ninety-seven percent of all new HIV infections, the (then mostly illicit) sex industry soon became the most critical domestic

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<sup>72</sup> Heald, “Abstain or Die,” 30-34.

stakeholder.<sup>73</sup> After the failure of a sweeping HIV/AIDS awareness campaign, Dr. Wiwat Rojanapithayakorn led the Ministry of Health in adopting the “100% Condom Program,” mandating that all commercial sex establishments require their clients to use condoms. Researchers today concur that this unconventional policy played an instrumental role in curtailing the spread of HIV/AIDS in Thailand during the 1990s.<sup>74</sup> Another example is Uganda’s “Zero Grazing Campaign,” launched in the early 1990s, which recognized religious stakeholders’ role in affecting behavioral change and tackling the HIV/AIDS crisis. The campaign placed less emphasis on condoms, instead vehemently stressing faithfulness in order to curtail the practice of concurrent sexual relationships.<sup>75</sup> HIV/AIDS prevalence and infection rates in Uganda soon were on a steady decline, at least in part as a result of this campaign.<sup>75</sup>

A stakeholder analysis of Botswana’s HIV/AIDS crisis during the 1990s, therefore, suggests a different explanation to the “Botswana Paradox”: that Botswana’s well-intentioned policies failed to direct these four stakeholders meaningfully, and perhaps even misguided some by antagonizing them. As such, it was the joint influence of cultural and religious opposition, private sector inaction, and tenuous foreign intervention, which allowed the epidemic to proliferate – with devastating consequences.

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<sup>73</sup> John Grenny et al., "Find Vital Behaviors," in *Influencer*, 2nd ed. (New York: McGraw Hill Education, 2013), <https://itunes.apple.com/us/book/influencer-new-science-leading-change-revised-updated/id615233756?mt=11>, 65.

<sup>74</sup> For a comprehensive appraisal of this policy and its impact, see UNAIDS and Thailand Ministry of Public Health AIDS Division, *Evaluation of the 100% Condom Programme in Thailand*, publication no. 00.18E, UNAIDS Case Study (Geneva, Switzerland: UNAIDS, 2000), [http://data.unaids.org/publications/irc-pub01/jc275-100pcondom\\_en.pdf](http://data.unaids.org/publications/irc-pub01/jc275-100pcondom_en.pdf).

<sup>75</sup> See Allen and Heald, "HIV/AIDS Policy," 1148-1151.

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# Tilings of a $(2 \times n)$ Checkerboard with Squares and Dominoes

Rana Ürek

*Author Background: Rana Ürek grew up in Turkey and currently attends Robert College in Istanbul, Turkey. Her Pioneer seminar program was in the field of mathematics and titled "Fibonacci Numbers and Visual Proofs".*

## Abstract

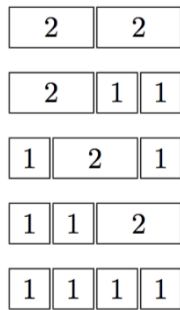
The Fibonacci and Lucas sequences both have visual representations. The Fibonacci sequence can be interpreted as the number of ways to tile a strip of length  $n$  with either length 2 dominoes or length 1 squares. Similarly, the Lucas sequence can be interpreted as the number of ways to tile a ring of length  $n$  with either length 2 or length 1 squares.

Using the above mentioned interpretations of the well-known and studied sequences, combinatorial arguments can be made to prove various identities. "Proof that Really Count" by Benjamin and Quinn demonstrates this situation extensively. Furthermore, this paper also aims to use combinatorial proofs to relate the Fibonacci and Lucas sequences to new sequences that will be defined.

One of the sequences used in the paper,  $R_n$ , can be interpreted as the number of ways to tile a  $2 \times n$  board either with length 2 dominoes (which are allowed to be placed vertically) or length 1 squares. The  $R_n$  sequence has been studied to detail by Katz and Stenson in "Tiling a  $(2 \times n)$  Board with Squares and Dominoes," and some of the theorems presented in this paper directly or indirectly relate to and confirm their results. On the other hand, the second sequence used in this paper,  $S_n$ , can be interpreted as the number of ways to tile a  $2 \times n$  board without using any consecutive vertical breaks. The relationship between the sequences  $S_n$  and  $R_n$  will be discussed for the first time here in this paper.

## 1. Introduction

In this paper,  $f_n$  is defined to be the number of different ways to tile a board of length  $n$  with squares (of length 1) and dominoes (of length 2). Thus,  $f_4 = 5$ , since there are five ways to tile a board of length 4. In Figure 1 below, 1's and 2's are used to represent squares and dominoes.



**Figure 1.** Visual representation of  $f_4$

Using the method described above, the values of  $f_n$  can be achieved:

$n$	0	1	2	3	4	5	6	7	8	9	10	11
$f_n$	1	1	2	3	5	8	13	21	34	55	89	144

**Table 1.** The first few values for  $f_n$

(In the table above,  $f_0$  is equal to 1, since there is exactly one way to tile a board of length 0, and that one way is to use exactly 0 squares and 0 dominoes.) A quick glance at the above chart will lead to the discovery that each Fibonacci number is the sum of two previous Fibonacci numbers; in other words,

$$f_n = f_{n-1} + f_{n-2}$$

There is a well-known demonstration of this fact in the book “Proofs That Really Count” by Art Benjamin and Jennifer Quinn, which contains many ways to prove mathematical equations using visual proofs. Inspired by this idea, instead of observing Fibonacci numbers (which are obtained by counting the number of ways to tile a strip of length  $n$  using dominoes and squares) this paper will observe the sequence of numbers obtained by counting the number of ways to tile a  $2 \times n$  board with dominoes and squares.

## 2. A Variation of the Fibonacci Numbers

### 2.1 Tiling the $2 \times n$ Checkerboard

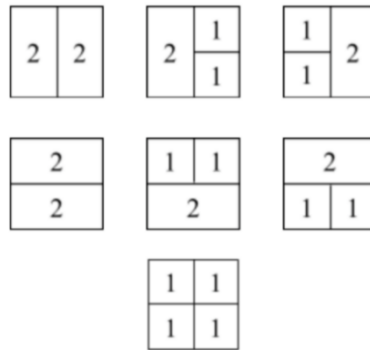
$R_n$  is defined to be the number of different ways to tile a  $2 \times n$  checkerboard with squares (of length 1) and dominoes (of length 2).  $R_0$  is equal to 1 since there is only one way not to tile a board that does not exist. The first few numbers in the R-sequence are listed below:



$n$	0	1	2	3	4	5	6	7	8	9	10
$R_n$	1	2	7	22	71	228	733	2356	24342	78243	251498

**Table 2.** The first few values for  $R_n$

When  $R_2$  is taken as an example, it can be seen in Figure 2 that there are 7 ways to tile the 2 x 2 checkerboard.



**Figure 2.** Visual representation of  $R_2$

### 2.2 Finding a General Equation

With the Fibonacci sequence, there is the equation  $f_n = f_{n-1} + f_{n-2}$  which enables one to expand the sequence by generating more Fibonacci numbers. With the R-sequence, there should be a similar equation that defines  $R_n$  with respect to the previous numbers in the R-sequence. There are two such equations that this paper will be concerned with:

$$R_n = R_{n-2} + 2 \sum_{i=0}^{n-1} R_i$$

The above equation will be shown with a visual proof in the section outlined as Theorem 1. For the second equation, which is:

$$R_n = 3R_{n-1} + R_{n-2} - R_{n-3}$$

the method of induction will be used in the section outlined as Theorem 2.

**Theorem 1.** For  $R_n$ , with  $n \geq 2$  the following hold.

$$R_n = R_{n-2} + 2 \sum_{i=0}^{n-1} R_i$$

*Proof.* Firstly, we will condition on the breakability of the  $2 \times n$  board at length  $n - 1$ , and this will imply that if there are no horizontal dominoes occupying the  $(n - 1)$ th and  $n$ th places, the  $2 \times n$  board will be breakable.

If the checkerboard is indeed breakable at length  $n - 1$ , there are  $2R_{n-1}$  ways to tile that situation since the  $n$ th place can either be occupied by a vertical domino or two squares, as shown below in Figure 3:

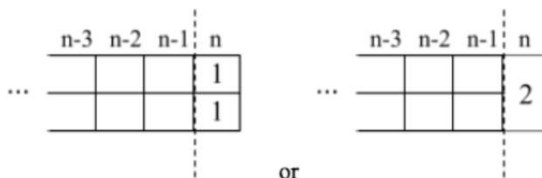


Figure 3.

On the contrary, if the checkerboard is not breakable at length  $n - 1$ , counting the ways of tiling this scenario by conditioning on the place of the first breakability will be necessary. In order to achieve this goal, one can start from the right-hand side, the end of the checkerboard, and move to the left.

If the first breakability is at length  $n - 2$ , there are  $3R_{n-2}$  ways to tile that situation, as shown below in Figure 4:

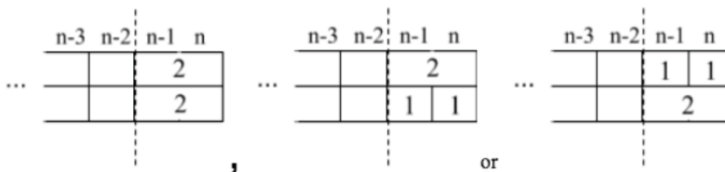


Figure 4.

If the first breakability is at length  $n - 3$ , there are  $2R_{n-3}$  ways to tile that case, as shown below Figure 5:

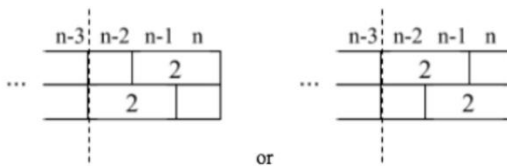


Figure 5.

If the first breakability is at length  $n - 4$ , there are  $2R_{n-4}$  ways to tile and if the first breakability is at length  $n - 5$ , there are  $2R_{n-5}$  ways to tile. To generalize, if the first breakability is at length  $n - k$  where  $3 \leq k \leq n$  there are  $2R_{n-k}$  ways to tile that situation.

Therefore except the term  $3R_{n-2}$ , all the terms with  $2R_{n-k}$  where  $k = 1$  or  $3 \leq k \leq n$

will be added together in a sum. Re-arranging this sum, and writing it by using the Sigma notation will yield the following:  $R_n = R_{n-2} + \sum_{i=0}^{n-1} R_i$ .

**Theorem 2.** For  $R_n$ , with  $n \geq 3$  the following holds

$$R_n = 3R_{n-1} + R_{n-2} - R_{n-3}$$

*Proof.* The method of induction will be used to prove the above equation. By examining the base case where  $n = 3$ , it can be verified that

$$R_3 = 3R_2 + R_1 - R_0$$

$$22 = (3 \times 7) + 2 - 1$$

For the induction step, the following assumption is made.

$$R_k = 3R_{k-1} + R_{k-2} - R_{k-3}$$

If the following equation holds, given the above assumption, Theorem 2 will be verified.

$$R_{k+1} = 3R_k + R_{k-1} - R_{k-2}$$

It is known from Theorem 1 that  $R_k = R_{k-2} + \sum_{i=0}^{k-1} R_i$ . By plugging  $i=0$  this proven identity into the equation above and manipulating the terms the following will be obtained:

$$\begin{aligned} 3R_k + R_{k-1} - R_{k-2} &= R_k + 2R_k - R_{k-1} - R_{k-2} \\ &= R_{k-2} + 2 \sum_{i=0}^{k-1} R_i + R_k + R_{k-1} - R_{k-2} \\ &= 2 \sum_{i=0}^{k-1} R_i + 2R_k + R_{k-1} \\ &= R_{k-1} + 2 \sum_{i=0}^k R_i \\ &= R_{k+1} \end{aligned}$$

Therefore by induction,  $R_n = 3R_{n-1} + R_{n-2} - R_{n-3}$  holds.

### 2.3 Further Conditioning on Breakability

The method of conditioning on the breakability of the checkerboard will be used in this section again, but at arbitrary points to see what this approach will yield.

**Theorem 3.** For  $R_{m+k}$ , where  $m, k \geq 1$  the following holds:

$$R_{m+k} = R_m R_k + R_{m-1} R_{k-1} = 2 \sum_{i=0}^{m-1} \sum_{j=0}^{k-1} R_i R_j$$

*Proof.* For a checkerboard of length  $m+k$ , this paper will condition on the breakability at length  $m$ .

If the checkerboard is breakable at length  $m$ , there will be  $R_m R_k$  many ways to tile.

If the checkerboard is not breakable at length  $m$ , but breakable at lengths  $m-1$  and  $m+1$  there are  $3R_{m-1}R_{k-1}$  ways to tile, since there are 3 cases where the horizontal domino (connecting the lengths  $m$  and  $m+1$ ) can be at the top row, at the bottom row or both at the top and the bottom row.

If the checkerboard is not breakable at length  $m$ , but breakable at lengths  $r_1$  and  $r_2$ , where  $0 \leq r_1 \leq m-2$  and  $0 \leq r_2 \leq k-2$  (here, at length  $m+1$  the checkerboard is thought to go back to zero). In this case, there will be  $2 \sum_{i=0}^{m-2} \sum_{j=0}^{k-2} R_i R_j$  many ways to tile.

When all the cases above are summed up, the following equation will be achieved:  $R_{m+k} = R_m R_k + 2 R_{m-1} R_{k-1} + \sum_{i=0}^{m-1} \sum_{j=0}^{k-1} R_i R_j$ .

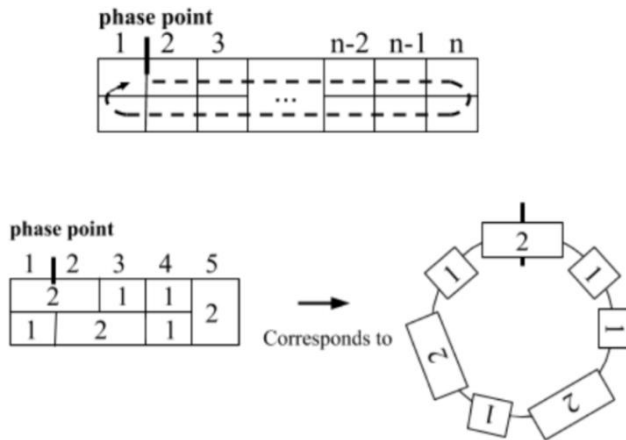
### 3. Relations with Fibonacci Numbers and Lucas Numbers

R-sequence numbers can be related with Fibonacci and Lucas numbers through various identities. In this section the use of conditional tiling methods will be used to generate equations that can relate and define R-sequence numbers with respect to the Fibonacci and Lucas numbers.

**Theorem 4.** For  $R_n$  and  $L_n$ , the Lucas numbers (starting with  $L_0 = 2$ ), and  $f_n$ , the Fibonacci numbers (starting with  $f_0 = 2$  as discussed earlier in terms of the tilings of the  $1 \times n$  strip), with  $n \geq 2$  the following holds:

$$R_n = L_{2n} + \sum_{i=1}^{n-2} f_{2i} R_{n-1-i}$$

*Proof.* Whether one can circle around the  $2 \times n$  checkerboard, the same way one can with the visual representation of the Lucas numbers will be investigated in this proof. For that purpose conditioning on the existence of vertical dominoes at all lengths besides length 1 and length  $n$  will be necessary. If there are no vertical dominoes at lengths between 2 and  $n - 1$ , circling around the checkerboard will be possible and the sum of those cases can be represented with the  $2n$ th Lucas number,  $L_{2n}$ .

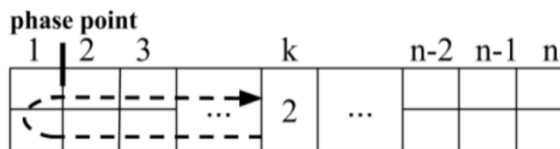


**Figure 6.** the checkerboard corresponding to a closed ring, tiled with dominoes and squares, when there are no vertical dominoes on the checkerboard between lengths 2 and  $n-1$ .

But if there are vertical dominoes placed between lengths 2 and  $n - 1$ , the checkerboard will not correspond to a closed ring. That is why those cases will be counted separately.

If there are vertical dominoes at such lengths as discussed above, the method of conditioning on the place of the first vertical domino will be used.

If the first vertical domino appears at length  $k$  where  $2 \leq k \leq n - 1$ , there will be  $f_{2k-2}R_{n-k}$  ways of counting those cases as visually shown below:



**Figure 7.** the left side of the first vertical domino which can be represented with the  $(2k-2)$ nd Fibonacci number, and the right side, which can be represented with the tiling of a  $n-k$  length checkerboard

The above visual representation can be expressed with the following Sigma notations:  
 $\sum_{k=2}^{n-1} f_{2k-2} R_{n-k} = \sum_{i=1}^{n-2} f_{2i} R_{n-1-i}$ .

There are either vertical dominoes between lengths 2 and  $n - 1$  or there are not. If these two cases are summed up, the following equation to tile a length  $n$  checkerboard will be achieved:  $R_n = L2n + \sum_{i=1}^{n-2} f_{2i} R_{n-1-i}$ .

**Theorem 5.** For  $R_n$  and  $f_n$ , the Fibonacci numbers with  $n \geq 3$  the following holds:

$$R_n = f_n + \sum_{i=0}^{n-1} f_i R_{n-1-i} + \sum_{i=2}^n f_i R_{n-i} + \sum_{i=1}^{n-2} \sum_{j=0}^{n-2-i} f_i R_j$$

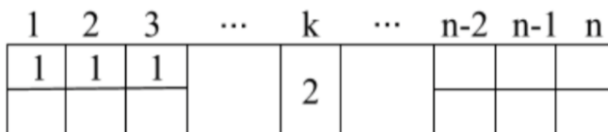
*Proof.* The first step is to focus on the top row of the  $2 \times n$  checkerboard. The method of conditioning on the first domino piece (either horizontal or vertical) to appear on the first top row will be used throughout this proof.

The case where there will be no dominoes on the top row will be counted in  $f_n$  many ways. Since the top will all be filled with squares we will only need to fill the  $1 \times n$  board at the bottom row, as shown below in Figure 8:



**Figure 8.**

The case, such as in Figure 9, where the first vertical domino at the top row appears at length  $k$ , where  $1 \leq k \leq n$ , there will be  $f_{k-1} R_{n-k}$  ways to tile.



**Figure 9.**

The above cases where the place of the first vertical domino is conditioned on, can be represented with the following Sigma sums:  $\sum_{k=1}^n f_{k-1} R_{n-k} = \sum_{i=0}^{n-1} f_i R_{n-1-i}$ .

The case where the first horizontal domino appears at the top can be analyzed in two separate cases depending on breakability.

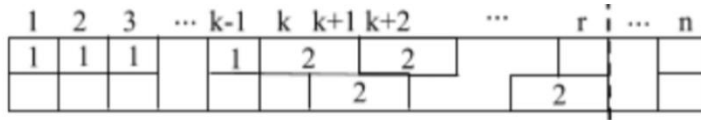
If the first horizontal domino appears at length  $k$ , where  $1 \leq k \leq n - 1$ , and the checkerboard is breakable at length  $k + 1$ , there will be  $f_{k+1} R_{n-k-1}$  ways to tile.



**Figure 10.** the checkerboard, breakable at length  $k+1$ , which is filled only with squares for its top row until length  $k$

The above cases where the place of the first horizontal domino is conditioned on, (with breakability at length  $k + 1$ ) can be represented with the following Sigma sums:  $\sum_{k=1}^{n-1} f_k + 1 R_{n-k-1} = \sum_{i=2}^n f_i R_{n-i}$

If the first horizontal domino appears at length  $k$ , where  $1 \leq k \leq n - 2$ , but the checkerboard is not breakable at length  $k + 1$ , but breakable at  $r$  (where  $k + 2 \leq r \leq n$ ), there will be  $f_k R_{n-r}$  ways to tile as shown below in Figure 11.



**Figure 11.**

The above cases where the place of the first horizontal domino is conditioned on, (with non-breakability at length  $k+1$ ) can be represented with the following Sigma sums:  $\sum_{k=1}^{n-2} \sum_{r=k+2}^n f_k R_{n-r} = \sum_{i=1}^{n-2} \sum_{j=0}^{n-2-i} f_i R_j$ .

When the above cases where the first domino on the top row is vertical, horizontal or not there at all are all summed up, the following equation will be achieved:  $R_n = f_n + \sum_{i=0}^{n-1} f_i R_{n-1-i} + \sum_{i=2}^n f_i R_{n-i} + \sum_{i=1}^{n-2} \sum_{j=0}^{n-2-i} f_i R_j$ .

#### 4. The First and the Last Tiles

In this section, the method of conditioning on the place of the first tile (whether it is a horizontal domino, vertical domino or a square) will be used in order to observe the equations that will yield in all of these three cases.

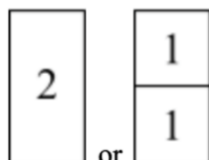
##### 4.1 Horizontal Domino

**Theorem 6.** For  $R_n$ , the following holds:

$$R_n = 2^n + \sum_{i=2}^n 2^{n-i} (R_i - 2R_{i-1})$$

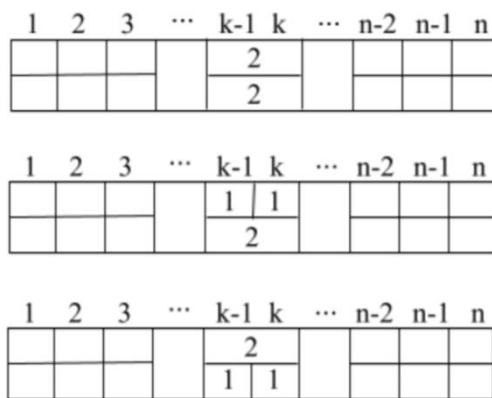
*Proof.* Conditioning on the place where the last horizontal domino appears.

If there are no horizontal dominoes at all on the checkerboard there will be  $2^n$  ways to count since there will either be a vertical domino or two squares on top of each other for each of the  $n$  columns. As shown below in Figure 12, there are 2 options for each of the  $n$  columns.



**Figure 12.**

The last domino's (whether it appears on the top or the bottom) end will be placed at position  $k$  where  $2 \leq k \leq n$ . If the checkerboard is breakable at length  $k - 2$  there will be  $\sum_{k=2}^n 3R_{k-2} \cdot 2^{n-k}$  ways to count. As shown below in Figure 13, the last dominoes' end are positioned at length  $k$ . Furthermore, to the left of the stacked horizontal dominoes there are  $R_{k-2}$  ways to tile, whereas to the right of them there are  $2^{n-k}$  ways to tile.



**Figure 13.**

If the checkerboard is not breakable at length  $k - 2$ , it will be breakable at a length  $r$  where  $0 \leq r \leq k-3$ . In these cases there will be  $\sum_{k=2}^n (2 \sum_{r=0}^{k-3} R_r) 2^{n-k}$  ways to tile. The coefficient 2 appears at the front, since the cases where the last horizontal domino appears on the top or the bottom row are symmetrical to each other. Starting from position  $k$  to position  $r$  the checkerboard will be filled with horizontal dominoes. As shown below in Figure 14, the checkerboard will be breakable at length  $r$ , where  $0 \leq r \leq k - 3$ .



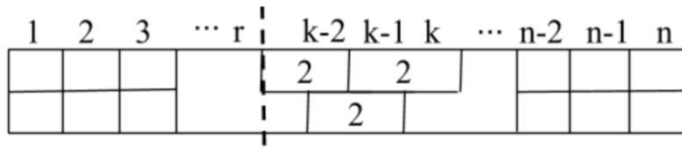


Figure 14.

All the cases discussed above can be summed to reach the equation below.

$$\begin{aligned}
 R_n &= 2^n + \sum_{k=2}^n 3R_{k-2} \cdot 2^{n-k} + \sum_{k=2}^n \left( (2 \sum_{r=0}^{k-3} R_r) \cdot 2^{n-k} \right) \\
 &= 2^n + \sum_{k=2}^n 2^{n-k} \left( 3R_{k-2} + (2 \sum_{r=0}^{k-3} R_r) \right) \\
 &= 2^n + \sum_{k=2}^n 2^{n-k} \left( R_{k-2} + (2 \sum_{r=0}^{k-2} R_r) \right)
 \end{aligned}$$

Using Theorem 1, the expression above can be rewritten to reach the final form of Theorem 6.

$$\begin{aligned}
 R_n &= 2^n + \sum_{k=2}^n 2^{n-k} (R_{k-2} + (2 \sum_{r=0}^{k-2} R_r) + 2R_{k-1} - 2R_{k-1}) \\
 &= 2^n + \sum_{k=2}^n 2^{n-k} \left( R_{k-2} + \left( 2 \sum_{r=0}^{k-1} R_r \right) - 2R_{k-1} \right) \\
 &= 2^n + \sum_{k=2}^n 2^{n-k} (R_k - 2R_{k-1})
 \end{aligned}$$

#### 4.2 Vertical Domino

**Theorem 7.** For  $R_n$  and  $f_n$ , the Fibonacci numbers with  $n \geq 1$  the following holds:

$$R_n = f_n^2 + \sum_{i=0}^{n-1} f_i^2 R_{n-1-i}$$

*Proof.* Similar to Theorem 4, the method of conditioning will this time be used on all vertical dominoes. This section is concerned with the place where the first vertical domino appears.

If there are no vertical dominoes, this means that the checkerboard is horizontally breakable. In that case there will be  $f_n^2$  ways to tile as shown below in Figure 15.

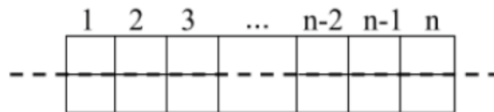


Figure 15.

If there are vertical dominoes those cases will be counted by conditioning on where the first vertical domino appears. If the first vertical domino appears at length  $k$ , where  $1 \leq k \leq n$ , there will be  $(f_k - 1)^2 R_{n-k}$  ways to tile as shown below in Figure 16.

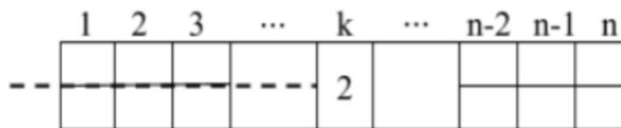


Figure 16.

The above visual representation can be expressed with the following Sigma notations:  
 $\sum_{k=1}^n f_k - 1^2 R_{n-k} = \sum_{i=0}^{n-1} f_i^2 R_{n-1-i}$ .

There are either vertical dominoes between lengths 1 and  $n$ , or there are not. Summing up these two cases will yield the following equation to tile a length  $n$  checkerboard:  $R_n = f_n^2 + \sum_{i=0}^{n-1} f_i^2 R_{n-1-i}$ .

### 4.3 Square

**Theorem 8.** For  $R_n$  and  $f_n$ , the Fibonacci numbers with  $n \geq 1$  the following holds:

$$R_n = f_n + \sum_{i=1}^n (2f_{n-i} - \left(\sum_{j=0}^{i-1} R_j\right) - f_{n-i} R_{i-1})$$

*Proof.* Conditioning on the last square to appear at the top or the bottom row, the last square can be positioned at length  $k$ , where  $1 \leq k \leq n$ .

If there are no square tiles in the checkerboard, there will be  $f_n$  many ways to tile. Since using only horizontal or vertical dominoes will be allowed. In Figure 17, once the top

row is inspected carefully (and vertical dominoes are thought of as squares in the  $1 \times n$  board) we can see that there are in fact  $f_n$  many ways to tile.

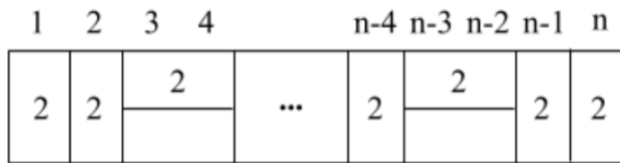


Figure 17.

If there are squares present in the  $2 \times n$  checkerboard, conditioning on the last square will be necessary. When the last square is positioned at length  $k$ , we can either have a square or a horizontal domino beneath it (or above it - depending on which row the last square appears at). The horizontal domino can be positioned to the right or to the left. An example of such tilings are shown below in Figure 18.

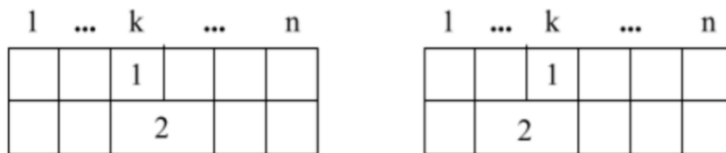


Figure 18.

However, it will be shown that the horizontal domino shifted to the right is not possible. We can't tile the board between  $k + 1$  and  $n$  without using another square which would cause a contradiction since the last square is already positioned at length  $k$ . Therefore the case where horizontal domino is positioned to the left will be the only concern, such that the checkerboard is breakable at length  $k$ .

In that case, where the horizontal domino is shifted to the left, the method of conditioning on the breakability will be used in order to count the cases. The last break before length  $k$  can be positioned at length  $r$ . In that case, there will be  $2f_{n-k}R_r$  many ways to tile. The coefficient 2 will be included in the result since the same argument for the last square appearing at the top row or the bottom row can both be made. Also for the last break positioned at  $r$  before length  $k$ , the following is true:  $0 \leq r \leq k-2$  and  $1 \leq k \leq n$ .

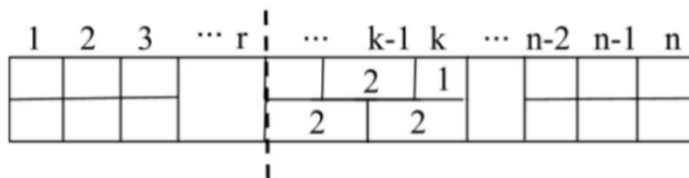


Figure 19.

That is why in total, for the case with the horizontal domino shifted to the left, we will have  $\sum_{k=1}^n (2f_n - k \sum_{r=0}^{k-2} R_r)$  many ways to tile, as shown above in Figure 19.

Only the cases where there is a square beneath or above the last square are left. The last squares stacked on top of each other can appear at length  $k$  where  $1 \leq k \leq n$ . Since the checkerboard will surely be breakable at lengths  $k - 1$  and  $k$ , there will be  $f_{n-k} R_{k-1}$  many ways to tile. This will produce the following result for the case with the last squares being stacked on top of each other:  $\sum_{k=1}^n f_n - k R_k - 1$ .

When the discussed and calculated cases above are summed together the following expressions will be achieved:

$$R_n = f_n + \sum_{k=1}^n (2f_n - k \sum_{r=0}^{k-2} R_r) - f_n - k R_k - 1 = f_n + \sum_{i=1}^n (2f_n - i \sum_{j=0}^{i-1} R_j) - f_n - i R_i - 1.$$

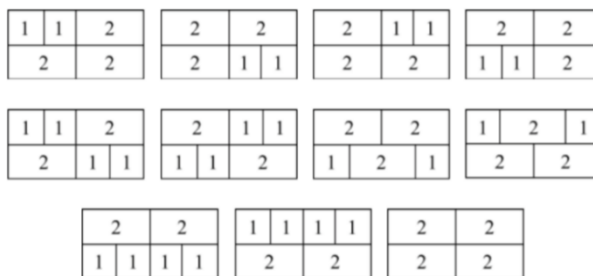
### 5. Another Sequence

In this section, another sequence will be created using the  $2 \times n$  checkerboard which will then be related to the  $R_n$  sequence. The new sequence  $S_n$  is defined as the number of ways to tile the  $2 \times n$  checkerboard without allowing any “free are defined as the vertical space between two consecutive breaks in the checkerboard. In other words, if the checkerboard is breakable at length  $k$  as well as  $k + 1$ , the checkerboard has at least one “free column.”  $S_0$  is defined to be equal to 1. The first few numbers in the S-sequence are listed below:

**Table 3.** The first few values for  $S_n$

$n$	0	1	2	3	4	5	6	7	8	9	10	11
$S_n$	1	0	3	2	11	14	45	76	197	380	895	1838

Take  $S_4$  as an example. There are 11 ways to tile a  $2 \times 4$  board with no consecutive breaks, or with no free columns, as shown below in Figure 20:



**Figure 20.** Visual representation of  $S_4$

### 5.1 Finding a General Equation

As it was done with the R-sequence,  $S_n$  will also be expressed with a general equation. To extend the terms listed in  $S_n$ , the cases where there are consecutive breaks in the checkerboard will be subtracted from all the cases which can be expressed with  $R_n$ . As a result, the sequence  $S_n$  will be related to  $R_n$ . This calculation will yield the following result:

$$S_n = R_n - 2 \sum_{i=0}^{n-1} S_i R_{n-1-i}$$

Similar visual proof techniques will be used as before to prove that the equation presented above is true.

**Theorem 9.** For  $R_n$  and  $S_n$  with  $n \geq 1$  the following holds:

$$S_n = R_n - 2 \sum_{i=0}^{n-1} S_i R_{n-1-i}$$

*Proof.* The number of cases with one or more free columns needs to be counted by conditioning on where the first consecutive break in the checkerboard is placed. The first consecutive break can be positioned at length  $k$  where  $0 \leq k \leq n - 1$ , as shown below in Figure 21:

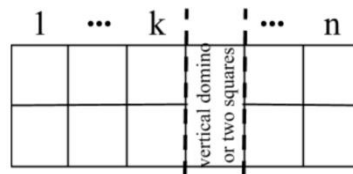


Figure 21.

The free column between the two consecutive breaks as shown above can either be tiled with a vertical domino or two squares stacked on top of each other. These are the only two options for the free column. Therefore after figuring out the tiling of the rest of the board, a factor of two will be added to the result in order to account for the choice between vertical domino or the stacked squares.

To the left of the first consecutive break, there will be  $S_k$  many ways to tile by definition since another consecutive break before the first consecutive break, which is positioned at length  $k$ , will not be allowed.

To the right of the first consecutive break, there will be no conditions to tile the board, and therefore, there will be  $R_{n-1-k}$  ways to tile. In total, there will be  $2 \sum_{k=0}^{n-1} S_k R_{n-1-k}$  ways to tile checkerboard where consecutive breaks exist.

Once we subtract this result total from  $R_n$ , the total number of ways to tile the  $2 \times n$  checkerboard without any conditions, the following equation, which counts the number of ways to tile a  $2 \times n$  checkerboard where two consecutive breaks are not allowed, will be achieved:  $S_n = R_n - 2 \sum_{i=0}^{n-1} S_i R_{n-1-i}$ .

### 5.2 Relating $S_n$ to the $2 \times n$ checkerboard

The sequence  $S_n$  gives the number of ways to tile the checkerboard without having any free columns or consecutive breaks. We can use this method of tiling to condition on the number of free columns. In other words,  $S_n$  sequence can be used to construct  $R_n$ .

**Theorem 10.** For  $R_n$  and  $S_n$  with  $n \geq 0$  the following holds:

$$R_n = \sum_{k=0}^n p(k) 2^k$$

where  $p(k)$  is defined as follows:

$$p(k) = \begin{cases} \sum_{i_1=0}^{n-k} \sum_{i_2=0}^{n-k-i_1} \dots \sum_{i_k=0}^{n-k-i_1-i_2-\dots-i_{k-1}} S_{i_1} S_{i_2} \dots S_{i_k} S_{n-k-i_1-i_2-\dots-i_k} & 1 \leq k \leq n \\ S_n & k = 0 \end{cases}$$

or equivalently with a partition notation:

$$p(k) = \begin{cases} \sum_{i_1, \dots, i_{k+1} \vdash n-k} S_{i_1} S_{i_2} \dots S_{i_k} S_{i_{k+1}} & 1 \leq k \leq n \\ S_n & k = 0 \end{cases}$$

*Proof.* While tiling the  $2 \times n$  checkerboard, the number of free columns,  $k$ , that can exist in the board will be conditioned on. The free columns can take the following values:  $0 \leq k \leq n$ .

When there are  $k$  free columns, there will be  $2^k$  many ways to tile those free columns since a vertical domino or two stacked squares can both be used for the vertical space left between those two consecutive breaks. Once the free columns are positioned, tiling the rest of the board will be achieved by the function  $p(k)$ .

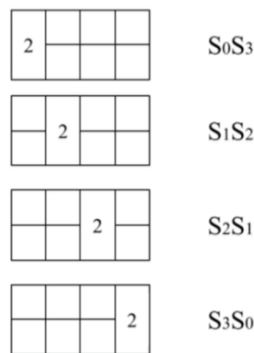
Take  $k = 0$  case as an example, if there are no free columns allowed in the checkerboard there are  $2^0 = 1$  many ways to tile those non-existing columns. The rest of the board can be tiled with  $S_n$  many ways due to the definition of the S-sequence.

If there are  $k$  free columns, where  $1 \leq k \leq n$ , we can condition on the places of those  $k$  columns. It should be true that if there exists  $k$  free columns, the board is split into  $k + 1$  pieces. Those  $k + 1$  pieces can each be tiled with using the S-sequence numbers.

Those  $k + 1$  pieces to tile without using any two consecutive breaks, can be expressed with using  $k + 1$  many S-sequence numbers, such as follows:  $S_{i_1} S_{i_2} \dots S_{i_k} S_{i_{k+1}}$ . The sum of  $i_1 + i_2 \dots i_k + i_{k+1}$  will be equal to  $n - k$ , since there will be only  $n - k$  columns in total to divide into pieces and tile once the  $k$  many free columns are positioned. Therefore, we will be summing over the partitions of  $n - k$  columns.

To mathematically express this partition  $(S_{i_1} S_{i_2} \dots S_{i_k} S_{i_{k+1}})$  a sigma notation will be used. For the first partition and its length  $i_1$  the following should hold true:  $0 \leq i_1 \leq n - k$ . For the second partition, the length  $i_2$  can take integer values depending on the length of the first partition. In order not to violate the total length limit of  $n - k$  columns the following inequality should also be true:  $0 \leq i_2 \leq n - k - i_1$ . For the third partition and its length  $i_3$  the following will be true:  $0 \leq i_3 \leq n - k - i_1 - i_2$ . The logic can be extended to  $i_4, i_5, i_6 \dots$  until  $i_k$ . Once all the boundaries for  $i_1$  through  $i_k$  are defined, the length of the  $(k + 1)$ th or the last partition will simply be equal to  $n - k - i_1 - i_2 \dots - i_{k-1} - i_k$  in order to reach the desired length of  $n - k$  columns. Therefore  $S_{i_{k+1}} = S_{n - k - i_1 - i_2 \dots - i_{k-1} - i_k}$ .

The argument above justifies the mathematical representation of  $p(k)$  which essentially tries to tile the pieces of the board that are separated by the free columns. After those partitions are tiled, they are multiplied by a factor of  $2^k$  due to choosing between two alternatives (vertical dominoes or two stacked squares on top of each other) to fill the  $k$  free columns.



**Figure 22.** Example case with  $n=4$  and  $k=1$ , with calculation below

$$p(1) = \sum_{i_1=0}^{4-1} S_{i_1} S_{4-1-i_1}$$

**Theorem 11.** For  $R_n$  and  $S_n$  and  $f_n$ , the Fibonacci numbers, with  $n \geq 0$  the following holds:

$$(f_n)^2 = \sum_{k=0}^n p(k)$$

*Proof.* The above equation sums the values of the function  $p(k)$  from  $k = 0$  to  $n$ . In other words, the equation  $\sum_{k=0}^n p(k)$  only tiles the partitions created by the free columns yet does not account for choosing between vertical dominoes and stacked squares in the place of the free columns. Therefore it ends up only counting the cases where the free columns are chosen and each single one of them are filled with two stacked squares without a second choice.

The function  $p(k)$  tiles the  $k + 1$  many partitions without using any free columns or equivalently without using two consecutive breaks. Because of the non-existence of vertical breaks in that tiling, any partition filled according to the function  $p(k)$  will have the ability to be horizontally breakable. And for the rest of the  $2 \times n$  checkerboard, since the decision was to tile all the free columns using two stacked squares (due to not including the  $2^k$  factor that appeared in Theorem 10) the part of the board that is filled with the free columns will also have the ability to be horizontally breakable.

In conclusion, the whole  $2 \times n$  board will be horizontally breakable. Essentially, this tiling procedure tiles two strips of length  $n$  simultaneously by not using any vertical dominoes. The expression  $\sum_{k=0}^n p(k)$  counts all the possible cases of tiling two  $1 \times n$  strips simultaneously by conditioning on the number of places where the two squares on the upper and the bottom strip coincide. The number of coinciding places can be any integer between 0 and  $n$ , which is covered by the expression in Theorem 11.

According to the visual representation of Fibonacci numbers the calculation discussed above the expression  $\sum_{k=0}^n p(k)$  should in fact be equal to  $(f_n)^2$ .

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## Reward Deficiency Syndrome (RDS): the “Liking” Reaction and Behavioral Implications

Liuxi Sun

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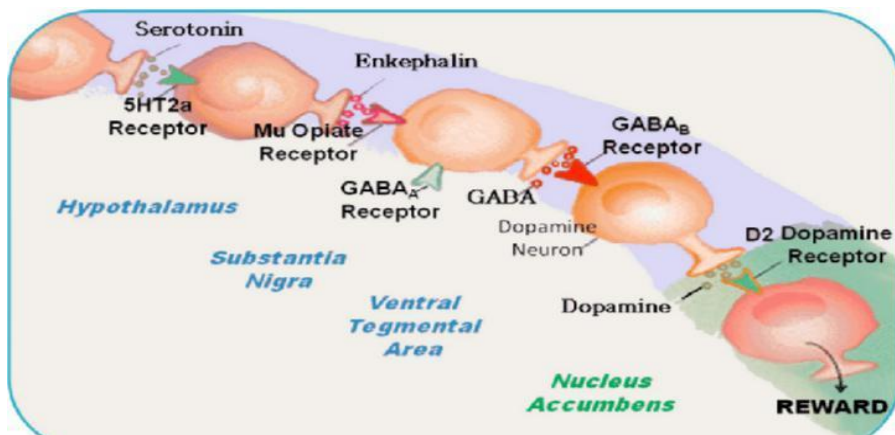
### Abstract

The connection between the mid-anterior orbitofrontal cortex (OFC) and addiction as well as emotional disorders may suggest a neurological basis for the compulsivity and impulsivity deficits implicated in the Reward Deficiency Syndrome (RDS). For decades, RDS has been described as the genetic basis for numerous disorders that are described as both impulsive and compulsive, including alcoholism, drug abuse, and attention deficit disorder (Blum, Cull, Braverman, Comings, 1996; Blum et al., 2008; Beyers, Toumbourou, Catalano, Arthur, & Hawkins, 2003; Blum, Badgaiyan, Agan, Fratantonio, & Gold, 2014) The hypo-dopaminergic state that arises from the reduction of dopamine D2 receptors, a hallmark of the Reward Deficiency Syndrome, has been heavily correlated with the habitual drug-seeking behavior that usually progresses into addictions. However, little research has been conducted into analyzing the role of the brain mechanisms involved in the compulsive and impulsive deficits that also characterize these addictions, and thus RDS. Numerous studies have already supported the OFC’s role in controlling impulsivity and compulsivity, as well as in the “liking” reactions in the reward system. Based on the current research, I hypothesize that the “liking” reaction will be reduced in patients suffering from Reward Deficiency Syndrome. Specifically, I predict that reduced activation of the orbitofrontal cortex will be implicated in the presence of RDS, and thus result in the increased impulsive and compulsive behaviors also associated with the disorder.

### 1. Introduction

#### 1.1 The “Liking” and “Wanting” Reactions and Dopamine

Pleasure in response to rewarding certain behavior in animals is produced as a result of the interactions between various molecular systems and regions of the brain. These various networks are collectively grouped as the reward circuitry. The current hypothesis is that the interaction of the various dopaminergic and glutamatergic systems in the brain, and thus the resulting dopamine and glutamate levels, respectively, are responsible for the development of addiction and are implicated in reward mechanisms (Vousoogho et al., 2016). Studies observing the various molecular and psychological effects of rats with a preference for alcohol led to the development of the cascade theory of reward (Alvaksinen et al., 1984; Blum & Kozlowski, 1990). In addition, the theory of the existence of a complex reward and reinforcement network was further supported by research on human subjects, which revealed that electrical stimulation on certain parts of the brain generally produced feelings of pleasure and a decrease in feelings of stress (Blum et al., 2008). For example, stimulation in one area of the human brain, the medial hypothalamus, produced feelings of sexual arousal. Blum et al therefore concluded that pleasure was a distinct neurological function involving various brain regions and mechanisms. Research is still ongoing to identify the specific components of the reward cascade system.



**Figure 1.** An artist-rendered model of the current Reward Cascade Model. Reprinted from “Pro-Dopamine Regulator – (KB220) to Balance Brain Reward Circuitry in Reward Deficiency Syndrome (RDS),” by Blum et al., 2017, *Journal of Reward Deficiency Syndrome and Addiction Science*, 3(1), 3-13.

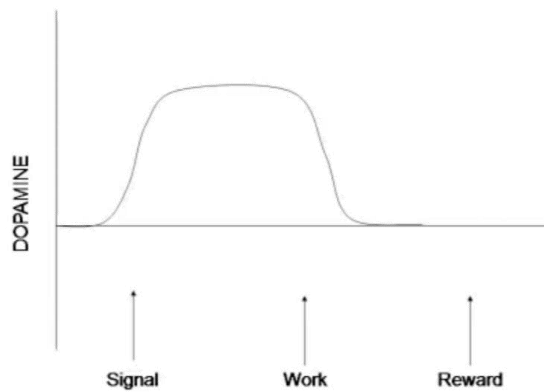
Brain structures composing the reward system are situated within the cortico-basal ganglia-thalamo-cortical loop, which contains most of the connecting pathways including glutamatergic interneurons, GABAergic medium spiny neurons (MSNs), and dopaminergic neurons (Yager, Garcia, Wunsch, & Ferguson, 2016). In the current brain reward cascade model as proposed by Blum et al, serotonin is released, which stimulates enkephalin at the hypothalamus (Blum et al., 2017). Enkephalin inhibits GABA at the substantia nigra, which then regulates the amount of dopamine released at the nucleus accumbens (NAc) from the

ventral tegmental area (VTA). However, although numerous brain systems play important roles in the reward system, the common link across many abused substances is the involvement of the dopamine system.

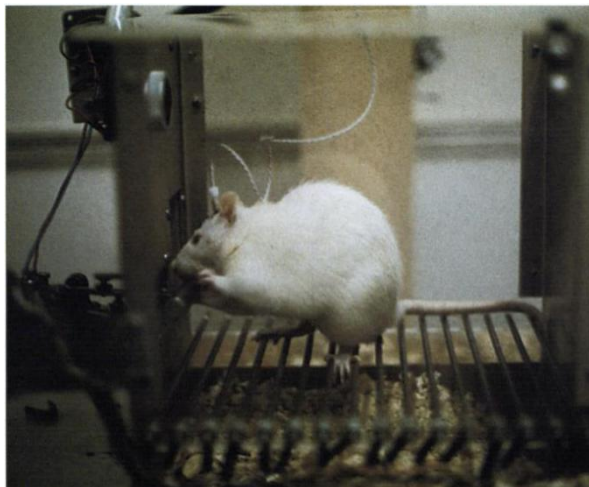
The reward circuitry system is now believed to be even more complex, with functions in attention, reward expectancy, and incentive motivation. In fact, recent research by Berridge et al has found that there are three main aspects of the reward system that each involve various networks and pathways in the brain. The “liking” reaction, which is most commonly thought of as the main function of the reward system, produces the pleasure associated with achieving the reward (Berridge, Robinson, & Aldridge, 2009). This aspect of the reward system is thought to dominate the consummatory phase that leads to satiety. Next, the “learning” reaction is the anticipation of the rewarding effects based on memory. Finally, the “wanting” reaction, also called incentive salience, is the reaction towards a reward-related cue with the motivational quality (that is unconscious more often than not) that encourages the seeking out of that reward. It is believed to be involved in much of the initial substance usage phase. Sensory information also plays a large role in triggering cue-induced incentive salience, and is also a major cause of the development of addictions (Zhang, Berridge, Tindell, Smith, & Aldridge, 2009). Both the “wanting” and “liking” reactions are necessary to achieve the full reward, although they involve distinctly separate mechanisms, so one can exist without the other (Berridge & Robinson, 2016). Incentive salience’s role and involved neural networks in the reward system has been gaining more attention recently because of the incentive-sensitization theory, which suggests an association between increased incentive salience and the progression into addiction without an amplification of the “liking” reaction (Berridge & Robinson, 2016). It is extensively researched also because of its significant role in cue-induced relapse and cravings in drug addicted patients.

The mesolimbic pathway is one of the most important mechanisms in the brain reward circuitry that has also been most commonly associated with the “wanting” reaction of the reward system (Adinoff, 2004; Berridge & Robinson, 1998; Franken, 2003). The most important projection from the VTA, a major region in the midbrain that produces the dopamine in the reward system, is to the nucleus accumbens, which is located in the basal ganglia within the limbic system (“Drugs and the Limbic System,” n.d.). Dr. Robert Sapolsky, a professor of biology and neurological sciences at Stanford University, used a model involving monkeys working towards a reward in order to illustrate how the levels of dopamine would begin to increase at the reward signal and then reach its peak and plateau from the presentation of the signal to the beginning of the work for the reward (Robert Sapolsky: *Are Humans Just Another Primate?*, 2011, 28.14; Berridge, 2006; Tindell, Smith, Berridge, Aldridge, 2009). Furthermore, studies involving direct electrical stimulation of rat brains found that the greatest dopamine release in the NAc was caused by stimulation of a region of the limbic system, the medial forebrain bundle, particularly in the lateral hypothalamic, posterior hypothalamus, and ventral tegmental levels (Wise, 1998; Blum, Cull,

Braverman, & Comings, 1996; Olds & Milner, 1954). When Olds et al placed electrodes in a region of the limbic system, they discovered that the particular area served as a powerful reward; the rats in the Skinner box pressed the lever to self-stimulate the region up to 5,000 times an hour (Olds & Milner, 1954). Meanwhile, stimulation of other structures such as the cerebellum, brainstem, olfactory bulb, and prefrontal cortex is also rewarding but may cause different rewarding effects (Wise, 1998). These studies have cumulatively demonstrated that various brain mechanisms and regions are involved in the complex reward system, including many that have not yet been discovered.



**Figure 2.** A graph displaying how the levels of dopamine peak at the signal and plateau until the beginning of the work. Reprinted from “Robert Sapolsky: Are Humans Just Another Primate?” by R. S., 2011, worldinformant.



**Figure 3.** As demonstrated by Olds et al., rats in a Skinner box press the lever up to 5,000 times an hour in order to self-stimulate specific regions of the limbic system. Reprinted from “Reward Deficiency Syndrome,” by Blum et al., 1996, American Scientist, 84(2), 132-145.

Current research into the reward cascade system have controversial views on which reaction has the most significance in the development of drug addictions. For example, according to Adinoff et al, the progression from initial rewarding drug use to addiction of the substances has been associated with a decrease in the extracellular dopamine concentrations in the mesolimbic NAc. In addition, previous studies have also linked glutamate neurotransmission and NMDA receptor activation, which are associated with the mesocortical pathway, with incentive salience; when presented with a food stimulus of motivational significance, elevated extracellular glutamate levels in the prelimbic cortex and in the nucleus accumbens core was noted. Furthermore, studies of mice showed that elevated levels of DA led to greater incentive salience, but the hedonic impact of the reward was unaffected (Peciña, Cagniard, Berridge, Aldridge, & Zhuang, 2003). The results showed that hyper-dopaminergic DA-transporter knockdown mice displayed greater incentive performance in anticipation of a sweet reward, such as by pausing less during work and proceeding more directly towards the goal. These studies presented evidence for the hypothesis that dopamine in the reward system is only necessary in the “wanting” for rewards in order to encourage pursuit of that reward, but not in the learning or “liking” reactions (Berridge, Robinson, & Aldridge, 2009; Davis et al., 2012; Peciña, Cagniard, Berridge, Aldridge, & Zhuang, 2003). The general consensus thus far has been in support of the association of the mesolimbic dopaminergic and mesocortical glutamatergic pathways with incentive salience, contributing to the addictive effects of abusive substances (Zhang, Berridge, Tindell, Smith, & Aldridge, 2009).

Recently, research has demonstrated that dopamine also mediates reward “liking”. For example, a study comparing D2 receptor density in obese and healthy subjects using positron emission tomography (PET) scans concluded that D2 receptor availability was significantly lower in the obese subjects (Wang et al., 2001). This finding suggests that the reduced levels of D2 receptors, which can have a genetic basis (RDS) or be a result of the habitual reward-seeking behavior that is characteristic of addictions, reduce the pleasure that the affected individuals derive from food. Thus, these individuals are further motivated to participate in such reward-seeking behavior in order to compensate for the decreased levels of pleasure. It is important to understand the “liking” reaction and consider how dopamine is associated with it because reducing the “liking” reaction often also reduces the “wanting” reaction (Berridge, 2010).

## 1.2 RDS and Dopamine

Blum and colleagues proposed that any disturbance within the brain reward cascade system as developed by Moeller et al, Blum, and Kozlowski, will result in an imbalance of the interactions between the components of the reward system (Blum et al., 2015; Moeller et al., 2013; Blum & Kozlowski, 1990). Blum et al. also coined the umbrella term “Reward

Deficiency Syndrome” (RDS), which describes the changes in the reward cascade that leads to a hypo-dopaminergic state (characterized by a decreased extracellular dopamine) and thus a predisposition to addictive behaviors that increase dopamine release (Blum, Thanos, & Gold, 2014). There are currently five known types of dopamine receptors, D1-D5, that the dopamine bind to in the NAc (Blum et al., 2012). A major hallmark of RDS in humans is the decrease in D2 receptors in the brain, which had previously been controversially linked to a greater risk for alcoholism (Blum et al., 2015; Blum et al., 2012). The nucleus accumbens is most commonly studied in RDS because it contains many D2 receptors located along the axons projecting from the VTA (Rahman & McBride, 2001). The two main forms of the DRD2 gene, which regulates the synthesis of D2 receptors, are the A1 and A2 alleles. The A2 form of the allele is considered “normal”, and is present in 66% of the population, while carriers of the A1 form of the allele have 30-40% lower D2 receptors (with significant variation across races). The Royal Society of Medicine concluded that carriers of the DRD2 A1 allele have a 74.4% predictable risk for RDS, as well as an increased risk for relapse (Blum et al., 2017). The significant decrease in receptors leads to less interaction with dopamine at the NAc.

The disorder can also serve as a biogenetic model for treating non-affected individuals with severe addictions as well as individuals with behavioral conditions such as ADHD and OCD (Blum et al., 2000). The main characterization of RDS, the decreased number of D2 receptors in the brain reward circuitry, is also implicated in drug addictions. A common quality that most addictive drugs share is their tendency to elevate levels of midbrain DA at the NAc; thus, they tend to produce strong cravings and little hedonic pleasure in addicted individuals (Arias-Carrión, Stamelou, Murillo-Rodríguez, Menéndez-Gonzalez, & Pöpel, 2010; Adinoff, 2004). Therefore, many RDS-affected individuals turn to behaviors that cause greater dopamine release such as seeking—and often abusing—various drugs (Blum, Cull, Braverman, Comings, 1996). In fact, the hypo-dopaminergic state is one of the main causes of withdrawal symptoms, making the process very difficult for recovering addicts; the strong signals from the significantly increased dopamine levels during drug usage decrease the number of D2 receptors (Volkow, Fowler, & Wang, 2003; Berridge, 2010). The decrease in D2 receptors, which is responsible for the reduced sensitization towards natural rewards in RDS, causes the same effect in addicts during the withdrawal period such as inability to feel joy, low motivation, insecurity, feelings of being overwhelmed, seasonal affective disorder (SAD), and difficulty achieving orgasm (Nørgaard et al., 2017; Berridge, Robinson, & Aldridge, 2009; Blum et al., 2008; Blum, Thanos, & Gold, 2014). Moreover, RDS has already been heavily correlated with individuals with both behavioral disorders such as ADHD and OCD (Downs et al., 2013). Later in the paper, I will introduce my hypothesis that the mid-anterior region of the orbitofrontal cortex, which is responsible for controlling compulsivity and impulsivity, is significantly involved in the reward system and RDS. Thus, even in individuals not suffering from the Reward Deficiency Disorder, it can still serve as an

accurate model for effective strategies for reducing withdrawal symptoms, relapse rates, and treating behavioral disorders.

Until recently, research into the hedonic pathway (anatomical and influence in addictions) have been neglected; current research focuses on the “wanting” reaction, or incentive salience, of the reward circuitry and addiction. By understanding the possible role that the “liking” reaction may play in the disorder, future research and treatment strategies can be targeted towards the mechanisms involved in this system to be more effective in treating RDS.

### 1.3 The Anatomy and the Significance of the “Liking” Reaction

#### 1. *What pathways in the brain are involved in the “liking” reaction?*

Although both elements of the reward circuitry, incentive salience and hedonic impact (pleasure), are required in order to receive the effects of the “full reward”, they are partly dissociable from each other because they involve different brain regions and neural mechanisms to carry out their differing functions. For example, across various studies, findings have been consistent in proving that dopamine is only necessary for influencing and developing the “wanting” reaction, not for the “liking” reaction (Kerridge & Kringelbach, 2016). The mechanisms involved in the “liking” reaction, however, have not been studied as extensively. From an evolutionary perspective, it has been proposed that affective (physical and emotional) reactions developed and are maintained because of their “survival functions” that encourage reward-seeking behavior for natural rewards (such as sex, food, and physical exercise) (Darwin, 1972; LeDoux, 2012). However, artificial rewards can be used as well to trigger the much of the same neural systems in order to stimulate the rewarding “high”.

Although the activation of many brain structures have been correlated with the presentation of a reward through neuroimaging and other techniques, only some regions of the brain, named “hedonic hotspots”, activate in the hedonic response, or “liking” reaction, to a reward. Hedonic hotspots, which are located in the forebrain in various regions including the mid-anterior orbitofrontal cortex, the posterior insula cortex, the parabrachial nucleus, the NAc shell, and the posterior ventral pallidum, have been found to be capable of increasing the “liking” reactions through stimulation chemicals such as opioids (Berridge & Kringelbach, 2016; Peciña, Smith, Berridge, 2006). A hotspot commonly linked to producing sensory pleasure in response to opioids is located in the rostradorsal quadrant of the NAc medial shell (Berridge, Robinson, & Aldridge, 2009). In addition, increased activation of the ventral pallidum is associated with an increased hedonic impact for various reward substances including food, sex, and cocaine (Berridge, 2009). There are also further distinctions within the

hotspots; for example, in the mu-opioid hotspot in the NAc, which enhances the hedonic reaction associated with opioid usage, only a small part of the region was associated with “liking” (the others were associated with “wanting”). There were some zones, called “coldspots”, that delineated a decrease in “liking” reactions. Hedonic hotspots may be linked in multiple networks or in a single integrated circuit that combines multiple brain regions in order to process pleasurable feelings in the “liking” reaction.

Although subjective pleasure is only one aspect of the reward system, it has large implications in the progression of initial drug use into addictions. The hedonic quality associated with a reward is not an intrinsic detail of their sensation, but instead depends on the various neural networks involved in the “liking” systems. For example, a study on rats that analyzed data recorded by electrodes placed throughout the ventral pallidum as well as orofacial affective reactions found that the activation of the ventral pallidum neurons were responsible for the hedonic reaction instead of simpler sensory systems; hedonic hotspot neurons in the ventral pallidum fired more vigorously in response to a sweet taste instead of an unpleasant salty taste, while sodium depletion led to the same neuronal activation for the salty taste as for the sweet taste (Berridge, 2009; Tindell, Smith, Peciña, Berridge, & Aldridge, 2006). In addition, with a disturbance in the reward system, a sweet food may lose the induced pleasurable feelings, while retaining its sweetness (Berridge, 2010). Thus, although the sensory systems were not affected, the hedonic feelings can be manipulated because it arises from the complex pathways involved in the “liking” reaction of the reward cascade system. Many literatures currently focus on incentive salience’s role in the reward system in order to develop treatment strategies for the reward deficiency syndrome, but the less extensively-researched “liking” reaction may also play a large role.

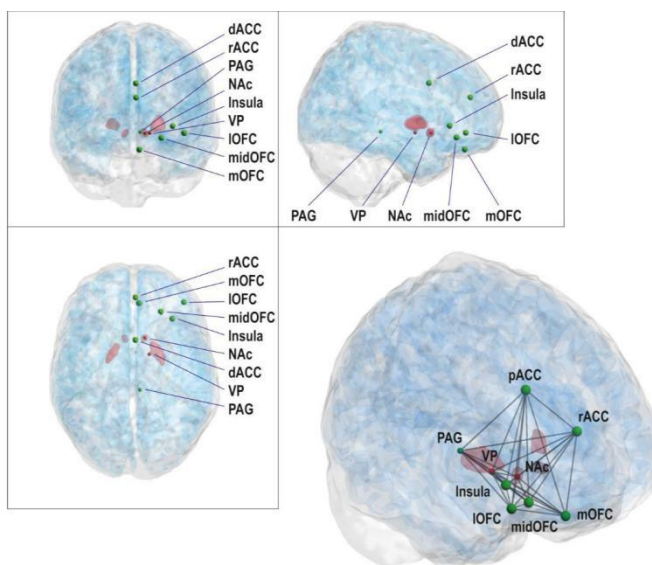
#### **1.4 The “Liking” Reaction in RDS and Drug Addiction: The OFC**

2. *Is the liking reaction a function of RDS, as observed in RDS-affected individuals?*

The prefrontal cortex region that is mid-anterior and mid-lateral within the orbitofrontal cortex has been most significantly correlated with producing hedonic pleasure because it tracks the *change* in pleasure of a stimulus and sensory satiety, instead of merely assigning reward values (Berridge & Kringelbach, 2016; Kringelbach, Phil, Berridge, 2010). The orbitofrontal cortex is responsible for sensory integration, modulation of autonomic reactions, and various functions relating to emotional and reward-related behaviors (Kringelbach, 2005). It includes regions in the hypothalamus, amygdala, insula cortex, ventral and dorsal striatum, and the medial prefrontal cortex.



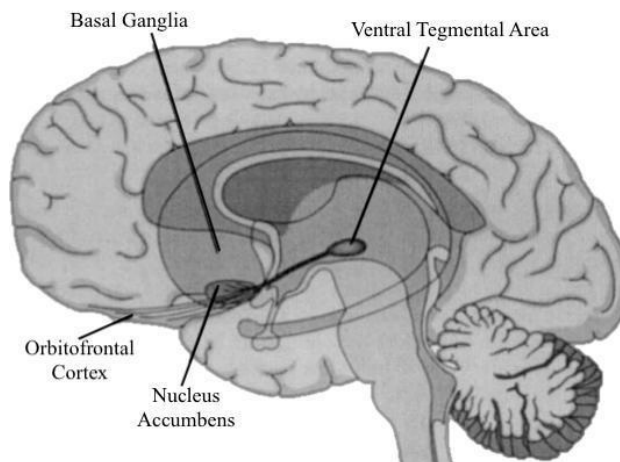
Although the orbitofrontal cortex has many functions in both hedonic and incentive salience systems in the reward circuitry, the mid-anterior orbitofrontal cortex specifically is directly responsible for using the stored reward values in order to produce subjective hedonic experiences (Kringelbach, 2005). In addition, the orbitofrontal cortex is also associated with inhibitory regulation and executive control functions (Bryden, Roesch, 2015; Chang & Ho, 2017). Furthermore, an experiment analyzing the OFC through fMRI scans when C-touch fibers, slow-conducting nerve fibers that produce pleasure under specific conditions (see “*Measuring Psychophysical Judgements of Pleasure*” under “Methods”), were activated found that different regions of the orbitofrontal cortex are responsible for representing pleasant touch and pain (Rolls, O’Doherty, Kringelbach, Francis, Bowtell, & McGlone, 2003).



**Figure 4.** A 3D model of the human brain and the various regions involved in processing the hedonic impact in the reward cascade system as well as hotspots (red) and coldspots (blue). Reprinted from “*Pleasure Systems in the Brain*”, by K. C. B. and M. L. K., 2015, *Neuron*, 86(3), 646-664.

The orbitofrontal cortex has been strongly associated anatomically and psychologically with the reward circuitry. For example, the orbitofrontal cortex plays a significant role in emotional disorders such as anhedonia, or the decreased sensitization to pleasure, which usually leads to depression and addiction, both of which are common symptoms of RDS (Kringelbach, 2005). Research indicates that while some of the axons extending from the ventral tegmental area in the reward system terminate in the nucleus accumbens, others continue forward and terminate in the orbitofrontal cortex (“*Drugs and the Limbic System*,” n.d.). This suggests that the large cluster of D2 receptors located along the axons projecting

from the VTA to the nucleus accumbens may also extend with the projecting axons into the orbitofrontal cortex (Robinson & Sohal, 2017; Puig, Rose, Schmidt, & Freund, 2014). In fact, there is a pattern of reduced levels of D2 receptors and dopamine (DA) levels in areas of the prefrontal cortex such as the anterior cingulate gyrus and the orbitofrontal cortex in deficits involving those regions (Volkow et al., 2011). Volkow et al concluded that decreased D2 receptors have been associated with reduced activation of the OFC. Furthermore, there is evidence that suggests that the medial regions of the OFC are part of a network for the baseline activity of the brain at rest (Kringelbach, 2005; Blum et al., 2015). This provides further support for the proposal that D2 receptors are implicated in deficits in the OFC. The resulting hypo-dopaminergic state correlates with the addicted individual's decreased sensitivity to natural rewards, thus encouraging habitual and compulsive reward-seeking behavior that usually progress into addictions. In addition, there was a significant difference in activation patterns in the OFC in the brain scans of heroin-addicted and healthy individuals during resting-state brain activities (Blum et al., 2015). The orbitofrontal cortex may be implicated in the Reward Deficiency Syndrome (RDS) because of the correlations between neural mechanisms and emotional systems that lead to decreased baseline "liking" reactions, leading to the development of addictions.



**Figure 5.** A model of the human brain and the axons extending from the VTA. Some axons, drawn as a thick line representing the large cluster, terminate at the nucleus accumbens while others, represented as straight lines, terminate at the OFC. Reprinted from "Drugs and the Limbic System," retrieved from <https://www1.udel.edu/chem/C465/senior/fall10/DrugAddiction/Parts.html>.

Studies have also analyzed the association of drug addiction with decreased activation of the OFC. Individuals with lesions in the OFC as well as drug- and alcohol-addicted patients performed poorly on the Gambling task, which involves uncertainty, reward, and punishment (Adinoff, 2004). The Gambling Task, as administered by Bechara et al, tests

decision- making in human subjects; the participants chose various cards associated either with high risk and high gain, or low risk and low gain, in order to achieve the objective of winning as much fake money as possible (Bechara, Damasio, Tranel, & Anderson, 1998). In addition, individuals with lesions in the orbitofrontal cortex made more errors and were quicker to respond than individuals without OFC deficits in a behavioral impulsivity test, the Matching Familiar Figures Test (MFFT), in which each of the participants selects a pair of exactly matching pictures from a set of highly similar pictures (Berlin, Rolls, Kischka, 2004). The results suggest that the orbitofrontal cortex, which plays a major role in decision-making processes in the ventromedial prefrontal cortex, is responsible for controlling impulsivity and is involved in inhibitory restraint. Compulsivity is defined as repetitive, often subconscious behaviors while impulsivity refers to rapid, unplanned reactions and reduced inhibitory restraint (Angoa-Pérez et al., 2012). With lesions or decreased activation of the OFC due to disturbances within the region, the decision-making processes that are vital to the reward system are impaired, which makes the patients more susceptible to engaging in impulsive and compulsive behaviors.

The experiments in this paper will determine the correlation between the “liking” reactions with the Reward Deficiency Syndrome, and thus analyze a different facets of the disorder,; the compulsivity and impulsivity and how they can be used to fully understand the basis of RDS as a function of addiction. This paper proposes a new perspective on the RDS by observing the significance of the hedonic impact as well as the possibly associated compulsivity and impulsivity characteristics in the Reward Deficiency Syndrome. Furthermore, the proposed significant involvement of the orbitofrontal cortex in the disorder may provide another target for future treatment and preventative strategies for individuals suffering from RDS as well as addicted individuals not afflicted with RDS.

## 2. Methods

Four groups of fifteen individuals each will be tested in the experiments; one control group composed of healthy individuals without RDS and not suffering from any addictions, Group 2 composed of addicted individuals without RDS, Group 3 composed of individuals with RDS and without any addictions, and Group 4 composed of individuals with both RDS and addictions. Because aging has been found to negatively influence dopamine D2 receptor density in many studies, the participants will have to be between 18-35 years old. The control groups of the individuals without RDS are included in order to ensure that any observations of differences in brain activity can be accurately attributed as a function of RDS. The group of non-RDS afflicted individuals suffering from addictions is included in order to test the hypothesis and note differences in OFC activation (which is already evidenced to be involved in various addictions) as well as other brain regions/systems. All subjects will give written

consent and be made aware of all aspects and risks, if any, of being involved in the study. The addicted individuals without RDS will be recruited from the National Institutes of Health (NIH) organization. Finally, in order to form the test group of the individuals afflicted with RDS, all participants will be tested for the disorder by a combination of a self-answered questionnaire and a brain scan in order to measure one of the major hallmarks of RDS, the density of D2 receptors in the brain.

	With RDS	With Addictions
Group 1	X	X
Group 2	X	√
Group 3	√	X
Group 4	√	√

*Figure 6.*

## 2.1 Self-Questionnaire For The Presence of RDS

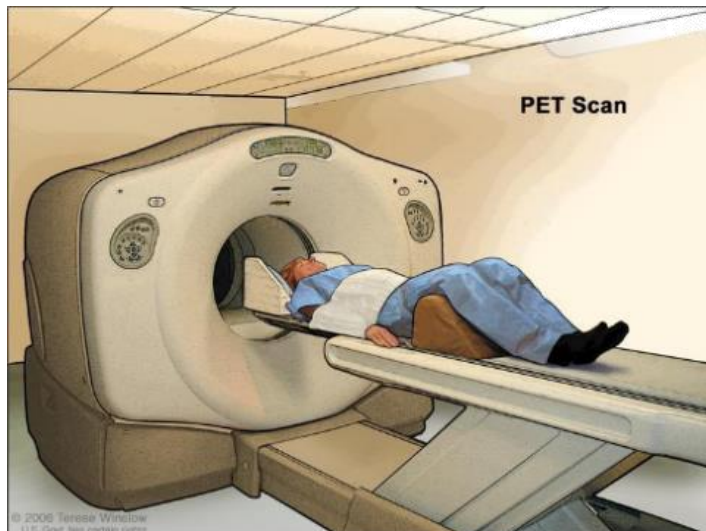
First, all subjects in all four groups who have not already been diagnosed with RDS will be given a self-reported questionnaire to test for the presence of Reward Deficiency Syndrome. The questions are based on identified RDS symptoms. The participants will answer each question on a scale of 1 to 5, with 1 being “Never” and 5 being “Very often”. The scores for each question will then be totaled in order to yield an overall score for this self-report aspect of the preliminary RDS diagnosis.

- Have you ever been diagnosed with RDS?
- Do you experience seasonal affective disorder (SAD)?
- Do you have difficulty achieving orgasm?
- Do you often feel overwhelmed?
- Do you often feel like it is harder to feel pleasure and joy in your daily life?
- Do you often feel insecure?
- Do you often feel the need to go out of your way to seek large thrills?

## 2.2 PET Scan To Test For D2 Receptor Density

### 2.2.1 Overview: PET Scan

Previous studies have found that positron emission tomography (PET) scans used in conjunction with a dopamine D2 receptor antagonist have been successful in determining the characteristics of D2 receptors and dopamine in human subjects. This common method of assessing D2 receptor density is noninvasive for the subjects. PET scans show metabolic changes in areas of the body such as the organs or tissue by using radioactive tracers, radionuclides, which gather in areas of greater chemical activity (“What is a PET Scan?” n.d.). These radionuclides are formed by attaching a radioactive isotope to substances that are normally found in the region of interest (“Positron Emission Tomography (PET),” n.d.). Once inside the body (inserted intravenously, swallowed, or inhaled), the radionuclides are absorbed by certain organs or tissues and begin to break down (“Positron Emission Tomography (PET),” n.d.; “What is a PET Scan?” n.d.). The gamma rays from the positrons emitted by the radionuclides during this process are detected by a scanner on the PET machine. A computer-generated map of the organ or tissue shows the areas in varying brightness, which indicates the level of metabolic function of the region of interest. PET scans are beneficial in analyzing blood flow and oxygen consumption, as well as tracking chemical neurotransmitters such as dopamine (Berger, 2003).



**Figure 7.** A model of a PET scanner and the subject about to start a scan. Before the individual enters the scanner, a small amount of radionuclide is injected into the subject’s vein. Reprinted from “NCI Dictionary of Cancer Terms,” by the National Cancer Institute.

### 2.2.2 PET Scan: Radionuclides

Many different receptor antagonists, which are ligands, have been found with moderate- to high-affinity for the D2 receptors that are effective for determining the density of D2 receptors in the brain. The most widely used ligands are raclopride and N-methylspiroperidol (NMS) (Volkow et al., 1996). Although raclopride has a moderate affinity for the receptors, it also binds to D3 receptors (Berry et al., 2018). Meanwhile, the NMS has a higher affinity for the receptors in comparison to raclopride, but it also binds to 5HT2 and D4 receptors. Both seem to bind predominately to postsynaptic receptors in the striatum (where the neurons containing D2 receptors are GABAergic or cholinergic). The [<sup>11</sup>C]raclopride can be displaced by increases in endogenous dopamine (Yoder, Kareken, O'Connor, Wang, Zheng, Mock et al., 2005). To function effectively as tracers in the brain scans, the antagonists must be labeled with a radioactive isotope; for example, raclopride is most commonly labeled with <sup>11</sup>C (Berry et al., 2018). [<sup>11</sup>C]raclopride has been used in many PET scans of a variety of diseases involving D2 receptors, such as Huntington's disease (Antonini, 1996). In this experiment, I will use [<sup>11</sup>C]raclopride (RACLO) with ordinary high specific radioactivity (133-280 GBq/μmol) in the PET scans (Fujimara et al., 2010). In addition, the posterior cerebellar gray matter in the brain will be used as a reference region because it has an extremely low density of dopamine receptors and metabolites compared to the striatum (Ikoma et al., 2009; Suhara et al., 1999).

All individuals in this study will participate in the PET scan. First, the [<sup>11</sup>C]raclopride will be synthesized in the laboratory using methods described by Volkow et al (Volkow et al., 1993). The individuals will be positioned in the scanner with the help of a head mold made of urethane foam in a polystyrene holder, and a laser beam to align the head (Antonini et al., 1996). While in the scanner but before the scan, 10 mCi of [<sup>11</sup>C]raclopride will be administered intravenously in an antecubital vein. RACLO will be later flushed with saline after the experiment to ensure the safety of the participants. Regions of interest during the scan will be the posterior cerebellar gray matter, the nucleus accumbens, and the orbitofrontal cortex. Twenty total time frame scans will be completed over the course of 1 hour (Antonini et al. 1996). The average decay-corrected levels of radioactivity in the ROIS will be plotted against time after the scans are completed (Hietala et al., 1999). Finally, the measurements of the reference regions, the left and right hemispheres of the cerebellum, will be averaged for the "cerebellar activity value" in the final calculations of the RACLO index.

### 2.2.3 PET Scan: Calculation of Results

$$[^{11}\text{C}]\text{raclopride index} = (\text{target ROI activity} - \text{cerebellar activity})/\text{cerebellar activity}$$

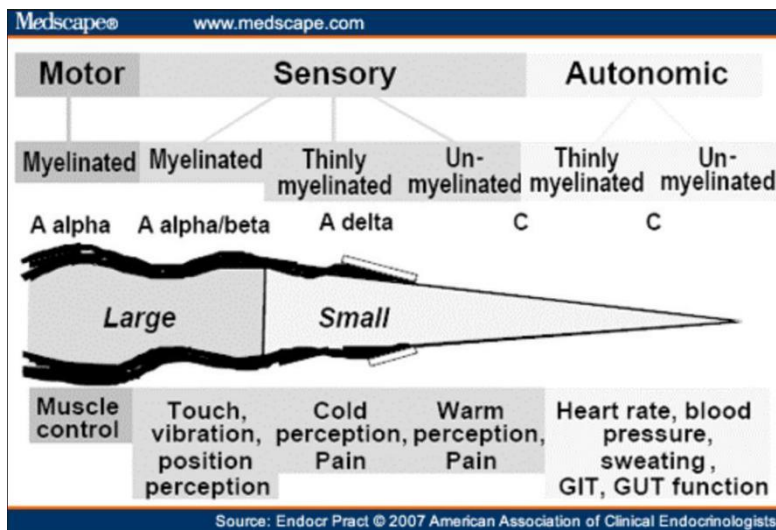
The RACLO index calculations for each person will then be compiled in a table and used order to identify the groups with significantly lower RACLO calculations, and thus D2 receptor densities. Because RDS has already been strongly associated with decreased D2 receptor densities and dopamine binding potentials (the capacity of a receptor to bind to a ligand), the individuals with significantly lower D2 receptor binding potentials will be separated from the individuals with significantly higher receptor binding potentials. In order to further distinguish the participants that have RDS from addicted participants without RDS, the results of the self-reported questionnaire and PET scan administered to each subject will both be taken into consideration in order to determine the overall likelihood of the subject being affected by the Reward Deficiency Syndrome.

### **2.3 Measuring Psychophysical Judgements of Pleasure (as a function of RDS)**

In order to measure the presence of the “liking” reaction as a function of RDS, certain equipment will be used that use the association of C touch fibers and pleasure. This next section of the paper will further discuss this association, and how the experiment will be performed.

#### **2.3.1 Overview: C Touch Fibers**

There are many known types of sensory affective fibers in humans, including A delta, A beta, and C touch fibers. They are distinguished by their different characteristics such as the type of information carried by the fiber, myelination (or lack of myelin sheaths), conduction velocity, and mechanical thresholds. While A delta and A beta fibers are fast-conducting, myelinated sensory nerves, C touch (CT) fibers are touch-sensitive nerve fibers that are slow-conducting and unmyelinated (Richards, 2012). There are two types of C fibers; one is stimulated in moments of deep pain, while the other type, C-tactile fibers, is sensitive to gentle stroking. Vallbo et al found that these C-tactile fibers are found only in hairy skin, such as human forearm skin, and that they were only responsive to gentle tactile stimulation (Vallbo et al., 1993). Previously, these fibers had only been found in the faces of mammals, which Olausson et al attributes to the evolutionary response to social behavior such as grooming (Olausson, Wessberg, Morrison, McGlone, Vallbo, 2010).

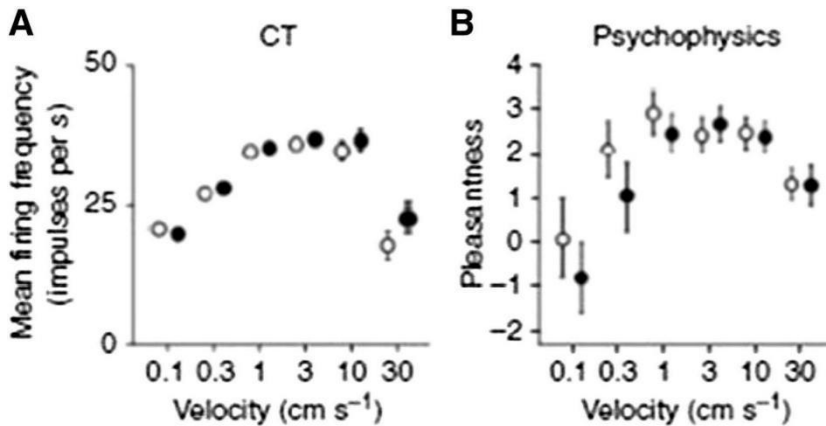


**Figure 8.** More information about the different types of sensory nerve fibers including information carried and examples of when the different fibers are activated. Reprinted from “Clinical Manifestations and Current Treatment Options for Diabetic Neuropathies,” by A. I. V. et al., 2006, *Nature Clinical Practice Endocrinology Metabolism*, 2(5), 269-281.

The mechanical thresholds of CT fibers are very low; in fact, they respond preferentially to slow, light stroking than to indentation (Macefield, 2009). Increased CT firing frequency has been associated with the individual’s rating of pleasantness. Patients lacking only large-fiber sensory axons have reported that they are able to feel this light touch and the pleasurable feelings it evokes. A study that observed the activation of a subset of C-touch fibers, MRGPRB4+ neurons, in mice through electrophysiology experiments found that the neurons were only activated by massage-like stroking on hairy skin rather than noxious mechanical stimulation such as pinching (Vrontou, Wong, Rau, Koerber, Anderson, 2013). CT afferents respond very preferentially to specific types of stimuli, such as pressure and stroking speed. The conduction velocity, measured through mechanical or electrical stimulation, has been determined to vary between 0.6 and 1.3 ms<sup>-1</sup> (Olausson, Wessberg, Morrison, McGlone, Vallbo, 2010). The maximal response of the CT afferents has been determined to occur for movement velocities at around 3 cm s<sup>-1</sup> and pressure measurements at around 0.3N through electrophysiological studies measuring heart rate (Pawling, Cannon, McGlone, Walker, 2017). In addition, fMRI used to study brain responses to touch stimuli found that in somatosensory areas S1 and S2 receive Aβ (fast tactile afferents) projections, while the insular cortex receives slow (CT) fiber projections. The insular cortex has been found to be involved in a wide range of brain activities from sensory processing to tasks involving emotion such as empathy, risk prediction and decision-making, and representing feelings and emotions (Gogolla, 2017). Thus, it has been suggested that they engage the



limbic system of the brain, which is responsible for processing emotion, instead of the somatosensory system.

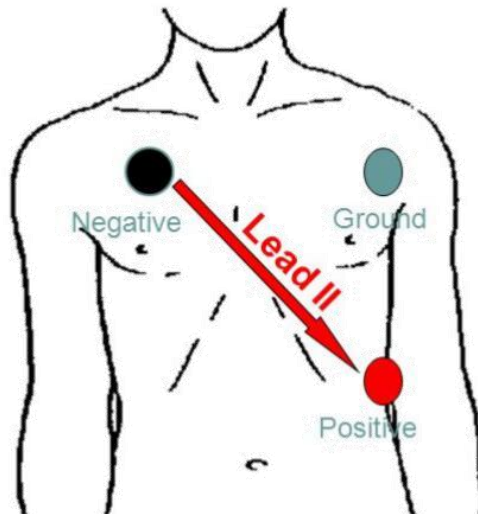


**Figure 9.** These graphs show that the velocity of stroking of the stimulus (A) correlates with the psychophysics, or hedonic ratings (B). Reprinted from “Discriminative and Affective Touch: Sensing and Feeling,” by F. M., J. W., H. O., 2014, *Neuron*, 82(4), 737-755.

This paper proposes an experiment measuring and comparing the pleasant feelings from C touch fiber activation across the four groups of subjects in order to determine if activation of the “liking” reaction mechanisms in the brain are altered as a result of addictions, having RDS, and both. The following experiment to test the “liking” reactions in the different groups of subjects will use heart rate as a physiological measure in conjunction with subjective self-reports of pleasantness. According to my hypothesis, I predict that the activation of CT afferent fibers will produce decreased heart deceleration and decreased subjective reports of pleasantness in comparison to the healthy, non-addicted individuals without RDS.

### 2.3.2 Measuring the “Liking” Reaction: Heart Rate

In order to record heart rate of the subjects throughout the experiment, self-adhesive ECG electrodes will be placed on the skin above the participants left hip and below their right clavicle (Pawling, Cannon, McGlone, Walker, 2017). The ground electrode will be placed below the left clavicle. The algorithm in the software system AcqKnowledge will be used to identify R-peaks and convert them into measurements of inter-beat intervals (IBIs), expressed as the number of seconds between each R-peak. The mean of the two IBIs immediately before the stimulus is applied will be used as the baseline, while the first five beats after the stimulus will be subtracted from the baseline measurement, and expressed as a change in seconds. Thus, a positive value represents heart rate deceleration while a negative value represents heart rate acceleration.



**Figure 10.** The positive electrode of the ECG will be placed above the participant's left hip, the negative electrode below their right clavicle, and the ground electrode below the left clavicle. Reprinted from the Ontario Base Hospital Group Education Subcommittee.

### 2.3.3 Overview: fMRI

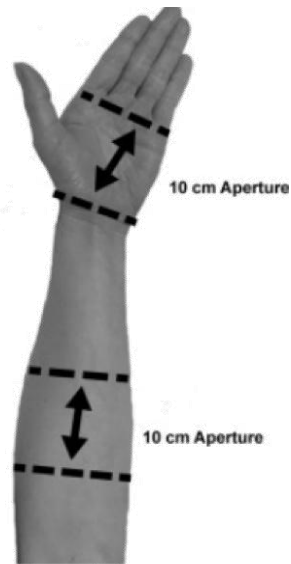
Functional magnetic resonance imaging (fMRI) is a scanning technique used in measuring brain activity by measuring changes in blood flow (Devlin, Clare, & Tracey, n.d.). Using an fMRI scanner to analyze brain activity is convenient and useful because it is non-invasive, does not involve radiation, has excellent resolution, and can be easily operated by the experimenter. The scanning uses a combination of a strong magnetic field and radio waves in order to assemble an image of the part of the body that is being examined; the magnetic field produced by a strong magnetic within the machine aligns the hydrogen atoms in the subject's body (found in water) while the radio waves move the nuclei from the aligned position ("Magnetic Resonance Imaging (MRI)," n.d.; Devlin, Clare, & Tracey, n.d.). Blood oxygenation level dependent (BOLD) imaging measures the level of oxygen in the blood in order to determine the region of interest's current metabolic activity (Devlin, Clare, & Tracy, n.d.). BOLD fMRI scanning uses the principle that oxygenated hemoglobin is strongly magnetized parallel to the magnetic field while deoxygenated hemoglobin has a very weak magnetic attraction. Thus, by assuming that higher oxygen levels correlate with greater neural activity, the strong alignment of certain hydrogen nuclei in response to the magnetic field will determine which regions in the part of the body being studied have greater metabolic activity at the time.

### 2.3.4 Experimental Procedures

The stimuli will be delivered by a soft goat hair brush by a rotary device, the rotary tactile stimulator (RTS), designed by McGlone et al, to the participant’s volar forearm, with each unidirectional stroke having a velocity of 3 cm/sec and a pressure of 0.3 Newtons (McGlone, Vallbo, Olausson, Loken, & Wessberg, 2007; Pawling, Cannon, McGlone, Walker, 2017). The device allows the experiment to have a higher degree of controlled conditions such as stimulus velocity and force. Meanwhile, the subject will lie down in an fMRI scanning machine and a series of brain scans will be taken throughout the constant stimulation by the experimenter. The participants will close their eyes in order to prevent distraction from any visual stimulation. Each trial of stroking the brush across the forearm at a constant velocity and pressure will last approximately 30 seconds, for a total of 10 alternating strokes in both directions. The participants will open their eyes for a 30 second rest break between each trial. There will be a total of eight trials. Twenty fMRI brain scans will be taken consistently over the course of the eight minutes for each subject. Immediately after each trial, during the 30 second block rest periods, the participants will rate their pleasant feelings from the stimulus on a scale of 1 to 10, with 1 being “Unpleasant” and 10 being “Pleasant”.



**Figure 11.** A rotary machine will be used to deliver a controlled stroking of the stimulus in order to measure the hedonic ratings in the various groups of participants. Reprinted from “Discriminative Touch and Emotional Touch,” by F. M. et al., 2007, *Canadian Journal of Experimental Psychology*, 61(3), 173-183.



**Figure 12.** A model of where the participant would be stroked by the goat hair brush: on the 10 cm aperture on the forearm. The 10 cm aperture on the palm of the hand will not be stimulated in this experiment. Reprinted from “C-tactile Afferent Stimulating Touch Carries a Positive Affective Value,” by R. P. et al., 2017, PLoS ONE, 12(3).



**Figure 13.** A timeline of the blocks during which the rotary machine is activated and rest blocks.

### 2.3.5 Measuring Psychophysics: Calculation of Results

After the fMRI/ECG experiment, the mean of the subjective self-reports of pleasantness will be used in order to determine the overall subjective pleasantness score for each subject. The mean of the heart rate deceleration/acceleration measurements gathered from the software algorithm will also be used to consider the overall physiological response to the pleasant stimulation. Next, the fMRI results will be carefully analyzed for differences in activation of the mid-anterior orbitofrontal cortex in order to determine if it plays a role in the “liking” reactions. Ultimately, the results from the three tests in this experiment will ascertain (1) whether the “liking” reaction plays a role in the Reward Deficiency Syndrome, a function of addiction, and (2) if the orbitofrontal cortex is involved in the “liking” reaction, and thus RDS.

	Self Questionnaire for the Preseence of RDS	Pet Scan	ECG	Self Reported Pleasure Ratings	fMRI Scan
Range of Scores (Total)	7-35	n/a	n/a	1-10	n/a

**Figure 14.**

### 3. Conclusion

The proposed experiments as outlined above may yield many results and thus conclusions. In this section of the paper, I will discuss the possible results and analyze the conclusions that could be drawn in each scenario. If the self-reported pleasure ratings and physiological measures remain consistent in all of the participants in all four groups (Groups 1, 2, 3, and 4), it would show that the “liking” reaction is not affected in the presence of the Reward Deficiency Syndrome, addictions, or both. Thus, it would suggest that the “liking” reaction does not play a significant role in the development of addictions, and is not involved in RDS. However, if the feelings of pleasure are determined to be reduced in subjects with addictions, but are at normal levels in the control group as well as the group of individuals without RDS nor addictions, it can be reasonably concluded that the “liking” reaction is only affected in the presence of addictions. This would further illustrate that the “liking” reaction is not implicated in RDS. However, if the “liking” reaction” is shown to be reduced in Groups 2, 3, and 4, it will support my hypothesis that the hedonic aspect of the reward system is involved in both addictions and the Reward Deficiency Syndrome, which includes reward-seeking behavior that often progresses into addictions.

Different conclusions can also be drawn from the possible fMRI scan results in the experiment. If the scans are consistent across all groups of participants and the mid-anterior orbitofrontal cortex is equally activated (through comparisons of the RACLO calculations) in all subjects’ brains, it can be concluded that activity in this brain region is not reduced in addiction or RDS. This would illustrate that the compulsivity and impulsivity as regulated by the OFC is not implicated in addictions or in the Reward Deficiency Syndrome. On the other hand, if the scans indicate the mid-anterior orbitofrontal cortex shows decreased activation in only Groups 2 and 4, it would suggest that the OFC is significant in modulating the habitual reward-seeking behavior of addictions. Furthermore, this result would also illustrate that RDS does not involve the increased compulsivity and impulsivity that would have arisen from disturbances in the orbitofrontal cortex. The final scenario, in which activation of the orbitofrontal cortex is reduced in Groups 2, 3, and 4, would support my hypothesis that the mid-anterior orbitofrontal cortex is significant in causing the main symptoms of RDS and addictions by encouraging abnormal, habitual reward-seeking behavior. The conclusion that

the compulsivity and impulsivity characteristics are implicated in both addictions and RDS suggests another common link between the two disorders that provides a clearer understanding of both.

Finally, there is a final set of possible results from the experiments proposed in the previous section that I will now analyze. In the first scenario, my hypotheses could be proven as partially correct if the results show that the “liking” reaction is implicated in addictions and RDS while the orbitofrontal cortex is not involved in the presence of addictions or RDS. This would suggest that while the “liking” reaction is significant in the Reward Deficiency Syndrome, the OFC is not involved in the “liking” reaction and that disturbances in its regulation of compulsivity and impulsivity are not significant in causing addictions. In the next scenario, my hypotheses could again be partially correct, but with the results demonstrating that the “liking” reaction is not implicated in addictions and RDS while the orbitofrontal cortex is involved in the presence of addictions or RDS. This result would reveal that while the OFC’s functions in processing and conveying pleasure are not significant in RDS, the region’s function in regulating important characteristics such as compulsivity and impulsivity is responsible for encouraging addictions. Finally, the results could indicate that both of my hypotheses are correct; both the “liking” reaction and the OFC could be involved in addictions and RDS, which would allow the conclusion that the combination of increased compulsivity and impulsivity along with a decrease in the “liking” reaction (caused by disturbances of the mechanisms in the system) is significantly involved in causing addictions, a function of the Reward Deficiency Syndrome.

This paper aimed to understand a broader image of the Reward Deficiency Syndrome and addictions by analyzing the significance of many less-extensively researched possible implications. Results proving the involvement of the OFC would also have other implications because compulsivity and impulsivity are involved in numerous serious abnormal behaviors. For example, Obsessive Compulsive Disorder (OCD) is a condition characterized by obsessions that lead to compulsive behaviors. In addition, impulsivity has been strongly implicated in Attention-Deficit/Hyperactivity Disorder (ADHD). A greater understanding of the OFC’s roles in regulating behaviors and how deficits can lead to many behavioral disorders is important in targeting future medical treatments. Moreover, results illustrating that the “liking” reaction plays a significant role in addictions and RDS would introduce a different way of looking at and treating/preventing addictions. The “wanting” reaction has been far more extensively researched than the “liking” reaction in studies analyzing RDS. In fact, even though my hypothesis and current research into the “liking” reaction illustrates that the “wanting” reaction is most likely not as significant in the Reward Deficiency Syndrome, evidence shows that both reactions are significantly involved in addictions from the very start. With reduced pleasure-producing systems in the reward system, the affected individual will be unable to experience the same levels of pleasure in response to a normal daily dose of natural rewards. Incentive salience, or the “wanting” reaction, then becomes very significant in the further development of addictions; the motivation to seek other rewarding behavior often leads to drug abuse. Ultimately, the research outlined in this paper introduces a novel perspective of the Reward Deficiency Syndrome and addictions. It would also allow us to see

how the reward system, which governs most of our daily actions and decision-making processes, is extensively associated with many important behavioral characteristics. The interconnected network of systems involved in the reward circuitry has long puzzled psychologists and neuroscientists, but it only serves as another reminder of the complexity of the human brain. With continual study in this field, however, we may be able to use the reward system as a model to understand how the brain works and to develop more effective strategies to treat behavioral disorders.

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## **Examination of Antisocial Personality Disorder: Determining Gender Bias on MMPI Psychopathic Deviate and Evaluating Substance Abuse Relapse Rates**

Raaka Mukhopadhyay

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### **Abstract**

Antisocial personality disorder is a personality disorder characterized by “a pervasive pattern of disregard for, and violation of, the rights of others that begins in childhood or early adolescence and continues into adulthood” (DSM-IV). For this specific disorder, there are three times as many men diagnosed as women. However, studies suggest that women show less severe symptoms. This prompts the idea that women could exhibit a lesser form of the disorder, which could imply that women do not need to demonstrate behaviors as severely as men to be diagnosed with antisocial personality disorder. In addition, individuals with the disorder have a much higher tendency for substance abuse, which is due to their impulsive nature. However, there are no programs specifically targeted towards this population. This proposed study addresses the gender gap of diagnosis and relapse rates among this population. As a result, the study will test two outcomes: (1) whether there is a gender bias in diagnosing antisocial personality disorder, and (2) if relapse rates are higher in individuals with antisocial personality disorder. The results of this study will help further refine treatment and diagnosis of these patients.

### **Introduction**

#### *Overview of Antisocial Personality Disorder (ASPD)*

As defined by the American Psychiatric Association, antisocial personality disorder is “a pervasive pattern of disregard for, and violation of, the rights of others that begins in childhood or early adolescence and continues into adulthood” (DSM-IV).

The cause of ASPD is unknown. However, both genetic and environmental factors are contributors to the disorder. In fact, about 50% of the likelihood of the onset of ASPD can be accredited to genetics (Rautanen et al., 2016). Monoamine oxidase A (MAOA) is a gene that controls the production of an enzyme, monoamine oxidase A, which breaks down monoamines, including neurotransmitters. Mutations of this gene reduce activity of the enzyme, which leads to a build up of neurotransmitters in the brain and can influence behavior. For example, one variant, MAOA-L, has been linked to impulsive and aggressive behavior. This variant has been prevalent in many diagnosed with ASPD (Lewis, 2015). Environmentally, having an antisocial or alcoholic parent, or being subjected to child abuse increases the risk of the disorder (MentalHealth.gov, 2017).

Those with ASPD tend to share several behavioral characteristics: having a charismatic personality; tending to be manipulative; law-breaking; neglecting the safety of oneself and others; abusing or misusing substances; lying, stealing, and fighting; lacking the ability to show guilt or remorse; being angry or arrogant (MentalHealth.gov, 2017).

There are several childhood behaviors associated with ASPD: being physically cruel towards animals or people; participating in power imbalance acts (bullying, intimidation); fire-setting; stealing or other moral violations (Hoermann, Zupanick, & Dombeck, n.d.). When these behaviors are exhibited, children may be diagnosed with Conduct Disorder. Conduct Disorder is a broad term that refers to (1) consistency of antisocial behavior where the individual continually breaks rules and is aggressive and (2) oppositional defiant disorder, a milder version of '(1)', which is usually seen in children (Hoermann, Zupanick, & Dombeck, n.d.). A large portion of children and teenagers who have conduct disorders become antisocial adults with deprived and harmful lives; a considerable minority will develop ASPD (National Collaborating Centre for Mental Health [UK], Social Care Institute for Excellence (UK), Antisocial Behaviour and Conduct Disorders in Children and Young People: Recognition, Intervention, and Management. Leicester (UK), & British Psychological Society, 2013).

<b>SCALE 4 – PSYCHOPATHIC DEVIATE (Pd)</b>	
<b>T ≥ 75</b>	Antisocial behavior; trouble with the law
<b>T = 65-74</b>	Rebellious, non-conforming; family problems; impulsive, angry, irritable, dissatisfied; creative; underachievement; poor work history
<b>T=55-64</b>	unconventional; immature, self-centered; superficial relationships; extroverted, energetic
<b>T = 45-54</b>	Average score; no interpretation
<b>T &lt; 45</b>	Low score; no interpretation

*Figure 1. Psychopathic Deviate Scale*

A mental health professional typically diagnoses antisocial personality disorder. Before evaluating, a medical evaluation is usually performed to rule out other medical conditions. The diagnosis is typically based on a psychological evaluation, personal and medical history, and the symptoms mentioned in DSM-V from the American Psychiatric Association (Mayoclinic, 2017).

Although clinical evaluations are typically used to diagnose ASPD, the Minnesota Multiphasic Personality Inventory is a standardized test, based on control groups, that assesses personality traits and psychopathology. While psychopathy is not the term formally used by the American Psychiatric Association, the test was designed to identify antisocial behaviors within test takers. Specifically, a scale called “psychopathic deviate” quantifiably measures the behaviors of individuals. The scale for the psychopathic deviate, as defined by the University of Minnesota, is shown below.

### *Psychopathy and Sociopathy*

The American Psychiatric Association, which publishes the Diagnostic and Statistical Manual of Mental Disorders, does not use the terms “psychopath” or “sociopath”. These two terms are commonly used, but the distinctions and definitions are varied depending on the source. The most related, official term for both psychopathy and sociopathy is antisocial personality disorder. Therefore, henceforth, “psychopathy” and “sociopathy” will not be used in this proposal; only “antisocial personality disorder” and its subsequent definition (as defined previously) will be used.

### *Comparison of Males and Females with Antisocial Personality Disorder*

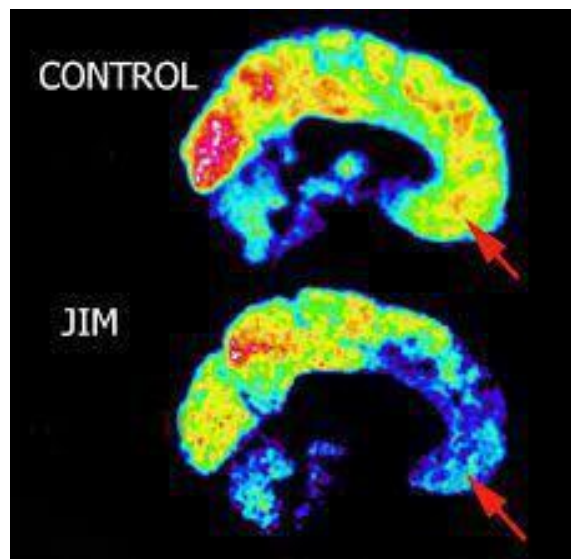
Males are three times as likely to have ASPD as females. However, antisocial personality disorder seems to affect men and women differently. Therefore, there is uncertainty as to whether the tools used to diagnose ASPD are only completely effective with men since many conclusions about ASPD are based on males. It is possible that there are more females with ASPD, but incorrect diagnostic tools are being used. On the other hand, it is also possible that females experience a distinctly different syndrome (Rogstad, 2011).

“Although women with ASPD present less violent antisocial behaviors and higher rates of aggressiveness and irritability (OR = 0.46; 95% CI: 0.31–0.67), they have higher rates of victimization, greater impairment, and lower social support” (Alegria et al., 2013). This signifies the difference in how ASPD affects men and women. Therefore, these data suggests that the development of separate treatment programs for men and women is imperative to fully address ASPD (Alegria et al., 2013).

*Neurologically*

People with antisocial personality disorder have been found to have different sizes of brain structures. Specifically, the frontal lobe, the part of the brain that controls judgment and planning, is different. As a result, it may be more challenging for people with these differences in brain structure to control their impulses. This can explain how those with antisocial personality disorder tend to have more aggressive personalities. However, it is not conclusive that these neurological differences are the cause of ASPD. These variations could be a result of traumatic life experiences, which are common in those with ASPD, but not necessarily the cause (Harvard Health Publications 2018).

This is supported by a study that showed “11.0% reduction in prefrontal gray matter volume in the absence of ostensible brain lesions and reduced autonomic activity during the stressor” in a group of subjects with antisocial personality disorder (Raine, Lencz, Birchle, LaCasse, & Colletti, 2000). This is important because the prefrontal cortex controls appropriate social behavior, impulses, and judgment (Weiss, 2016). Furthermore, another study’s findings demonstrated that ASPD is associated with a loss in neurological control, and this loss relates to general antisociality, not a specific antisocial syndrome (Zeier, Baskin-Sommers, & Newman, 2012). An additional study also suggests that ASPD is also marked by impulsivity (Swann, Lijffijt, Lane, Steinberg, & Moeller, 2009). This can be visually expressed by a PET scan (referring to the following imaging). The picture compares a brain with ASPD (Jim’s) to a normal brain (‘control’). As seen in the image, the frontal cortex in the brain with ASPD has much less activity than the control.



**Figure 2.** *Jim’s Brain vs. Normal Brain* (Lewis, 2015)



Another important structural component of the brain is the amygdala. The amygdala is accountable for learning from one's mistakes and responding to the facial expressions of others. In people with antisocial personality disorder, the amygdala is smaller. This may be the reason that individuals with ASPD suffer from a lack of empathy for others (Dryden-Edwards, n.d.).

The reward center of those with ASPD has been found to be hypersensitive. The results of a particular study displayed that, "individuals who scored high on a personality assessment that teases out traits like egocentricity, manipulating others, and risk-taking had a hypersensitive dopamine response system. The picture that emerges from these high-resolution PET and fMRI scans suggests that alterations in the function of the brain's reward system may contribute to a latent psychopathic trait...The amount of dopamine released was up to four times higher in people with high levels of these traits, compared to those who scored lower on the personality profile...Because of these exaggerated dopamine responses, individuals with a latent psychopathic trait may become focused on a chance to get a reward, and less able to shift their attention until they get what they're after. This pattern, along with other traits, could develop into psychopathic personality disorder" (National Institute of Health, 2010). As a result, of this brain mechanism, those with hypersensitive reward centers tended to care less about the consequences of their behavior. This trait, along with lessened awareness of others' emotions and resistance to learning from mistakes, matches common behavior in antisocial personality disorder. By connecting impulsivity and the potential for antisocial behavior to a hypersensitive dopamine response, this study proves that aggression in certain individuals can evoke the same sense of reward that drugs do in others.

### *Susceptibility to Addictive Behaviors*

**Gambling:** An addictive form of gambling is formally called compulsive gambling or gambling disorder (Mayoclinic, 2016). When an individual is affected by compulsive gambling, his or her brain reacts to the impulse the same way it reacts when addicted to alcohol or drugs (MedlinePlus, n.d.).

In one study, pathological gamblers were interviewed using DSM-III [the most updated version of DSM at time of study] criteria for ASPD. The study found that 15% of subjects met the DSM-III criteria for ASPD (Błaszczynski & McConaghy, 1994). This demonstrates that a significant proportion of compulsive gamblers show ASPD-related traits.

An additional study had similar results. This study concluded that 16.5% of the subjects, all pathological gamblers, had ASPD. In addition, the study also concluded that compulsive gamblers started gambling at a younger age. Finally, this study also compared drug use in compulsive gamblers with ASPD to compulsive gamblers without ASPD. Table 1 details the

results of the study, which compares drug usage in pathological gamblers with and without ASPD.

Drug	Usage by Pathological	Usage by Pathological
	Gamblers with ASPD	Gamblers without ASPD
Nicotine	89.7%	74.7%
Marijuana	59.0%	26.8%
Cocaine	53.8%	17.7%
Heroin	28.2%	8.1%
Amphetamines	25.6%	3.5%
Hallucinogens	23.1%	2.5%
Sedatives	12.8%	2.0%

**Table 1.** Pathological gamblers with ASPD display higher rates of drug abuse than pathological gamblers without ASPD, even among a diverse set of drugs (*The Worldwide Addiction Gambling Education Report, 2006*).

This also demonstrates the significant prevalence of ASPD within compulsive gamblers. Furthermore, it emphasizes the differences in drug use among compulsive gamblers with ASPD to compulsive gamblers without ASPD. This is important to acknowledge because it suggests that these two subtypes need to be addressed separately.

**Alcohol:** Formally called alcohol use disorder (which includes a level sometimes called alcoholism), alcohol addiction is characterized by consistent use of alcohol that also includes problems with drinking control, continuity drinking alcohol even when problems arise, drinking more to get the same feeling as previous drinking experience, or having withdrawal symptoms from alcohol (Mayoclinic, 2018). In addition, those who have alcoholism are at a higher risk for abusing prescription or illicit drugs (Beach House Center for Recovery, 2018a). In fact, over “2.6 million people with addictions have a dependence on both alcohol and illicit drugs” (Beach House Center for Recovery, 2018b). There are several drugs that are commonly used with alcohol: cocaine, heroin, ecstasy, marijuana, painkillers, antidepressants, and sleeping pills (Beach House Center for Recovery, 2018a).

The term ‘*comorbidity*’ describes the occurrence of at least two health conditions and the interactions between them that can alter or enhance their impacts on the body. Comorbidity can describe the simultaneous presence of antisocial personality disorder and substance abuse. Those with ASPD usually present a lowered impulse control and therefore are more likely to abuse drugs or alcohol (Elements Behavioral Health, 2013). In fact, 90% of all individuals with ASPD abuse drugs or alcohol (Elements Behavioral Health, 2013). Furthermore, those with ASPD tend to begin to abuse drugs and alcohol at an earlier age than those who do not have ASPD (Elements Behavioral Health, 2013). Compared to those

without ASPD, those with ASPD tend to develop more serious abuse problems faster and have more damaging forms of abuse (Elements Behavioral Health, 2013). Lastly, as many as 40-50% of those in substance abuse treatment programs display prominent and numerous enough ASPD symptoms for a diagnosis of ASPD (Elements Behavioral Health, 2013).

#### *Susceptibility to Other Disorders*

One study analyzed how a genetic risk of major depression (MD), alcohol dependence (AD), and marijuana dependence (MJD) contributed to ASPD in men. The study concluded that “the shared genetic risk between MD and both AD and MJD was largely explained by genetic effects on ASPD, which in turn was associated with increased risk of each of the other disorders” (Fu et al, 2002). “People with antisocial personality disorder are also vulnerable to mood problems, such as major depression, anxiety, and bipolar disorder; having other personality disorders, especially borderline (BPD) and narcissistic personality disorders; self-mutilation and other forms of self-harm, as well as dying from homicide, suicide, or accident” (Dryden-Edwards, n.d.). In addition, if ASPD is left untreated, individuals with the disorder are at risk for developing or worsening mental disorders (Dryden-Edwards, n.d.). All of these conclusions demonstrate the frequency of co-occurrence of ASPD with other mental disorders, which is why it is important to address both or all disorders during treatment.

#### *Susceptibility to Criminal Behavior*

Statistics suggest that 50-80% of individuals who are incarcerated have been found to have ASPD (Dryden-Edwards, n.d.). Furthermore, a study concluded that within drug abusers, ASPD was associated with high levels of criminal behavior (Fridell, Hesse, & Billsten, 2007). Both of these findings indicate that those with ASPD are susceptible to criminal behavior, as shown in the criminal history of those with ASPD. This could be due to genetic influences, such as higher impulsivity, or environmental factors, such as an abusive childhood.

#### *Treatment*

Antisocial personality disorder can be treated by psychotherapy. The most effective method of therapy involves long-term therapy, followed by continued outpatient therapy (American Addiction Center, n.d.). Continued treatment is necessary because the disorder sustains over a lifetime. One important factor of the therapy process is a compatible relationship between the patient and therapist (American Addiction Center, n.d.). In fact, a strong relationship is a predictor of a successful treatment. However, this type of therapy is not always effective. If the individual receiving therapy has extreme symptoms or is unable to

acknowledge the severity of his or her problems, the treatment can be unsuccessful (Mayoclinic, 2017).

While there are treatments for ASPD, there are no current treatments that address both ASPD and substance abuse. However, those suffering from both disorders can reap benefits from cognitive behavioral therapy (CBT) or contingency management (CT) (Elements Behavioral Health, 2017). Those going through CBT can learn to manage stressful or challenging situations, and how to apply these behaviors in their real lives (Elements Behavioral Health, 2017). In addition, individuals will receive positive reinforcement for behaviors that are enforced by the treatment; they receive negative reinforcement for behaviors that are not (Elements Behavioral Health, 2017).

The general approach to treatment is a tailored treatment process, which depends on the specific needs of the individual. The National Institute of Drug Addiction found certain factors to demonstrate the highest levels of effectiveness: (1) treatment addressing all needs, not just addiction; (2) treatment continuing for an adequate amount of time; (3) a combination of individual and group therapy; (4) medication use as necessary (2018). While relapses may occur, the individual can still have the potential to recover completely or improve.

An important circumstance for the treatment of both ASPD and addiction is involuntary treatment. According to the National Institute on Drug Abuse, involuntary treatment can still prove to be effective (2018). In addition, one study observed the effect of court-mandated treatment of ASPD and residential substance abuse. The study revealed that court-mandated treatment is more effective because the patients must attend treatment. On the contrary, those receiving voluntary treatment were more likely to drop out of treatment, decreasing the effectiveness of treatment (Daughteers, Stipelman, Sargeant, Schuster, Bornovalova, & Lejuez, 2007).

While there are factors that can increase the effectiveness of ASPD and addiction treatment, there are numerous challenges involved. For example, “individuals with ASPD are often excluded from substance abuse treatment programs due to the symptoms of their personality disorder. Likewise, individuals with a substance use disorder are often excluded from personality pathology treatment because they are often disruptive and uncooperative. Individuals are often told to leave treatment until they have stopped using or have a certain amount of time abstinent from using” (Haase, 2009). This is because most programs are not created to treat the co-occurrence of both antisocial personality disorder and addiction (American Addiction Center, n.d.).

## **Hypothesis**

1. Women need a new diagnostic tool for ASPD.

As stated previously, women exhibit less prominent symptoms of ASPD. As a result, the scores used to diagnose ASPD in the MMPI are a higher threshold for women--it is more difficult for women to score that high on the test.

2. People with ASPD have higher relapse rates due to the lack of specific programs tailored towards people with ASPD and substance abuse.

This is because of the lack of programs tailored toward this specific need. It is important to address this issue because ASPD and substance abuse are commonly co-occurring, meaning there is a significant population with the potential need for this type of treatment.

## **Methods**

### *Objective*

There are two main objectives to test the both hypothesized statements. The first objective (which addresses the first hypothesis) is to determine if a new diagnostic tool for ASPD needs to be created for women. The second objective (which addresses the second hypothesis) is to determine the relapse rates of people with ASPD after drug/alcohol recovery/rehabilitation programs.

### *Subjects*

The subjects will be from different drug and alcohol rehabilitation centers. An estimated 1,000 subjects will be used for this study, 500 men and 500 women.

### *Design*

To begin with, all subjects will go through a clinical evaluation. Professionals will determine if the subject has ASPD or experiences ASPD-related symptoms. Then, all subjects will take the Minnesota Multiphasic Personality Inventory (MMPI).

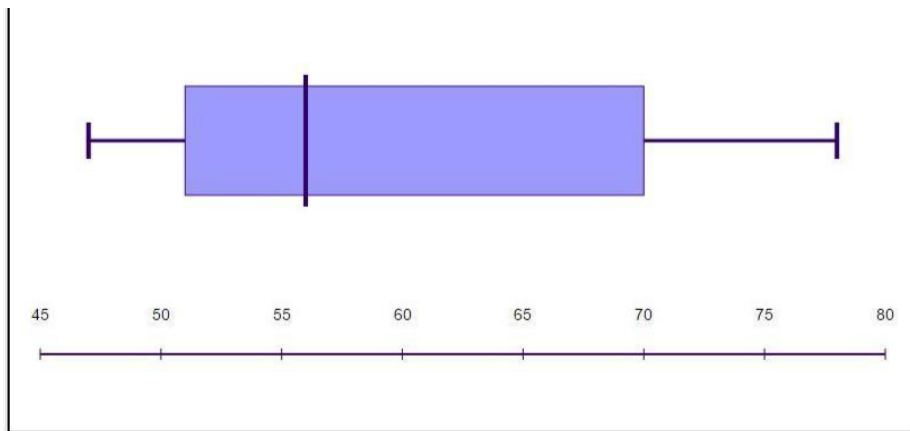
Those individuals who have either been identified as having ASPD from the clinical evaluation or have achieved a certain standard on the psychopathic deviate of the MMP will be used for the relapse study. These individuals will be monitored over a 10-year period. Each year for that time period, those subjects will fill out a simple survey. This survey's purpose is to determine if the subject has experienced a relapse or is going back to rehabilitation. After the 10-year period, the relapse rates from the cohort will be analyzed.

From those individuals who have been clinically diagnosed with ASPD, their MMPI scores will be compared. This will allow the comparison of the scores to determine any significant differences of ASPD traits or symptoms.

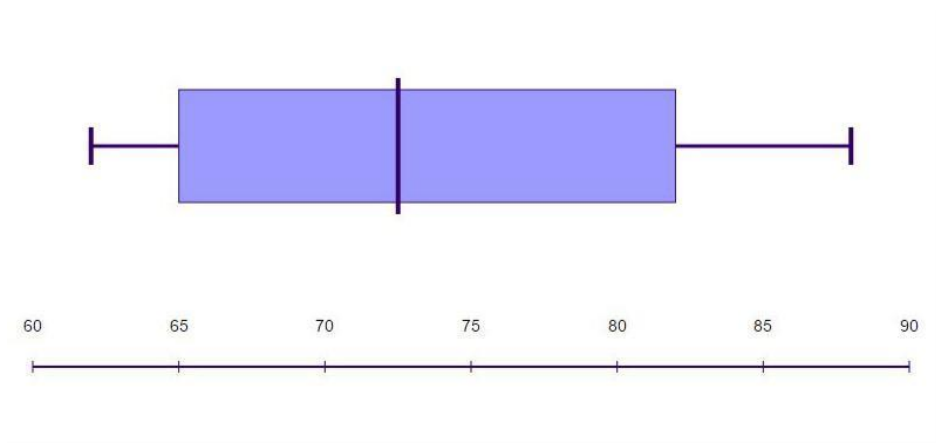
### Results

The results from the MMPI will be used to compare the results from females and males (all clinically diagnosed with ASPD). Each individual's score will be plotted on either a male or female specific box-and-whisker plot. This way, the average scores and ranges of males and females can be directly compared.

If the hypothesis is correct, then the females and males with clinically diagnosed ASPD will compare as follows:



**Figure 3.** Predicted Female MMPI Scores



**Figure 4.** Predicted Male MMPI Scores

These hypothesized results demonstrate that the average (ASPD clinically diagnosed) female scores lower on the MMPI than the average (ASPD clinically diagnosed) male. The quantities for the scores are based on the previously shown psychopathic deviate scale.

The results from the relapse rates will be analyzed using a method used by the Food and Drug Administration (FDA). “The relapse rate for each treatment group was to be calculated as the total number of relapses experienced in the group divided by the total number of days in the study for the group, and the ratio multiplied by 365. This is the unadjusted relapse rate. In addition, the relapse rate for an individual subject was to be calculated as the number of relapses for that subject divided by the number of days the subject participated in the study, and the ratio multiplied by 365. Based on these individual relapse rates, the mean and median for each treatment group were to be presented” (FDA). This analyzation method will present an overall group rate. In addition, by calculating individual relapse rates, it is possible to see the range of relapse rates, which will be visually demonstrated by a box-and-whisker plot.

## Conclusion

The results of the drug relapse rates can yield several conclusions:

1. If the relapse rates in individuals with ASPD are significantly higher than the relapse rates of those without ASPD, then new measures need to be taken to address the issue of comorbidity. It proves that those with ASPD are more likely to relapse, and therefore, more programs need to be created to specifically target the population.
2. If the relapse rates in individuals with ASPD are the same or about the same as the relapse rates of those without ASPD, then it proves that there needs to be no specific treatment difference for those with ASPD. However, it contradicts previous studies showing the difficulty in addressing the issues of comorbidity. Nonetheless, it can help identify the need for intervention.
3. If the relapse rates in individuals with ASPD are significantly lower than the relapse rates of those without ASPD, then this strange correlation needs to be examined further. This is because it contradicts previous studies showing the difficulty in addressing the issues of comorbidity. Those with ASPD are significantly more likely to develop substance addiction, so it is necessary to investigate factors for reducing relapse.

The results of the comparison between men and women can also yield several results:

1. If men and women have similar clinical evaluation and MMPI scores, then it shows that there should be no significant difference in diagnosing or treating women with ASPD. It also proves that the current data is true: women are less likely to have ASPD than men. This could be the result of several genes that contribute to the onset of ASPD being X-linked, since it is more prevalent in men; more research will need to be done on genes, such as MAOA, associated with ASPD.
2. If men and women have similar clinical evaluations but different MMPI scores, then it shows that there should be a significant difference in diagnosing or treating women with ASPD. Furthermore, a new diagnostic tool would need to be created to address women with

ASPD. Many studies and observations of women with ASPD will need to be done to create baseline evaluations for women. However, these will help correctly diagnose women with the disorder, and allow them to receive the treatment and help they need.

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## Descartes' Justification of the Reliability of Memory

Kehui Guo

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### 1. Introduction

*Meditation on First Philosophy*, written by French philosopher and mathematician René Descartes and first published in 1641, demonstrates the existence of God and the immortality of the soul. This book indicates the beginning of modern philosophy and the quote "cogito ergo sum" ("I think, therefore I am"), later becoming one of the fundamentals in the history of philosophy (AT, Volume 7, p. 24-34). In the process of proving the existence of God, Descartes first needs to abandon and doubt everything he has been relying on. Descartes starts off by rejecting "all (his) opinions," thus he does not need to run through all the doubts on everything individually and infinitely (AT, Volume 7, p. 18). Then, he presents three things of which he is skeptical about: the reliability of senses, the illusion in dreaming, and the presence of an evil demon that manipulates people's minds. By questioning the credibility of humans' sensory receptions, Descartes concludes that one's senses are deceptive, and cannot be trusted (AT, Volume 7, p. 18). Afterward, he proposes a scenario where one is dreaming to suggest that the body and the soul are separated and independent (AT, Volume 7, p. 18).

Through denying all previous knowledge, Descartes discusses the nature of the human mind, and how it is better known than the body in the Second Meditation (AT, Volume 7, p. 24). In this chapter, he introduces two arguments: the wax argument and the dream argument. In this essay, I will mainly be focusing on Descartes' dream argument and questioning the justifications Descartes gives to claim the reliability of memory (AT, Volume 7, p. 28). To what extent Descartes succeeds in justifying the argument that memory can be relied on for recalling past events is a question worthy of investigation. This is because this argument is overlooked in the dream argument since Descartes views "memory is reliable" as a premise. The assumption he makes about the issue should be carefully examined because it is critical in order to understand the logic behind his claim, or it will severely undermine the foundation of the dream argument.

In the dream argument, Descartes poses a unique view of how dreams can be so real at times that one may not be able to tell the difference of whether one is dreaming or being awake (AT, Volume 7, p. 20). This view is different from how people normally understand “memory” and how people define “memory.” This is because “memory” should be something remembered from the past reality, instead of recollections from the past dreams (Sherwood, 2015, p. 159). He then calls into question the existence of the material world, but most importantly, he doubts humans’ sensory judgments (AT, Volume 7, p. 34). He claims that our judgments about the material world are mostly based on experience, showing the significance of experience (AT, Volume 7, p. 58). However, if the experience is not the reality, but a dream, then there is the reason to doubt the judgments one makes. In the First Meditation, Descartes includes two stages of response and one of them is about the imagination in dreaming (AT, Volume 7, p. 20). For example, a person might imagine a painting or an image, which is mostly constructed based on real sensation and past memories. Take a black cat as an example; if one wants to imagine a black cat, then one would use the past experience and memory of “cat” and the color “black” to construct the image of a black cat. Therefore, imagination is actually the reconstruction and reorganization of the real things that are stored in one’s memory, and all of those are all based on experience in the real world instead of in one’s dream. Fortunately, at the end of the book, Descartes eventually reaches the conclusion that one can distinguish the dreaming experience and real-life experience by checking the coherency of the content based on one’s memory (AT, Volume 7, p. 90). Nevertheless, he does not clearly justify why memory is reliable or how it is accurate and representing reality.

I will divide the entire paper into three sections: indications and evidence of the assumption that memory is reliable, proofs that show how the assumption is flawed, and counter-arguments which Descartes could propose to defend his stand and justify his assumption.

## **2. Indications of the Assumption: Memory is Reliable**

There are several pieces of evidence showing that Descartes sees the reliability of memory as a premise. At the beginning of the First Meditation, Descartes raises the question on the state of dreaming (AT, Volume 7, p. 19). He says, “As I think about this more carefully, I see plainly that there are never any sure signs by means of which being awake can be distinguished from being asleep (AT, Volume 7, p. 19).” This shows how he understands the concepts of “being awake” and “being asleep.” He meant that there might be no specific and distinct evidence or hint to separate two states, which lead to a dilemma in his thinking process.

## 2.1 Establishment of the Assumption

As many people have experienced at least once in their lives, it is sometimes difficult for people to distinguish the difference between the reality and dream state. Therefore, it will lead to uncertainty about one's existence because one could not know whether one is living in the real world or just inside a simulation. Then, Descartes says, "Suppose then that I am dreaming, and that these particulars—that my eyes are open, that I am moving my head and stretching out my hands—are not true (AT, Volume 7, p. 20)." At this stage, Descartes prepares to accept the current situation and tries to analyze it. By supposing that one is dreaming for all times, he doubts the imaginative part of dreaming and also sensory illusion because what one sees, hears, tastes, feels could all be illusions that are triggered in the dreaming state. This is crucial because it sets the foundation of the dream argument and the entire book—by proving the context that one could distinguish these two states, it could prove the existence of one's soul and its relationship to the body, thus the existence of the material world more over the existence of the perfect God.

Holding this doubt, Descartes further justifies his claim that if senses are deceptive, then it is possible that there is a being that is superior to humankind, whether it is an evil demon or a perfect God that endows the masses with information (AT, Volume 7, p. 36). Proceeding with his arguments, he returns back to the dream argument at the end of the Sixth Meditation. Descartes suggests that there is actually a simple way to find the difference between two states. One huge difference between two states is that the images one formulates in dreams can only make up to bits and pieces of the real experience that combined in novel ways (AT, Volume 7, p. 88).

## 2.2 Difference Between Two States

According to Descartes, there is a "vast difference between being asleep and being awake" because "dreams are never joined by memory with all the other actions of life as waking experiences are (AT, Volume 7, p. 89)." As a result, it indicates that Descartes thinks that the "real" memory is formed while being awake, and one can use the "real" memory to compare with the memory that forms while being asleep to tell the difference. However, this claim is undermined because one could argue that due to the presence of sensory illusion and false memory, it could potentially destroy and distort the "real" memory, and then become mixed up with the sleeping-state memory if the memory is lifelike to a certain extent.

The juxtaposition of one's memory in the "reality" and in dreams can validate one's experience, which thus infers "memory" as the fundamental knowledge of a human being (AT, Volume 7, p. 89). For example, if a person uses the method of pinching his or her face to test whether he or she is awake, then the sensory "touch" and pain are the fundamental elements of this comparison. In Descartes's arguments, he also uses this kind of reasoning

to claim that memory can be the method of checking one's mental state; he ultimately decides that memory is a source that one could trust.

### **2.3 Methods for Distinguishing Two States**

While Descartes explains, "I will suppose: then, that everything I see is spurious. I will believe that my memory tells me lies and that none of the things that it reports ever happened" at the beginning of the dream argument, it does not necessarily provide any of his own justifications regarding the reliability of memory (AT, Volume 7, p. 24). On the other hand, in the Sixth Meditation and the last two paragraphs of the entire book, Descartes says, "I can almost always make use of more than one sense to investigate the same thing; and in addition, I can use both my memory, which connects present experiences with preceding ones, and my intellect, which has by now examined all the causes of error (AT, Volume 7, p. 89)." This quote indicates the final resolution Descartes reaches at the end of the proof. He believes that memory and intellect are two powerful tools for any human being to examine the existence of the self, the material world and God. He defines memory as the instrument that connects present experience with preceding ones, showing that memory is like a series of continuous episodes that are always linked together by certain similarities. Nevertheless, there is definitely a lack of explanation as some people may consider their memory not continuous, and there could be various factors affecting the perception of memories. Furthermore, Descartes asserts that, "I ought not to have even the slightest doubt of their reality if, after calling upon all the sense as well as my memory and my intellect in order to check them, I receive no conflicting reports from any of these sources" by the end of the book (AT, Volume 7, p. 90). By saying this, Descartes emphasizes his trust in both memory and intellect. While intellect is only involved with knowledge given by the perfect God, memory has the uncertainty of mixing up with imagination (AT, Volume 7, p. 34).

Although Descartes stresses memory as the faculty that one can heavily rely on for judging the reality and the truth, he does not provide a clear definition on memory itself and also an explanation or justification of the reliability of memory itself. Therefore, it leads to questions from the reader of this book, who casts doubt on the accuracy and credibility of Descartes' assumption on memory in his dream argument.

### **3. Counter-Arguments of the Premise**

As mentioned in Section One, there is specific evidence indicating that Descartes treats memory as a reliable source to distinguish the dreaming experience and the awakening stage, and also to evaluate one's existence. On the contrary, his premise could be

undermined by considering more specific cases carefully, such as the essence of memory, the involvement of emotions and sense perceptions, and illness.

### **3.1 Definition of Memory from Personal Experience, Literature, and Scientific Paper**

Memory is only knowledge from the past, instead of knowledge about the past. On the opposite view of Descartes' argument that memory is continuous and reliable, a famous novelist Virginia Woolf has described in her novel *Orlando* that, "Memory is the seamstress, and a capricious one at that. Memory runs her needle in and out, up and down, hither and thither (Woolf, Aubert and Haberer, n.d.)," showing that memory and forgetting are untraceable and are always associated with one another. One of the reasons is the way we utilize external methods to record past events can influence our understanding of the real event, no need to mention only having the mind to remember all the information and details.

In people's daily lives, many people consider to have available exterior methods to serve as aids to organize past events in a physical way. In novelist Joan Didion's creative non-fiction, *On Keeping a Notebook*, she describes her own way of recording the events and how it helps her to remember things (Didion, n.d.). Unlike how the majority who usually note down the factual events along with emotions felt at that period of time, she tends to record based on the events, providing context and background information; furthermore, she claims that the way she records events are mostly exaggerated or altered. For example, at the time she transfers the real memory on to her notebook, she decides to alter the emotion, the extent and the gravity of events because she believes that could best arouse her memory when she looks at them again (Didion, n.d.). Unfortunately, she asserts that there are possibilities and experiences that she mixed up in the memory and believed in the "lies" of those exaggerated events. Although she thinks, "the point of (her) keeping a notebook has never been, nor is it now, to have an accurate factual record of what (she) had been doing or thinking," this proves the unreliability of memory because people cannot remember everything they have done even if it might seem memorable and significant at the times of the event (Didion, n.d.).

In addition, one of my acquaintances also expresses her concern in the efficiency of external tools as the aids of remembering things. She usually extracts specific events along with her emotion felt at the times of the event in her diary. However, she believes that languages are limited when expressing emotions. This is mainly because some emotions can only be understood through experiencing the same event and having the same mindset again. As a result, she believes that the external aids do not help with retaining her memory well.

This behavior shows the decrease in ability of the brain to retain memory over time, which is the foundation of the Ebbinghaus forgetting curve hypothesized by Hermann Ebbinghaus in 1885 (Ebbinghaus, 2018). In Ebbinghaus' graph, it shows the relationship

between the accuracy of the memory and the time passed by forming an exponential relation. For instance, although memory retention is 100% at the instant of learning any particular piece of information, it drops to less than 50% within the first few days. Then, the decline slows down and gradually reaches the bottom (Ebbinghaus, 2018). Nevertheless, Ebbinghaus also mentions methods and situations that could affect the memory retention, such as using the mnemonic techniques or employing repetition based on active recall, but these could also be argued because repetition could emphasize certain aspects of the memory and eventually distort it (Schacter, 2001, p. 7-18).

### **3.2 Role of Emotion, Language, Sense Perception, and Imagination**

Emotions, sense perception and imagination can distort one's memory. Since emotion is constantly changing, one could never have the exact same emotion in the past as the present because of the limitation in space and time. Therefore, one's interpretation of the same information will vary both biologically and instinctively (Schacter, 2001, p. 7-18). This is mainly because even with the help from eyewitnesses and external sources such as pictures, notes and so forth, we could never go back to when the event happens and experience the same things again.

Language and memory can also pose restrictions and undermine the reliability of one's memory. For instance, in a psychology study conducted by Loftus and Palmer (1974) that focused on an applied area of memory called the eyewitness testimony, it shows how people's memories are altered because of language. In the experiments, participants first watch a video clip showing two cars coming from opposite direction "a verb" one another. The verb can be "smashed," "collided," "bumped," "hit," and "contacted." Then, they are asked to answer the critical question: what is the approximate speed of two cars, but with different verbs describing the action, such as "smashed," "collided," "bumped," "hit," and "contacted." Eventually, people answer differently due to their previous understanding and education on the definition of those words because certain meanings are already attached to language in the first place. This experiment proves that memory of the education of language connotation based on past experience can influence the reliability of the current memory and affects the credibility of judging things.

Looking at the essence of memory from the sense perception perspective, it is evident in people's lives that we often interpret two-dimensional drawings or images as representing three-dimensional objects. This indicates that people interpret two-dimensional visual input of a real scene as it is from other space because of the inference people's perceptual system makes automatically (Mack and Rock, 1998). This behavior is similar to making an educated guess in order to fill in the gaps and make perception more real and possible. An experiment called *The Invisible Gorilla* done by a group of scholars from MIT shows how people usually overlook obvious things, such as a huge gorilla, when they are following a specific instruction of the number of balls passed by a group of people in the



video because the focus is distracted (Chabris and Simons, 2018). This psychological lack of attention is not associated with any vision defects, instead, it is due to the fact that individuals fail to perceive and anticipate an unexpected stimulus. This experiment demonstrates the limitation in sense perceptions (Chabris and Simons, 2018). Moreover, when an individual faces a situation like looking at an image in two-dimensional space, one tends to use imagination to extend the boundaries of the image (Chun and Marois, 2002, p. 184–189). This is interpreted as a constructive memory error, where one's memory extrapolates the actual view of a scene to a wider angle than it is in the reality (Mack and Rock, 1998).

Examples have also shown that pressure and stress can influence the reliability of memory. In scientific research, it shows that when one is experiencing stress, there is an over-recreation of stress hormones produced, which could impair long-term delayed recall memory; nevertheless, it claims to be enhancing short-term, immediate recall memory (Schacter, 2012, p. 7-18). Although in the period when Descartes lived, there were no publications on the biological study of the effects of stress on memory, it is undoubtable that people must have experienced similar situations. These effects can be explained from a clinical perspective. For example, there are cases where people lost their memories because of severe diseases and trauma (Kuhlmann, et al, 2005). Even though there were no actual equipment or experiments available at that time showing the extent of the influence, meaning that Descartes does not have the access to the science of the contemporary days, people have suffered from neurological cases in the past, and Descartes should have known about the cases where people lost their memory under specific context.

### **3.3 Nature of Memory**

Despite external causes for altering the memory, one's memory is altered due to its basic formation and mechanism. In PBS NOVA show on the unreliability of memory and the creation of false memories called "Memory Hackers," it explains the formation of memory from a biological perspective. Memory is formed because nerve cells communicate by sending electrical signals, and then those signals triggers "the release of chemical across tiny gaps is called synapse (Pbs.org., 2019)." The communication between cells and "transformation among a network of cells" forms both long-term memory and short-term memory (Pbs.org., 2019). Because of the way memory forms, neurobiologists investigate and unveil how the act of recalling a memory makes it vulnerable to change by dissenting human brain and analyzing the behaviors of cells when recollecting a past experience (TV News Desk, 2016). After knowing the nature of memory, the latest in optogenetics, a revolutionary technique, allows researchers to map a specific memory and then manipulate with lasers, suggesting how memory can be controlled and altered to a certain extent (NOVA Memory Hackers, 2016). Karim Nader, a neuroscientist involved in the investigation, believes that memory is more like a computer file that can be changed instead

of a library archive that is stored in its original form throughout time (NOVA Memory Hackers, 2016). As a result, memory itself is subject to alteration easily due to its mechanism of formation, making it unreliable to depend on.

### **3.4 Role of Repetition**

False memory can be formed by repetition. Take my experience as an example, I once heard from my acquaintance saying that a teacher of mine was married. Through constant recalling and retelling, this piece of information was repeated in my mind for so many times that eventually I truly believed this “rumor.” However, I later found out that the information was false when I confirmed with my teacher. This real-life experience illustrates how repetition of external information can eventually become one’s intuition. This intuition formed by repetition will further strengthen the reliability of that information in one’s memory and becomes the “reality” in one’s mind. When dreaming, the information in the dreaming state can be formed based on one’s memory about the reality. As I once dreamed of a person chasing me down the street I go home on every day, it seemed to be unrealistic for me in the beginning. However, this event appeared in my dream multiple times and I had also tried to recall the event many times that I ultimately believed that it really happened. In the end, I verified with my mother and found out this could be purely my imagination and a dream, yet I am still unsure about the credibility of it.

### **3.5 Nature of Dream from Films**

The experience when one is in the dreaming state could be so real that it can be combined with the memory of the real experience. If one examines the repetition of memory further, one could see the potential that memory becomes a replica of the “reality;” in another word, it forms to be the simulation of the “reality” when the memory in dreams is real enough. In the movie *The Matrix*, it depicts a dystopian society where the reality perceived by the majority is actually a simulated reality called “the Matrix,” which is created by machines to subdue the masses while their bodies are used as battery for the real world (Miller, 2002). In the production of this film, they claimed that parts of the movie are inspired by Descartes’ First Meditation in the book *Meditation on First Philosophy*, where the production of malicious machines in the movie symbolize the evil demon that deceive people by creating an illusion (Miller, 2002). In the “dream world” present in the movie, people have no doubt about their own existence and the existence of the material world because they firmly believe in the world they live in is the reality. This is because the simulation is so real and life-like that people are not able to distinguish the difference. Although the film exaggerates this phenomenon, it can be applied to people’s daily lives as well because there must be cases when people have a dream that is so real and eventually is indistinguishable from the memory of the “reality.”

As a result, although Descartes says that there is a “vast difference between being asleep and being awake” , and one can use memory, “which connects present experiences with preceding ones” to examine “all the causes of error,” the premise is significantly undermined by carefully considering various factors, such as the involvement of emotion, imagination, sense perception, language, biological behaviors and so forth (AT, Volume 7, p. 89-90).

#### **4. Defense from Descartes' Stand**

While there are many debates regarding the validity of Descartes' premise, some signs have also shown the values in taking this assumption. In addition, Descartes himself has also replied many of these objections. In the Third Set of Objections and Replies, Descartes claims that, “The term ‘independent’ is simply the memory of my own ideas, which began at different times and hence are dependent (AT, Volume 7, p. 187).” This statement shows that how Descartes defines “memory” is different from how people usually understand. While people in the contemporary days use “memory” to refer to what our mind stores, which is related to a range of other sources of knowledge, such as sense perception, imagination and so forth, Descartes uses “memory” as something that is independent and free from the influence of the external factors.

##### **4.1 Justifications from *Objections and Replies***

In the Fifth Set of Objections and Replies, Descartes replies to the doubts on the reliability of memory by arguing that, “One has no reason to think that one has previously noticed all the circumstances in which error can occur (AT, Volume 7, p. 264).” In addition, he thinks that, “As long as we are really awake we cannot doubt whether we are awake or dreaming (AT, Volume 7, p 230).” These two claims indicate Descartes' stand on memory. He believes that there are no possibilities that error could ever occur in memory, which refutes the counter-arguments presented in Section II since he has already excluded the influence of the other factors.

Furthermore, Descartes notes that, “Everything that anyone clearly and distinctly perceives is true, although the person in question may from time to time doubt whether he is dreaming or awake, and may even, if you like, be dreaming or mad (AT, Volume 7, p. 310),” which means that the information we perceive is all clear and distinct, and given from the perfect God, thus there is no reason for us to doubt the credibility of it. Nevertheless, errors and doubts still exist because we sometimes cannot distinguish the difference between two states, yet it does not mean that the information in memory is inaccurate and unreliable (AT, Volume 7, p. 68). This could be a defense from Descartes' perspective because it shows how people's false understanding or logical fallacy could affect the accuracy of information;

however, “clearly and distinctly perceived” information has great values (AT, Volume 7, p. 68).

In the Final Objection, one doubts Descartes’ premise that, “Dreams are never linked by memory (AT, Volume 7, p. 195).” One questions that what if a man is an atheist, who does not believe in the certainty and existence of the perfect God, then whether or not it means that this man is awake on the basis of memory of his past life (AT, Volume 7, p. 195). In reply, Descartes defends himself by stating that although an atheist could infer that he is awake, he cannot know the “criterion is sufficient to give him certainty since he does not know that he was created by a non-deceiving God (AT, Volume 7, p. 196).”

From all the statements Descartes has presented both in *Meditation on First Philosophy*, and in the Objections and Replies, one can infer that Descartes could have defined “memory” different from what people commonly understand it in the modern days. For Descartes, “memory” is perceived as not what things we remembered from the past experience, but instead, it is rather the information that is given by the perfect, non-deceiving God. Therefore, since the information is clearly and distinctly perceived, which means it is accurate, then if there is any error in memory, it means that it is due to the fallacy in our own understanding and thinking, and also due to the insufficient amount of information we have. This is also similar to how a computer functions. A computer has its original programming and fundamental setup codes, which are accurate and keep the computer functioning, and this is similar to the memory Descartes is referring to. However, while people are using the computer, they might execute certain programs in a flawed way due to the lack of knowledge, and the computer might function in an incorrect manner. Then, it does not mean there is the fault of the fundamental coding; instead, it is due to the external factors and fallacy of the one with insufficient knowledge.

#### **4.2 Justifications from Nature of Knowledge**

Another defense for Descartes is that memory is actually the basis of knowledge. People rely on their memory to recall the things they experienced, education they received and so forth. Without memory, people will not have anything else to rely on, which means knowledge does not exist in that state. By having memory, we then acquire perceptions of time and space, thus if we question all the fundamental knowledge, which are dependent on our memory, then there is no alternative for us to reach any clear and justified conclusion. It will eventually put everything in doubt. While there could be radical skeptics claiming that it is possible that nothing is certain and memory can never be relied on, it is still an acceptable statement by asserting the needs for memory and therefore to acquire other sources of knowledge from there.

## 5. Conclusion

When Descartes presents his dream argument, he makes the assumption that memory is reliable. There is clearly a lack of justification and development of this premise, which gives other philosophers and researchers reasons to doubt the credibility of his argument (AT, Volume 7, p.88-90). In addition, by having shreds of evidence that indicate memory can be unreliable as time passes by, or due to the interference of emotions, diseases, imagination, sensory illusions and so forth, it questions the foundation of Descartes' dream argument. While Descartes replies to the objections by claiming a different way of defining "memory" from how people read it, it still undermines the credibility of his work. Due to the significance of the dream argument in Descartes' work, this flawed assumption could significantly undermine his proof of the existence of the material world and that of the perfect God (AT, Volume 7, p. 88).

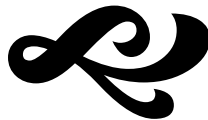
For further research, one could potentially examine more information regarding how Descartes defines "memory" and how "memory" is used in various ways in order to acquire a better and deeper understanding of Descartes' thinking. In addition, there could be more research done regarding the reasoning methods of Descartes. This is because, in this book, he stresses the importance of having "clearly and distinctly perceived" information, and uses this property to prove the existence of the perfect God. Nevertheless, it can be seen as a circular reasoning that is done without sufficient explanation on this logic (AT, Volume 7, p. 66-69).

Throughout history, there are countless philosophers, historians and researchers who analyzed and casted doubts on the fundamental belief presented in *Meditation on First Philosophy*. However, there are undoubtedly many significant insights that provide people a wider angle and more perspectives in the thinking regarding ourselves and the entire universe, which is worthy of exploration and recognition.

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## **Structures for Women's Empowerment: A Metaethical Analysis of Institutional Sexism in Modern History**

Lobna Jbeniani

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The difference between men and women is like that between animals and plants. Men correspond to animals, while women correspond to plants because their development is more placid and the principle that underlies it is the rather vague unity of feeling. When women hold the helm of government, the state is at once in jeopardy, because women regulate their actions not by the demands of universality but by arbitrary inclinations and opinions. Women are educated — who knows how? — as it were by breathing in ideas, by living rather than by acquiring knowledge. The status of manhood, on the other hand, is attained only by the stress of thought and much technical exertion.<sup>1</sup>

The discussion over women's position in society has known influential shifts in content and rhetoric throughout modern history. With prominent thinkers, philosophers, and politicians weighing in with their opinions and beliefs on the matter, we find ourselves compelled to follow the trail of these decisive yet controversial ideas; the very ideas that have long influenced the way women are perceived and treated in society. In his work 'Elements of the Philosophy of Right'<sup>2</sup>, Georg Wilhelm Friedrich Hegel puts forth some of these misogynistic ideas as he explores the rigid yet fundamental dichotomy between men and women and proceeds to delineate the grounds of his rationale. Hegel's binary dialectic puts women in an inferior position relative to their male counterparts. Men are naturally wired for progress and women are naturally wired for stagnation. Men are active agents in political, scientific, and socio-ethical advancements while women are mere spectators. Men are

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<sup>1</sup> Hegel, Elements of the Philosophy of Right, § 166, 167

<sup>2</sup> It is important to point out that Hegel discussed his views on women in several of his works including Lectures on Aesthetics and The Philosophy of History.

animals and women are plants. This excerpt successfully associates men with the active pursuits of knowledge and skill and women with the potent propensities for passivity and mediocrity, a juxtaposition that communicates a focal idea: *men are givers and women are receivers*.<sup>3</sup> The idea that men are inherently active and women are inherently passive has been perpetuated in countless literary works across several academic disciplines and practical fields. This drives our presumptions towards a key realization: the distinct metaphor Hegel is presenting in this excerpt is not merely a mirror of gender-based societal relations as he perceives them, but as they are seen by many, if not most. To Hegel, and many other prominent thinkers, the simple fact of being female is almost synonymous with being intellectually and morally incapacitated to hold positions of complete autonomy or power. Women are incompetent to the extent that imagining them in governmental positions ought to prompt distaste, if not outrage. Hegel does not limit his diagnosis of these defects in women to their ‘placid development’ or ‘arbitrary inclinations’: his mythicization of the female mind and mystification of the female intellect are undeniable as he poses the question of ‘Who knows how?’ with regard to women’s knowledge. It becomes clear, therefore, that women, to Hegel, are intellectually and morally inept. This conveys that the roots of Hegel’s anti-feminist assertions are not based on sentiment but on belief. In light of similar views portrayed by Immanuel Kant<sup>4</sup>, Friedrich Nietzsche<sup>5</sup>, and many other influential thinkers and philosophers, it is fair to say that Hegel’s view of women is not exactly groundbreaking nor intellectually adventurous in his era. If anything, it is a candid representation of the commonly-held beliefs and perspectives pervading the literary and philosophical endeavors of the 18th and 19th centuries.

The discernible misogyny which lies at the core of this philosophical school of thought is, by means of merit, extensively influential to the societal structures we know today. The roots of this misogyny, however, do not only lend themselves to the ideological edifices of philosophy but are equally entrenched within religious teachings and scripture. When delving into the way these anti-feminist ideas have been internalized within religious scripture, one would realize that they are not merely at the surface of devotional teachings, but are rather intrinsic to the religious fabric itself. It is important, therefore, in our related pursuits that we take into consideration that the discrepancies we see in how men and women are depicted and treated by religious scripture and teachings are nothing but the incremental consequences of an unshakable core ideology. This is particularly discernible in Abrahamic religions as one cannot deny the ascendancy of masculine

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<sup>3</sup> Sara Davis, “Hegel on the Differences Between Men and Women”, <https://bit.ly/2CuWrOf>, (accessed August 2018)

<sup>4</sup> Kant professed his unsettling views on women and their position in society in his Lectures on Logic. In this sense, he affirms that “There are sciences which require a sharp mind, much reflection, and profundity. These are for the male sex. On the other hand there are sciences that require wit and a kind of feeling, and these are proper for women.” (Lectures on Logic, §5, 17)

<sup>5</sup> In many of his prominent works, Nietzsche unapologetically put forth his condescending sentiments and patronizing beliefs with regards to women. These views are especially grasped in his 1886 book *Beyond Good and Evil*.



figures over their feminine counterparts. This evident hierarchical dichotomy began as early as the establishment of the faith itself:

*No longer will you be called Abram; your name will be Abraham, for I have made you a father of many nations.<sup>6</sup>*

The word 'Abraham' sounds similar to the word אב המון גוים (*ab hamon goyim*) in Hebrew which implies a particular understanding: *Father of many nations*. In this sense, God is assigning Abraham to a position of supreme power on earth. By means of induction, Abraham is not simply an individual exercising government and dominance amongst people, but one who perceives and treats them as his children. With regards to his own mandate, Abraham is, therefore, compelled to exert an inevitable vertical control with regards to both men and women. Once again, women find themselves in a situation where they are compelled by incontestable laws -of divinity this time- to be placed at an inferior position to men and follow their instructions wholeheartedly. The dilemma, we may argue, is not only that of an observable supremacy of men over women but that of a deliberate and unabridged marginalization of women and their opinions in the very process of decision-making at the implementation of this very supremacy. This law, being passed by God to man, in light of a full disregard of women, is inherently purblind to women's moral and intellectual capacities. In other words, women are born into a world where decisions that are made by men translate to laws coined by men, reinforced by men.

These ideas do not limit themselves to the written scriptures but evidently seek to extend towards conscious enforcement within all realms of the human experience. This is where the religious teachings come to play, for they provide distinct and palpable pathways for these ideas to translate from mere words on paper to well-defended beliefs and, later on, consistent patterns of action. It becomes comprehensible, then, that the role of religion, in this case, is not only that of a vital source of chauvinistic standards but an active agent in sustaining and furthering the patriarchal agenda itself. To think that theological notions are thoroughly fused with misogynist paradigms disguised as virtuous ideals is exhaustively pertinent to better understand the intensive yet broad-ranging nature of patriarchy in today's world. Religion is, by all means, the operative heart of the body of our society and is, in this account, the leader of all decisions emanating from our collective devotional spirit. This pivotal role played by theology with regards to the birth and flow of anti-feminist ideas and, consequently, the emergence and extension of decisions that are based on these very ideas is only complemented by the equally problematic philosophical archetypes of thought and judgment. In this sense, religion and philosophy, despite them being two distinct schools of thought, heavily reinforce each other with regards to instilling and nurturing the misogynist agenda. Philosophy with its deliberate pursuit of argument within rationale and religion with its

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<sup>6</sup> Book of Genesis 17:5, Bible

relentless investigation of truth within the boundaries of faith are two parallel lines of reason, two distinct ideological foundations. These two fields of knowledge, however, join together to express a shared disparaging opinion of women. Philosophy and religion, being the head and heart of our societal entity, give both structure and legitimacy to patriarchal despotism.

This particular understanding of the issue draws forth a compelling analogy: with religion as the macho heart of our society and philosophy its macho mind, women are left to be the body. Once again, in the progression of this ideological dilemma, women are cheated out of royalties of the heart and mind. Once again, women are cheated out of the capacity to make any sort of influential decision. In many ways, and following the prospects of this analogy, women are blind followers of men in the same way the body is a blind follower of the heart and mind. This ties closely to Hegel's reasoning, for once again, men are givers and women are receivers. Let us not be mistaken, however, that even in this warped way of thinking, we as a society cannot comprehensively do without women. Even in the poor logic that assigns women to the body, women are still fundamentally critical to the survival and well-being of the societal entity. Philosophy and theology, being the fundamental contributors to politics and society as well as mirrors of socio-ethical advancements hold a shared overriding standpoint in influencing public opinion and shifting the collective consciousness to this day. With anti-feminist ideals having been unapologetically held and professed amongst some of our greatest philosophers and religious thinkers, and with misogynist notions having been inscribed onto our theological records and scriptures, we are driven to suspect that our modern society is infested with these regressive principles of thought. Today, we can discern that what seems to be the zeitgeist of a bygone era at first is still, to a large extent, entrenched within the realms of our modern society. These patterns of ideas and constructs, when joined together, fall into the system of institutionalized sexism, also known as patriarchy.

The word patriarchy originates from the Greek πατριάρχης (patriarkhēs) which literally means 'the rule of the father' and is composed of πατριά (patria) which translates to lineage or descent, πατήρ (patēr), Greek for father, and ἄρχω (arkhō) which translates to rule. The word was first put to use in 1630 but was only employed heavily in the early 1960s, which coincides with the spread of the second wave of the feminist movement.<sup>7</sup> Despite being heavily used only recently as a word, patriarchy as a concept does not lend itself to a particular point in history. For as long as we can discern, it has been embedded within our collective consciousness, entrenched in the judgment of our greatest thinkers, and woven into the fabric of our long-established political and societal foundations. In light of our progressive pursuits, it is important to scrutinize these beliefs and recognize not only their relevance in today's world but their significance to the female empowerment structures we hope to erect.

We, as an educated theologically-oriented community of the world today that has long been nurtured by women, have the tendency to devalue these very women by depriving them

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<sup>7</sup> Patriarchy. (n.d.), <https://bit.ly/2EcJSsz>, (accessed August 2018)

of opportunities for their empowerment because we allow our long-held patriarchal structures and blatantly sexist principles to govern the way we perceive and treat the female figures in our lives. By upholding these anti-feminist standards, owing to the fact that they're at the core of all power structures, we as a knowledgeable and religiously-inclined society do not only further perpetuate the idea that men are active givers and women are passive receivers, but we also deprive women of their right to a just and equal representation in society. In order for us to satiate the ever-growing patriarchal forces that have long invaded our societal structures and dictated our reality, we as people who take seriously our faith and reason, have a propensity to trivialize women's role in society by alienating them from opportunities for personal and socioeconomic empowerment.

For instance, we allow governments and public policy to literally take control of women's bodies and their reproductive rights. In many countries around the world, including those which we would consider to be socioeconomically advanced, abortion is still illegal and punished by law. Women living in Andorra, Malta, San Marino, Angola, Congo-Brazzaville, Congo-Kinshasa; Egypt; Gabon; Guinea-Bissau; Madagascar; Mauritania; São Tomé & Príncipe; Senegal; Iraq; Laos; Marshall Islands; Micronesia; Palau; Philippines; Tonga; Dominican Republic; El Salvador; Haití; Honduras; Nicaragua; and Suriname<sup>8</sup> cannot legally terminate a pregnancy. To make the situation even more difficult for women living in the listed countries, these bans do not take into consideration the special circumstances surrounding some of these pregnancies; many of these instances concern women's health being endangered by the pregnancy or situations of rape or incest.<sup>9</sup> Women would find themselves resorting to clandestine methods which, more often than not, end in serious injury if not death. Taking the case of Egypt, which is considered to have one of the most restrictive legal policies with regards to abortion, we find that these bans were not based on any plausible legal reasons. If anything, we would come to the realization that the legal limitations on abortions are merely results of the cultural mores and religious backgrounds of the country. These restrictions which subject women around the world to severe health hazards tend to be driven by other overruling systems of beliefs. It is fair to say, then, that similarly, in this situation, we are prioritizing systems over people. In other nations, the restrictions on women's healthcare and the attempts to control women's physiology do not limit themselves to a ban on abortion, but extend towards bans on means of contraception as well. In Ireland, contraceptives were banned between 1935 and 1980. Today, many women do not have any access to means of contraception, especially those living across the African continent and Southeast Asia.

Again, for instance, within our own families we perpetuate notions that deprive women of opportunities that are assumed as a given for their male counterparts. Family as the micro

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<sup>8</sup> World Economic Forum, "The Many Countries Where Abortion is Still Banned"

<sup>9</sup> It is noteworthy to clarify that women living under such circumstances are allowed to travel to neighboring countries that allow abortion as one of their medical services.

unit of society, the inceptive institution in which all ideas are formed and all beliefs are devised, is still subject to an overruling system of patriarchal ideals. This very set of ideals consigns men to the authoritative ruling position and women to the passive subservient stance. As a consequence, women do not only get deliberately and unapologetically excluded from decision-making in the household but find themselves in a debilitating state of subordination to their male counterparts. This particular state of neglect of women's abilities to hold an authoritative position translates into a number of difficulties that women face within their homes. Women, especially those coming from financially-inadequate homes, become subject to all types of violence. This violence, evidently aimed towards women, is not focused in one specific group or community but traverses countries and cultures. From South Africa to the United States to Nepal, instances of violence against women are assorted and part of a global system of injustice. The same global system that encourages violence against women also hinders them from the opportunity to be formally educated and empowered. Despite the long history of struggle against the male dominance of the educational field, women still find themselves discouraged, if not completely excluded, from seeking a formal education. In Pakistan, young activist Malala Yousafzai was shot in the head by Taliban militants on her way back from school along with her female peers. To this day, women's and girls' education and empowerment in many countries is under serious and extensive attack. It becomes clear, then, that the effects of this long-lasting and overruling system of patriarchy exceed the noiseless efforts of marginalization towards the extreme and troubling cases of violence and sometimes even murder. In reality, these forms of disempowerment, no matter to what extent they may seem to be troubling, are all subsets of a larger, much more potent system. In this sense, one can easily discern the intricate connections that join these divisions into one bundle, one overruling machinery, which is that of patriarchy.

And still again, we as supposed progressive women have the tendency to engage in acts of horizontal violence when we project our normative notions and judgments of what it means to be a woman onto other women who we feel counter that narrative or challenge our own opportunities for social mobility or acceptance. The same women who have been born and raised in a society governed by institutional sexism, are willing to conform and comply with the large-scale male authority and act in accordance with its values by devaluing the opinions of any female figure they know, including themselves. We often find these women effortlessly altering any decisions that may contradict with the overruling male-dominated system and carefully refining their life trajectories so as to stay subservient to the male figures in their lives. To this day, we see women striving to be socially compatible with the feminine ideal and willing to go against their own needs and aspirations in order to attain protection from the unpredictable and uncontrollable male violence.<sup>10</sup>

Again, for instance, our greatest thinkers who are the hallmark of our civilization and

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<sup>10</sup> Prof. Stacey Floyd-Thomas, Institutionalism Sexism Student Handout

the enlightenment which undergirds our highest ideals and educational institutions are equally and actively contributing to this unjust system of patriarchy. Aristotle, the ancient Greek philosopher who has also been known as the father of the field of logic, has been recognized for his anti-feminist rhetoric and ideas. In his own words:

*A proper wife should be as obedient as a slave*<sup>11</sup>

It is plausible to say that the statement above encapsulates Aristotle's perception of women. In this literary excerpt, Aristotle begins by assigning a function to the woman, which is that of being a wife. This instant classification renders women to the regressive societal standards and the female ideal. To stress the matter, Aristotle further delineates his view by putting forth virtuous prospects, and these are stemming from the woman's ability to be as obedient as a slave. Beyond the palpable and explicit patronization of all women in this statement, the core issue is that Aristotle is demanding that women change themselves to fit into these poor standards. He is not advocating for women to *act* as slaves but *to be* slaves; and with being comes a numbing state of compliance. It is critical to tap into the realization that the issue with Aristotle's statement is not limited to Aristotle's statement but extends towards other realms in society. This is poignantly palpable within our own understanding of women and is at the basis of both our explicit and implicit biases. The issue here extends across socioeconomic and socioethical structures, infesting our means of communication and hindering our ability to perceive women as anything but inherently defective.

Last but not least, our religious scriptures, the paramount testimonials to our communal character as a knowledgeable theological society, are overrun by blatantly sexist ideologies. It becomes crucial, then, to consider these obvious misogynistic theological ideals in light of the obvious misogynistic philosophical ideals. Above and beyond that realization, we must understand that the other enterprise that gives the philosophical enterprise weight is that of religion. In this sense, if there is anything that encourages the patriarchal notions that have long been held and professed by influential philosophers and thinkers, it is that religious scripture legitimizes it.

As long as we continue to perpetuate these misogynistic notions concerning the women in our lives, we construct a false reality in which men are physically, intellectually, and morally apt while women are incapacitated to exceed immediate tasks and overly-simplistic, non-intellectually-challenging topics. In this sense, we start to perceive and later on treat women as inferior to men by imposing legal restraints on their innate freedoms and implementing societal measures that enforce this conceptual inequality. As long as we perpetuate this anti-feminist practice, we misperceive the actual care and support we rely upon for our society's welfare from the women in our lives which will soon enough cause us to lose the trust that women have long granted us. In our distorted and generalized depiction

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<sup>11</sup> Aristotle (384-322 BCE)

of women's character, we tend to entirely disregard the rigorous efforts that women make in order to give and sustain life. It becomes clear, then, that the issue is not merely an issue of women being categorized as inferior to men. It becomes clear that, in order of importance, we have chosen to place patriarchy, a system of poor ideals, above the women in our lives. It becomes clear that we have prioritized a system over an individual. In this sense, women become not only inferior to men, but inferior to this defective mechanical structure and are, therefore, dehumanized. Without the contributions of women in our lives, we will find ourselves unable to sustain what we consider to be vitally necessary. In favoring an indoctrinating machinery to the women that have devoted their lives to nurture and support us, we as educated individuals that often find ourselves in positions of power will end up living a reality similar to that of an organism grappling with muscle atrophy. In our relentless and misguided attempts to conform to the system of patriarchy, we are causing our own disintegration. Patriarchy is the chronic atrophy, a diseased system taking over the body of society, deteriorating it to bits, eradicating it slowly and incessantly.

Therefore, since we have said that we, as educated theologically-oriented individuals who have long been nurtured and cared for by women, have the tendency to devalue these very women by cheating them out of opportunities for their empowerment because we allow our long-held patriarchal structures and blatantly sexist principles to govern the way we perceive and treat the female figures in our lives; and since it is obvious that each of us has a deep concern in resolving this crisis, we must now stake the claim that we need to dismantle the patriarchy in all of its death-dealing forms and structures. This mandates that we as people of head and heart must consider deeply the weightier matter of the structures for women's empowerment in terms of some basic questions about the fair and impartial representation of women in literary works and religious scriptures as well as their equal treatment within larger society in our efforts to resolve the present moral crisis in which we find ourselves. We must strongly convey impartial reasoning, conceptual and practical consistency, as well as an unbound willingness to tackle these deep-seated issues relating to the blatant trivialization and discrimination against women in our society. Therefore, it is my contention that we as people who are led by our faith and reason must become willing to untangle the intricate deeply rooted structures of patriarchy in our current society as well as erect edifices that respond directly to the mission of empowering women by means of deliberate exertion. Structures for women's empowerment are crucial to this potent shift of collective consciousness as well as the radical alteration of our commonly-shared actions, and there are three fundamental points that will lead us towards a society that is both desired and realistic.

### **An Examination of the Consequences of Patriarchy**

The first step in erecting comprehensive *Structures for Women's Empowerment* is the recognition and meticulous investigation of the consequences of patriarchy. An examination

of the consequences of patriarchy entails the identification of the existing implications of the male-dominated power system by scrutinizing the current trends of violence and injustice in order for us to outline a plan of action that is both firm and devised. By engaging in an even-handed process of analysis with regards to the ongoing gender oppression in society, owing to the fact that these very behaviors are the fuel to the survival and progression of patriarchy, we find ourselves compelled to decipher the forms and patterns of injustice with regards to women. As is the case in handling any moral dilemma, in order for us to dismantle the overrun machinery, it is of pivotal nature that we tap into an exhaustive understanding of its different structures as they manifest, for that will further align our understanding with the reality of the issues. In reality, and against popular belief, these oppressive trends against women do not start at the point of physical violence and are certainly not limited to it. If anything, they form an expansive pattern of hostile and derogatory behaviors that evolve towards severe violence, rape, and even murder. In many ways, this pattern resembles the progression of the Fibonacci sequence in mathematics, with every act being the sum of the few preceding ones. This particular understanding of the matter re-emphasizes that violence is the apex of a much larger internalized body of oppression, which implies an evaluation that approaches violence from an unenclosed perspective. In this sense, we find ourselves tracking down the divisions of patriarchy at the root. This progression, most importantly, is best studied when put into its societal and historical contexts.

For instance, oppression begins with our unconscious expressions of sexism, which may display through acts and comments that we perhaps consider to be innocuous and inconsequential.

We tend to project our entitlement to this larger patriarchal system by vocalizing hostile comments that are deeply rooted within our intimate perceptions of females in all camps as being the deservedly marginalized group. Women in the workplace often find themselves subject to such verbal belligerence disguised as a behavioral norm. Women are often told that they're too hormonal, too sensitive, and too emotional as a way to halt their personal and professional empowerment. We can easily observe these behaviors in the way we tend to perceive and address outspoken women. In her latest speech for Global Citizen, Chimamanda Ngozi Adichie pointed out the double standard that lies at the basis of our perception and judgement of women with regards to their male counterparts. In her address, she voiced these concerns and brought forth that:

In our world a man is confident but a woman is arrogant. In our world a man is uncompromising but a woman is a ball breaker. A man is assertive, a woman is aggressive. A man is strategic, a woman is manipulative. A man is a leader, a woman is controlling. A man is authoritative, a woman is annoying.<sup>12</sup>

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<sup>12</sup> Chimamanda Adichie, Global Citizen Speech 2018

What is particularly significant about this speech is not the exposure of the truth itself, but the brutality with which this truth was brought forth, a brutality that is necessary for us to form an accurate understanding and develop a profound awareness of these long-lived issues. In reality, these microaggressions often pass by us unheralded, unheard, and unseen due to our numbing unfamiliarity with their potential consequences, and our incomprehensiveness of the fact that they are, too and to a large extent, patriarchal. These instances of oppression, no matter how micro they may be, are at the root of a much larger system; and these examples of oppression, which target the psychology of women as a disenfranchised group, can be either implicit or explicit, intentional or unintentional. This may envelop these blatantly sexist practices in a subtle layer, which renders it difficult for many of us to pinpoint them as microaggressions and classify them as a legitimate part of the patriarchal machinery or as manifestations of a larger oppressive agenda. In this sense, we as a society find ourselves normalizing these daily practices, and occasionally justifying them. These acts, despite being on a smaller scale and of a seemingly frail impact, leave women with profound and long-held psychological damage. In reality, the ripples of these outwardly miniscule practices extend towards the practical spheres of our world, affecting our means of reflection and expression to the point that even our language is inherently subjugated by an underlying misogynistic agenda. In the French language, for instance, the noun “un courtisan”, which translates to “courtesan” in English, refers to a male figure who has been ascribed to the court of a monarch, an undoubtedly elevating connotation. The feminine form of the same noun, “courtisane”, refers to a woman prostitute. In another example falling under the same subject matter, the noun “entraîneur” when assigned to a man translates to “coach”, while “entraîneuse” which is the female form of the same noun refers to women who would engage in sexual acts for payment. This sweeping discrepancy in the way genders are regarded in the French language does not limit itself to those terms but extends itself to the terms “gagneur”<sup>13</sup> and “gagneuse”<sup>14</sup>, “péripatéticien”<sup>15</sup> and “péripatéticienne”<sup>16</sup>, “professionnel”<sup>17</sup> and “professionnelle”<sup>18</sup> and there are many other instances in the French language.<sup>19</sup> The most striking facet of this deliberate disparity is that feminine nouns, in all of these examples, denigrate women by assigning them to abhorrent functions, and eventually stripping them of their moral capacities. In a principled and religiously inclined society such as ours, these attempts to abase women on the basis of morality result in strong collective disdain. One may

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<sup>13</sup> Gagneur, in French, means winner.

<sup>14</sup> Gagneuse, is the feminine of gagneur in French. However, it means prostitute.

<sup>15</sup> Péripatéticien, in French, refers to an individual closely involved with the peripatetic school.

<sup>16</sup> In French, péripatéticienne translates to prostitute.

<sup>17</sup> Professionnel means a professional in French

<sup>18</sup> Professionnelle, the feminine term to professionnel, refers to a lady who is sexually experienced

<sup>19</sup> “Pourquoi La Langue Française est Sexiste”, Catherine Ardit



argue, at this particular point, that such connotations are relatively inoperative due to their supposedly implicit nature. To this we may respond that subliminal discourse is as crucial as direct communication with regards to our understanding and ultimate interpretation of the world. Subliminal discourse is also powerful in immobilizing women and preventing them from defending themselves. When even language is inherently defective and strongly biased towards women, we are compelled to think that it contributes towards the overall state of helplessness where women often find themselves. If anything, the realization that we, a rational society, have been conditioned to uphold and occasionally defend these semantic biases is especially disturbing. To these ends, one realizes that language, being tampered with in ways that restrict empowered feminine discourse, transforms into an influential, unsupervised tool of oppression. It is significant to shift our focus, then, towards the incremental implications of these seemingly harmless instances. One may argue, at this point, that the severity of microaggressions as an issue lies in the fact that they usually do not stay as microaggressions but develop into acts of a wider spectrum and weightier gravity.

Again, for instance, we find that patriarchal approaches and inherently sexist ideals branch out towards evidently institutionalized discrimination and bias against women, especially when it comes to their position in the workplace. These biases, be they explicit or implicit, are entrenched within a collective conviction of women's inferiority and proceed to delineate a consistently unfair course of action towards women and their professional presence within institutions. In August 2018, Tokyo Medical University, one of Japan's most prestigious medical schools, admitted intentionally manipulating entrance exam scores for over a decade in order to restrict the number of female students and ensure that more men had access to the opportunity of pursuing medical studies.<sup>20</sup> What is most striking about this incidence, perhaps, is the fact that it carried on for a long time before being officially halted. This emphasizes the pervading collective numbness to these issues, which hinders our ability, as a society, to closely evaluate and judge situations of gender-based discrimination. This realization, at its core, alludes to another important point: the wide spectrum and multiple dimensions of discrimination with regards to women project their gravity in the very normalization of these very behaviors. In this sense, seeing sexism everywhere around us renders it not only normal but, to an extent, justified, and in instances, encouraged. As a result, we as people of reason and faith find ourselves congested with these reinforced structures and normalized practices, and, therefore, numb to their present gravity and future ramifications. It is equally important at this point to recognize the underlying yet roaring violence within these seemingly un-violent acts of discrimination. In order for us to do so, however, it is critical that we tap into one key realization: patriarchy, in all of its formations, is inherently violent. A potential question may rise at this particular stage to request a clarification of the difference between the violence women encounter through discriminatory acts and that encountered

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<sup>20</sup> Justin McCurry, "Tokyo medical school admits changing results to exclude women", *The Guardian Online*, August 2018

through actual physical aggression. The answer to this question lies at the core of Jean-Paul Sartre's philosophy with regards to colonialism. In the preface to Frantz Fanon's *The Wretched of the Earth*, Sartre wrote: "Violence in the colonies does not only have for its aim the keeping of these enslaved men at arm's length; it seeks to dehumanize them."<sup>21</sup>

In the excerpt above, Sartre delineates the drastic harm that colonialism inflicts on indigenous individuals. One may state at this point that Sartre's view of colonialism, despite it only involving the colonialist system and structures at the time, is congruent with the discernible aspects of misogyny in today's society. In this sense, his conviction of the dangers of the endemic violence in colonies may be assimilated in light of the threats of misogyny on women and society at large. We can easily draw a bold parallel between the tools of psychological violence used to dehumanize the indigenous through the colonialist machinery and those used to disempower women through the patriarchal system. In the same way that the indigenous are kept disenfranchised, at arm's length, and hindered from reaching a collective state of autonomy, women are collectively oppressed, marginalized, and kept out of decision making positions by state and institution sanctioned violence. In this sense, we come to the realization that acts of discrimination against women are at their core acts of dehumanization. This dehumanization, according to Fanon, trickles down the collective consciousness of the oppressors, offering them a guilt-free margin. It serves as a premise for the violence they're about to inflict on the indigenous people. Dehumanization could be unbinding, to an extent, from the heavy weight of culpability falling on the shoulders of the oppressor. One who does not admit their cruelties may never have to carry around the load of responsibility or consider placing their actions on a moral scale. Similarly, choosing to place women inferior to the patriarchal machinery results in an unbinding dehumanization, an unshackled oppression, an unapologetic despotism. At this stage, one can clearly state that violence is, indeed, entrenched within the operating tools and instruments of institutional sexism. At times, one may argue out of conviction that violence, unfiltered, becomes the very tool.

Still again, an amplification of these systems of oppression stems from men's relentless pursuit of power paired with a collective conviction of entitlement. This strong conviction translates into bitter acts of both physical and emotional violence towards women. South Africa, for instance, has an unfortunate record of instances involving physical violence which leads it to become a socially pervasive phenomenon in South African society. In a country deeply scarred by the brutality of apartheid, these acts of violence are considered chronically persistent. According to South Africa's 2016 Demographic and Health Survey, one in five women older than 18 has experienced physical violence.<sup>22</sup> In poorer households, these figures hit an apex with at least one in three women reporting physical or sexual violence. This unfortunate and continuous chain of events is not limited to South Africa but is, disturbingly and to different extents, palpable in other countries, including those which we

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<sup>21</sup> "The Wretched of the Earth Preface", Sartre

<sup>22</sup> South Africa's 2016 Demographic and Health Survey

would consider to be advanced or progressive. In France, for instance, the National Information Service for Women's Rights (CIDFF) estimates that a woman dies every three days due to domestic abuse. In countries like the United States, cases of physical and sexual violence against women sustain steady rates yet remain largely under-reported.<sup>23</sup> Therefore, the extent of this patriarchal agenda, we may note, is substantial in both depth and dimensions. Being culturally and geographically prevalent, these sexist structures inflict both implicit and explicit violence on women globally.

In addition to this vertical violence, which is primarily inflicted by men upon women, one may argue that women themselves are culpable of similar acts of oppression towards other women. In this sense, we tap into acts of horizontal violence, which may be even more aggressive due to the fact that women are best deciphering the means by which they can inflict the most harm. In the workplace, for example, we observe various acts of horizontal emotional violence. As women progress in their careers, they may be under the impression that their particular field or institution would not allow more than one or a few women to succeed in their professional pursuits. This fear, no matter how unfounded it may sound at first, is, in fact, legitimate. Women are often put into situations which reflect mere tokenism. Consequently, women would internalize this oppression and project it upon their female peers to hinder them from achieving their professional goals. These subjugating acts of horizontal oppression may even pass as love. Interestingly enough, mothers are most prone to pass their sexist ideologies to their daughters packaged in a subtle bundle of boundless sentiments of care and love towards these children. The dilemma with this is amplified to reach our mere understanding of love and affection. Above and beyond that realization, horizontal misogyny and internalized oppression, when being mirrored by family members and close friends, are able to shift our definitions of what it means to be loved, respected, and nurtured. As a consequence, we may find ourselves constructing new definitions to these terms, and new grasps of these concepts. To these ends, oppression may pass as love towards women, violence may pass as devotion towards God, and discrimination may pass as loyalty towards tradition. Not surprisingly then, women perceive these expressions of love, faith and loyalty to patriarchy as inextricably linked to what it means to live and survive while female.

Inevitably at this particular stage, it is critical for us to begin by seeking a definition for patriarchy that exceeds the semantic frame. In her book 'Equity or Equality for Women?', Alda Facio, a prominent Costa Rican feminist jurist and author, explores the perceptible outcomes of patriarchy in society and what they mean to the women living in these very societies:

Patriarchy is a form of mental, social, spiritual, economic and political organization/structuring of society produced by the gradual institutionalization of sex based political relations created, maintained and reinforced by different institutions linked closely together to achieve consensus on the lesser value of women and their

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<sup>23</sup> Violence Against Women, World Health Organization

roles. These institutions interconnect not only with each other to strengthen the structures of domination of men over women, but also with other systems of exclusion, oppression and/or domination based on real or perceived differences between humans, creating States that respond only to the needs and interests of a few powerful men.<sup>24</sup>

In this particular excerpt, Facio does not only expound patriarchy in its different forms but proceeds to outline the different realms influenced by the misogynistic agenda. Patriarchy, according to Facio, is an underlying structure, an invading system that plays on the intersectionality of our societal, political, and economic institutions. This intersectionality acts in favor of patriarchy, for its influence on one sphere may directly and incrementally extend toward the others. This fast expansion of sexism within the fabric of our larger society drives the degradation of our collective moral capacities.

As long as we continue to mirror these morally defective and inherently misogynistic ideals, we will be incapacitated to act against the chronic atrophy devouring our societal body intrapersonally, institutionally and intimately through state-sanctioned violence. It becomes necessary, then, that we reverse the seemingly inevitable course of action of this chronic disorder by means of radical and devised alteration of our perceptions, approaches, and means of interaction with regards to women. Only then will we be able to regain our strength as a collective entity. Only then will we be able to flex our muscles and reverting to a healthy shape.

### **An exploration of the forms of community**

After the careful examination of the consequences of patriarchy, our next point of action with regards to constructing *Structures for Women's Empowerment* addresses itself to a rigorous analysis of the forms of community that contribute towards this predominant, misogynistic scheme. An exploration of the forms of community entails the profound understanding of what it means to be in right relationship with the women in our lives by redefining the roles of our many support systems in order to not only sustain women as individuals but also cultivate a community that represents the respect we deserve. By pursuing an impartial and thorough process of enquiry with regards to the forms of community, owing to the fact that these very forms of community facilitate and sustain the internalization of misogynistic premises and practices in our society, we find ourselves driven towards exploring the societal systems and divisions that are, in one way or another, advancing the patriarchy.

The patriarchy, as any system of oppression, thrives on our collective immobility with regard to the undeniable injustices, may be they direct or indirect, towards women. In order

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<sup>24</sup> Alda Facio, "Equity or Equality for Women"

for us to dismantle this oppressive overruling system, it is critical that we further our understanding of the very societal and communal frameworks that give rise to misogynistic beliefs and practices. This analysis is to be conducted by means of impartial observation and criticism of the various sexist connotations we receive and see reinforced in our families, religious groups, and education systems. An exploration of the forms of community is, therefore, best conducted through the compartmentalization of these different societal divisions followed by the pursuit of intersectionality in their common sexist ideals and oppressive practices.

For instance, misogyny is particularly noticeable in the way women are perceived and treated within their own families. As the primary unit of society and our main support system, family is considered the nucleus of our larger extended community and the commencement point to our intellectual, religious, and social development. With the current patriarchal system fully dominating the structures of our society, we find ourselves suspecting the family's involvement in the origination and continuity of misogyny. When looking into our own family dynamics, we find ourselves coming to the realization that families heavily contribute towards the maintenance of the current sexist ideals. Parents, for instance, introduce misogynistic standards. When it comes to the role of mothers in contrast with the role of fathers, the differences are mainly socially constructed. Mothers have to reflect that change in themselves, modelling the female ideal of how a daughter should be and what a son should expect from other female figures. Through these tangible primary examples, mothers delineate an initial yet powerful set of practices and expectations that children end up imitating and taking into larger society. Fathers, on the other hand, do not have to model how daughters should be but how men should regard women. If we look at this very subject matter and scrutinize it with relation to wedding vows, for instance, we would find that men are pronounced *men* while women are pronounced *wives*. In this sense, the man's being is not, in any way, attached to his wife for he is a man, an autonomous individual. The woman's existence within the boundaries of marriage, on the other hand, is tied to that of her husband. To these ends, the woman's existence is heavily reliant on that of the man, and can even be regarded as inseparable from him. Through these misogynistic standards, we see women losing their sense of identity, their ability to exist on their own and only gaining their value through men. This concept is at the core of the dominating perspectives on marriage and divorce in many parts of the world as women are pressured into marriage as a way to validate them, and shamed when they are divorced for they're no longer reliant on a man. This point also closely ties back to Hegel's view of women as receivers. In this sense, women receive their own validation and self approval from their male counterparts, which deprives them of their autonomous capacity to evaluate not only themselves but others as well.

Again, for instance, our religious scripture and teachings continue to reflect deeply embedded misogyny. When we choose to study the underlying sexist agenda of Abrahamic religions, for example, we would find ourselves easily associating it to the larger patriarchal system. In the Bible, Abraham pressed his wife into conspiring with him to lie about the

nature of their relationship and present her as his sister. Eventually, Abraham was pressing his wife into engaging in sexual activity with the Pharaoh. Against all moral intuition, Abraham adjures his wife, Sarah, to go into Pharaoh's harem. Undoubtedly, despite his motives not being closely substantiated in the text, Abraham's actions are, by all standards, unethical:

But the Lord inflicted serious diseases on Pharaoh and his household because of Abram's wife Sarai. 18 So Pharaoh summoned Abram. "What have you done to me?" he said. "Why did you not tell me she was your wife? 19 Why did you say, 'She is my sister,' so that I took her to be my wife? Now then, here is your wife. Take her and go!" 20 Then Pharaoh gave orders about Abram to his men, and they sent him on his way, with his wife and everything he had.<sup>25</sup>

This Biblical story, as striking as it may be, is a palpable representation of how women, in their service of the higher male-dominated power structures, are continuously and unapologetically objectified. As the issue of women's objectification is an extensive one, it becomes important, as in discussing any moral case study, to contextualize the problem. In this particular incident, Sarah was used as a tool, more than anything, to serve Abraham's ambition of tricking the Pharaoh. This is particularly brought forth in the part where Sarah is grouped with other belongings. In fact, the verse reaffirms that "they sent him [Abraham] on his way, with his wife and everything he had."<sup>26</sup> To these ends, Sarah, having been objectified first by her husband, then by the Pharaoh, becomes a target to these men's misogynistic principles and overall belligerence towards women. In this sense, and by no choice of their own, women are stripped of their humanity to become instruments serving men's ultimate pride and contentment. The controversy over this incident is not only limited to the nature of the act itself, but extends itself towards the overall framework of the story and what it means to our current situation. It is important to reiterate, at this particular stage, that Abraham is a significant figure in Biblical scripture as he is 'the father of all nations', an individual who is meant to transcend the mundane and rise above human shortcomings. This elevated status, paired with the atrocity of the act, leads us to realize that Abraham's behavior must have been viewed as necessary, in the eyes of God, to pass a lesson to his people. With a divine being objectifying women to pass wisdom, the gravity of dehumanization is taken to a higher irrefutable level. As a consequence, dehumanization becomes necessary, objectification becomes meaningful, and misogyny becomes part of a noble mission. This particular perspective ties closely to a critical point in Nietzsche's moral philosophy: the nobility of acts. In his book 'Beyond Good and Evil', Nietzsche states that noble acts are considered noble because we associate them with noble individuals. In this sense, an

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<sup>25</sup> New International Version (NIV) Copyright by Biblica

<sup>26</sup> Ibid

authoritative man, through his practices, is the “determiner of values”<sup>27</sup>. According to this philosophy, acts generating from elite individuals, such as Abraham in this context, are always considered noble. This particular perspective reveals a disturbing reality: the incessant denigration of and belligerence toward women is not only normalized but assigned a noble connotation as soon as we assign it to a high-born individual. As Abraham is considered to be of supreme authority, he is automatically assigned supreme moral and societal standings, which makes all of his actions, including giving his wife away to another man, ideal. It becomes clear, then, that our own religious scripture blatantly normalizes, if not encourages, long-held misogynistic practices.

Still again, our scholars and public intellectuals, the fundamental educators of our society, have long exhibited strands of sexism, even within their most renowned works. Misogyny, dehumanizing at its core, is a common thread amongst the works and thinking of many western philosophers, from Hegel, to Kant, to contemporary Nietzsche. It becomes critical, therefore, to investigate the traces of these problematic ideas and pinpoint their different mechanisms of dehumanization towards women. Friedrich Nietzsche's master-slave morality, for instance, a focal theme in many of his works, especially in *'On the Genealogy of Morality'* and *'Beyond Good and Evil'*, is subliminally yet closely tied to his misogynistic views of and belligerence toward women. In order for us to tap into this tight interconnection between women and slave-morality in Nietzsche's work, one has to grasp the relevant principles of Nietzsche's philosophy. Master-slave morality, as extensive and convoluted as it may be, eventually falls into a distinct juxtaposition between defeated and dominant practices stemming from respectively inferior and superior societal statuses. In this sense, everything that is stemming from dominant structures or individuals is automatically assigned to master-morality, an ethical approach motivated by power and authority. Slave-morality, on the other hand, is a “herd morality”<sup>28</sup>, deriving from a strong awareness of one's inferiority, followed by desolate attempts to elevate one's moral and societal status. These two types of morality fall at two far ends of a power-based spectrum, and are assigned to certain traits and shortcomings. For instance, master morality is characterized by courage, pride, and fortitude while slave-morality is closely tied to weakness and vanity.

For Nietzsche, vanity is the hallmark of the meek and powerless. They cry for a good opinion of themselves--not being able to set their own value. The slave morality is subject to flattery--such persons know they do not deserve praise, yet they believe it when they are praised by the master since they have not the abilities to create value. Vanity is a consequence of inferiority.<sup>29</sup>

It becomes clear, therefore, that slave-morality, a central element of Nietzsche's work, is an ideology that extrapolates itself from one's attempts to override their inherent inferiority

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<sup>27</sup> Friedrich Nietzsche, *Beyond Good and Evil*

<sup>28</sup> Lander University, Philosophy 302

<sup>29</sup> *Ibid*

by means of vanity. According to Nietzsche, vanity is used as a tool, a desperate attempt to elevate one's self from eventual subordination. In this sense, vanity becomes essential to slave morality, a despicable facade to weakness and a driving force to internal insecurities. This particular view of vanity, as plausible as it may be, becomes problematic when Nietzsche explicitly lends it to women. In his book *Beyond Good and Evil*, and as he proceeds to extend the supposedly tight links between vanity and women's character, Nietzsche reveals the initially hidden subsets of his misogyny.

*In the background of all their personal vanity, women themselves have still their impersonal scorn—for 'woman' ".<sup>30</sup>*

Vanity, in this particular context, becomes a holder of a larger, underlying idea: women are extrinsically and inevitably subordinate to men. This assertion is not distinct from our previous analysis of Nietzsche's slave-morality. If anything, both ideas are perfectly-fitted pieces of a repeating sequence: women are inherently inferior, thus desperately vain, thus morally enslaved, thus permanently inferior. As women are rendered to slave-morality, Friedrich Nietzsche's blatant misogyny explicitly translates into blatant dehumanization. However disturbing his views towards women may be, Nietzsche remains one of the hallmarks of our modern education, a palpable proof of our sexist, oppressive educational foundations.

As long as we proceed to act upon these objectifying and inherently dehumanizing ideals, we will be incapacitated to respond to the chronic atrophy devouring our forms of community, be they our family members, religious leaders, or intellectual figures. It becomes critical, therefore, that our efforts should be targeting the overthrow of this chronic disorder by means of established and devised reform of our perceptions, interpretations, and overall approaches with regards to women. It is then that we will be equipped to fight our intrinsic diseases and secure our strength as a collective entity.

### **An Evaluation of the Opportunities for Empowerment**

The final step in erecting *Structures for Women's Empowerment* is a close and pertinent evaluation of the possible measures we can collectively take to elevate women. An evaluation of the opportunities for empowerment is therefore an investigation of the necessary policies and practices that will afford women equal rights and tangible support by protecting them from interpersonal, institutionalized, and state-sanctioned violence in order for their full agency and social value to be realized. In order to tap into these opportunities, one has to invest in a simultaneous scrutiny of the flaws within our current governmental and societal structures.

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<sup>30</sup> Friedrich Nietzsche, *Beyond Good and Evil*, 85



For instance, our governmental structures tend to unapologetically disregard important necessities for women's reproductive health, and this translates into measures and laws that are reinforced by many governments around the world for the sole purpose of criminalizing abortion and limiting women's access to means of contraception. Therefore, we as a society driven by reason and faith, are compelled to navigate the potential yet necessary areas of progress. In this particular case, development is closely tied to our governments' willingness to reform public policy in this area. To these ends, women's empowerment becomes a direct outcome of well-revised laws and regulations that provide women the right to safe abortions, adequate healthcare prospects, and the unconstrained access to means of contraception. To calculate the empowering outcomes of such endeavors, it is critical for one to explore their current trends. Many countries have, in fact, ventured into such policy reforms. In the majority of European countries, for instance, both medical and surgical methods of abortion are considered as an indisputable right for women. These decisions enable women to disentangle themselves from the convoluted constraints of a patriarchy, a system that seeks to harm them in all aspects, even physiologically. In the case of healthcare in general, progress with regards to medical practices is almost synonymous with the implementation and reinforcement of comprehensive diagnosis measures that take women's anatomy and physiology into high consideration. The enactment of such measures are especially relevant to our current healthcare system, for it is disturbingly defective. In fact, our current diagnosis mechanisms have been designed in accordance with men's physiological features and needs. In the practical sphere, this means that pharmaceutical companies and public health institutions are executing an agenda that has been built to effectively respond to men more than women. This particular shortcoming in our healthcare system deeply distorts the perception of women's physiological characteristics and needs in medicine. In fact, "a recent study by the British Heart Foundation found that women have a 50% higher chance of receiving a false diagnosis following a heart attack, in part because the severity of their symptoms is not immediately believed, and they are more likely to be told they're having a panic attack."<sup>31</sup> This indicates that women are not treated equally in the very institutions that are meant to provide exhaustive and unbiased treatment. To these ends, we realize that patriarchy has extended itself beyond harming women's psychology and societal status towards damaging their health and endangering their lives. Therefore, the implementation of policy that regards women with credibility, is not only necessary but extensively urgent with regards to their physiological and mental well being.

And still again, our society continues to be infested with misogynistic ideals that propel and justify violence towards women, may it be physical or psychological. This pernicious patriarchal oppression, as disturbing as it may be, makes of our society an undeniable ground for improvement, especially when it comes to allowing women their right to violence free environments. In fact, Tunisia is currently considered as a pioneer model for its surrounding

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<sup>31</sup> "The Problem of Gender Bias in Medical Diagnosis", Laura Elliott, *The Medium*

North African and Middle Eastern countries with regards to the full consideration and implementation of laws that protect women against violence. In 2018, for instance, a newly enacted law expanded the definition and thus the perception of violence against women in Tunisia. This law, considered as a first since Tunisia's 1956 'Personal Status Code'<sup>32</sup>, provides survivors of sexual and domestic violence the legal tools to empower themselves in their fight against patriarchy. Today women in Tunisia are no longer incapacitated to defend themselves against the unruly male violence. If anything, they have been empowered to navigate their way around the convoluted societal structures and position themselves in spaces where they can affect real tangible change with regards to their cause. In this sense, such policy becomes instrumental when it comes to the collective struggle and dismantling of misogyny. These efforts to dismantle patriarchy, despite the fact that they stem from highest governmental authorities, are still facing real challenges because of the overruling Islamic culture in the country. In order to grasp the links between the dominating religious climate and the need to empower women, one must start by exploring Islam's perception and views of women. For instance, inheritance in Islam, being an integral chapter of Sharia law is not distributed equally between the brothers and sisters of the same family. In this sense, the Quran affirms that:

***If (there are) women (daughters) more than two, then for them two thirds of the inheritance; and if there is only one then it is half.<sup>33</sup>***

These religious laws and regulations have long governed society in Tunisia, depriving women of opportunities for their own financial involvement and socio-economic progress. As owning property is almost synonymous with autonomy, these laws make women to be passive and stagnant, thus undeserving of any financial empowerment and of men innate leaders who are entitled to progress and prosperity. To these ends, the Tunisian government has coined a proposal to change the current inheritance law that blatantly discriminates against women. These decisions, despite receiving major backlash from religious leaders in the country, have remained persistent with regards to implementation and reinforcement.

As long as we, an educated and theologically oriented society, insist on conforming to patriarchy and abiding by its mechanisms, we will be incapacitated to find a possible cure to the chronic atrophy that is internally consuming our societal body. This atrophy, taking advantage of our inherent reverence towards faith and reason, masquerades itself in form of religious laws and regulations. To these ends, it becomes necessary that we dismantle these convoluted systems of authority so as to halt the progression of this chronic disorder by means of impartial investigation of our shortcomings and focused alteration of our views and

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<sup>32</sup> Tunisia's Personal Status Code is a national journal that was first implemented by the government in 1956. The journal focuses on organizing familial and societal relations as well as the overall empowerment of women in society.

<sup>33</sup> Quran 4:11

decisions with regards to women's empowerment. It is only then will we be able to fully tap into our strength as a society.

We, as an educated theologically-oriented community that has long been brought up and looked after by women, will no longer have the tendency to devalue these very women by depriving them of opportunities for their empowerment due to our fear of allowing obsolete patriarchal structures and pernicious sexist principles to dominate the way we perceive and consequently treat the female figures in our lives because we have taken seriously the crisis at hand in which our actions can be closely compared to that of a chronic atrophy demolishing the muscles of a body. In our willingness to dismantle the patriarchy, owing to the fact that misogyny is at the core of all power structures, we as a knowledgeable and religiously-inclined society who often find ourselves in authoritative positions, will no longer further perpetuate the idea that men are givers and women are receivers, nor deprive women of their right to a fair and equal representation in our society. In order for us to satisfy the need to be nurtured and supported by women in our lives, we as people who take seriously both our faith and reason, will instead enable women to reclaim their role in society by allowing them access to opportunities for personal and socioeconomic empowerment. Erecting *Structures for Women's Empowerment* is, therefore, a bold yet necessary step towards the full emancipation of women from the entanglements of the patriarchy.

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# Borderline Personality Disorder and Emotional Dysfunction: An Etiological Model

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## Abstract

In this paper, a model for the process of borderline personality disorder (BPD) patients' emotional dysfunction is proposed. This paper argues that alexithymia (impaired ability to identify and describe one's own emotions) and the inability to interpret others' emotions bring problems to BPD patients' social feedback, which later causes inaccuracy in feeling their own emotions and responding to social feedback. An experiment is proposed, and is waiting to be conducted by future researchers, to test part of the model. According to the plan of the experiment, one hundred participants (approximately equal gender distribution) diagnosed with BPD will be recruited; they will fill out self-reports of emotions, receive facial EMG and skin conductance response measurements, and be placed under negative or positive stimuli randomly. It is hypothesized that the difference between BPD patients' subjective feelings of emotion and real physiological response is correlated with their scores in alexithymia scale, the Movie for the Assessment of Social Cognition test, and the positive/negative social stimulus they receive during the experiment.

## 1. Introduction

Borderline personality disorder (BPD) is a mental illness that affects 1% to 2% of the general population, and is deemed a pervasive disorder that brings huge problems to patients and their families. BPD is characterized by frequent mood swings, problems in controlling anger, and long-lasting feelings of emptiness; patients may also have unstable self-images, and have serious problems in interpersonal relationships, as they often detest and fear abandonment. As a result, BPD impairs patients' wellbeing due to interpersonal problems and social dysfunctions. Moreover, the suicide rate of BPD patients is 10%, which is extremely high compared to 0.2% among all people (National Institute of Mental Health, 2017) (Lieb, Zanarini, Schmahl, Linehan, & Bohus, 2004). It is no doubt that BPD is a

serious and universal illness, and finding some ways to improve patients' wellbeing becomes an urgent concern.

Patients with BPD often experience difficulties in emotional control. Using the Global Assessment of Functioning (GAF) scores, Gunderson et al. (1997) assessed 175 patients with BPD, 312 with Cluster C OPD and 95 with Major Depressive Disorder (MDD) for a ten-year study. The patients were also followed up by the Diagnostic Interview for DSM-IV Personality Disorders to see patients' remission rates. The authors found out that patients with BPD persistently had low social functioning scores, with statistical significance, even after they were remitted (Gunderson et al., 2001). Low social functioning scores indicate that the person is having problems dealing with social, occupational, or school functioning, often in the range of affect regulation, suicidal attempts and interpersonal communications. (DATA, 1997)

If BPD patients' emotional dysregulation is to be resolved, finding reasons behind the disability becomes the first step. To this end, this research paper focuses on establishing a model for BPD patients' emotional dysregulation and following social functioning process, and a subsequent experiment to test part of the model is also designed for future use.

#### *BPD Patients' Interpretation of Emotion*

Several effective treatments exist for BPD. For example, dialectical behavioral therapy, a kind of cognitive behavioral therapy, tries to change patients' absolute and obdurate thoughts using different approaches (Linehan, 1993). However, among all existing therapies, Mentalization-Based Treatment (MBT), a treatment in improving patients' ability to understand others' emotions and feelings, serves as a treatment to remedy the patients' social dysfunctions. An 8-year assessment of MBT compared to treatment as usual, by Bateman and Fonagy (2008), interviewed 41 patients using "Multivariate analysis of variance, chi-square, univariate analysis of variance, and nonparametric Mann-Whitney statistics," and showed that patients who received MBT had fewer suicidal thoughts, better remission status, and longer job recruitment. As affect dysregulation and conflicts in daily life are caused by BPD patients' failures in mentalizing, and MBT improves BPD patients' daily functioning (Fonagy, Luyten, & Bateman, 2015), we can deduce that understanding others' emotions plays an important role in interpersonal relationships. As a result, if reasons behind BPD patients' deficits in emotion perception are elucidated, new therapies can target these specific problems, consequently improving patients' well-being.

Also, multiple studies have shown that BPD patients have problems in interpreting emotions. However, results in each study differ, indicating the need for future research to produce a complete and accurate model of emotion interpretation. For example, in Niedtfeld et al.'s study (2017), 31 BPD patients and 31 healthy controls were recruited to identify emotions in video clips that contain personal experiences told by a person, by the communication channels (three ways emotions and ideas are expressed): facial expressions,

content, and prosody. Prosody means variances in tone and stress, which differ from the content of the speech, which are only the words. Video clips were manipulated to contain different emotions, such as happiness, sadness, fear, etc. During the study, participants watched videos manipulated to have certain emotions and some of the communication channels, participants' skin conductance rates were measured to see their arousal, and they were also asked to identify emotions in the clip as well as their own emotions. The study found that BPD patients identified all emotions less accurately than healthy controls when facial expressions were used, but had no significant difference in their ability to identify emotions using content and prosody (Niedtfeld et al., 2017).

On the other hand, Berenson et al.'s study applied the Reading the Mind in the Eyes Test (RMET) to 64 BPD patients and 60 healthy controls (Berenson et al., 2018). In the test, 36 actors' eyes were shown in the center of a white screen one by one, with four choices of different emotions, and each participant needed to identify one emotional state choice that corresponded the best. The 36 questions came out randomly, and statistical results suggested that BPD patients only had lower thresholds for anger identification and no significant difference in happiness identification or overall emotional state identification. Also, a higher alexithymia score, which indicates the inability to identify and describe one's own emotions, and a lower anger identification threshold had a correlation with a lower RMET score (Berenson et al., 2018). This indicates that alexithymia, anger identification threshold, and emotion recognition ability are related, but the causal relationship is still not clear

In another study, Thome et al. (2016) displayed pictures of different facial expressions to 36 BPD patients and 36 healthy controls and asked them to rate the intensity of emotion and their confidence levels. The facial expressions were morphed using happy, angry and neutral faces from the NimStim-Face dataset, and were displayed on the screen. There were 84 total facial expressions, including four blends of angry and neutral, happy and neutral, both in 60/40 or 50/50, and three angry and happy blends in 60/40, 50/50 and 40/60. Participants were asked to use a cursor to move a scale from 1 to 6 to rate the emotional intensity. The study found that BPD patients had difficulties in perceiving happiness, but showed no significant difference from the controls in perceiving anger or ambiguous expressions (Thome et al., 2016).

These contradictions in cross-study results, some showing that BPD patients have problems in interpreting all emotions, some showing that patients only have lower anger identification thresholds, and others only showing higher happiness identification thresholds, may result from people's differences in impulsivity, as indicated by Preti, Richetin, Suttora, and Pisani (2016). The researchers recruited 80 college students to test the hypothesis that impulsivity and effortful control moderate BPD traits' influence on identifying angry and happy facial expressions. Students were measured in impulsivity scores, and were tested in emotion recognition ability, identifying the morphed faces in NimStim Face Stimulus Set as angry or happy by pressing the button on screen. Students received only visual information, or both visual and acoustic information of the faces on screen. The study supported the

opinion that differences in impulsivity scores mediate BPD traits' effects on emotion recognition (Preti et al., 2016).

It is doubtless that BPD patients are having problems in identifying others' emotions, and it is likely that the failure in emotion perception partly causes their social dysfunction. However, as patients vary in their impulsivity and alexithymia level, a model of BPD patients' emotional perception and social dysfunction needs to incorporate these individual differences.

#### *BPD Patients' Response Toward Emotional Situations*

According to research, BPD patients have problems in responding to emotional situations. In a study conducted by Reichenberger and fellow researchers (2017), videos selected from E.Vids database by 20 actors (trained to speak sentences naturally rather than dramatically) expressing 8 positive, 8 negative and 8 neutral sentences were displayed on screen to the participants. Twenty patients with BPD and 20 healthy controls were instructed to rate their emotional responses to video clips with positive/neutral/negative emotions. The result showed that BPD patients have significantly less positive responses to positive video clips, and more negative responses to negative videos (Reichenberger et al., 2017).

Matzke et al.'s research (2014) is also in line with Reichenberger et al.'s study. They measured 28 BPD patients and 28 healthy controls' responses to pictures of faces. The facial expressions were selected from NimStim Face Stimulus Set database, containing 5 females and 5 males with six basic emotions of happiness, sadness, anger, fear, disgust and surprise, and were morphed from neutral to a complete emotion, each time increased by 1%. A total of 101 pictures were then combined to show a continuous process of emotion. Participants' muscle movements were recorded, including the occipitofrontalis (the muscle from the brow to the back of the head), corrugator supercilii (the muscle close to the eye, near the end of brow), levator labii superioris (the muscle from the nose to cheekbone), zygomaticus major (the muscle on cheeks to draw the angle of the mouth), and orbicularis oculi (the muscle that closes the eyelids); their subjective feelings and emotional intensities in the presented face were also recorded by ratings. The study found that BPD patients have significant differences compared to the healthy control in increased corrugator supercilii activities to negative expressions and decreased levator labii superioris activities to positive emotions, indicating that BPD patients may have more negative responses to emotions (Matzke et al., 2014).

These studies show that BPD patients experience both emotion recognition impairment and problems in emotional response. A study conducted by Sauer and fellow researchers (2014) supports this idea. They compared 31 women patients having BPD with 29 women having major depressive disorder and 33 healthy controls, and studied their emotional reactions toward pictures of violence, sexual abuse, etc. The study reveals that when trauma or interpersonal situations are present, BPD patients hyper-react emotionally to these



situations, which explains their problems in dealing with conflicts, especially those concerning their private lives (Sauer et al., 2014).

Other studies also show BPD patients' problems in reacting to emotional situations. Dixon-Gordon, Yiu and Chapman's study used 68 female university students with high, medium and low borderline personality features to complete the Inventory of Interpersonal Problems-Personality Disorders-25; self-report and physiological responses are also measured as the subjects are exposed to a rejecting situation. The result shows that a positive correlation exists between emotional response and borderline personality features (Gordon, Yiu, Chapman, 2013).

In Jeung and Waltheret's study (2018), researchers used a chatroom to give positive, neutral or negative feedback to participants. Twenty-two BPD patients and 21 healthy controls were recruited in this study, in which they chatted with a computer program that was claimed by the researcher as a female peer. The computer program generated random feedback based on questions the participants answered in the first phase of the experiment. After receiving feedback to their answers, participants were asked to indicate whether they agree or disagree with the feedback, and rate their emotional intensities of happiness, sadness, anger and shame from 1 to 4. The result suggests that BPD patients respond more negatively and less positively to social feedback, and they are the happiest when in agreement with the other person, and less happy when encountering disagreement (Jeung & Waltheret, 2018).

### **Alexithymia and Emotion Recognition**

Alexithymia, a personality construct that depicts the inability to identify and describe one's own emotions (Taylor, 1984), also impairs people's emotion recognition ability. In Lane et al.'s study (1996), 380 participants were recruited to fill out the Toronto Alexithymia Scale and the Levels of Emotional Awareness Scale (LEAS) to see their severity in alexithymia; they also completed the Perception of Affect Task (PAT), in which they matched verbal/ nonverbal emotions with verbal/ nonverbal responses to the emotion. The result demonstrates that people who have higher alexithymia scores also perform lower in matching the emotion with responses, regardless of whether it is verbal or nonverbal, indicating that alexithymia is associated with problems in emotion recognition (Lane et al., 1996).

In Berenbaum and Prince's study (1994), 137 college students were measured in alexithymia, and a correlation between the severity of alexithymia and interpretation of emotion was found, using the Profile of Nonverbal Sensitivity (PONSS) and the Emotional Story Test (EST). Students with high alexithymia scores were more likely to interpret the emotion as anger. However, the accuracy of emotion interpretation did not vary much with different alexithymia scores, and it was stated that alexithymia was associated with "low ratings of emotional intensity" (Berenbaum, Prince, 1994). Given that people with alexithymia have impairments in correctly labeling emotions, it can be inferred that

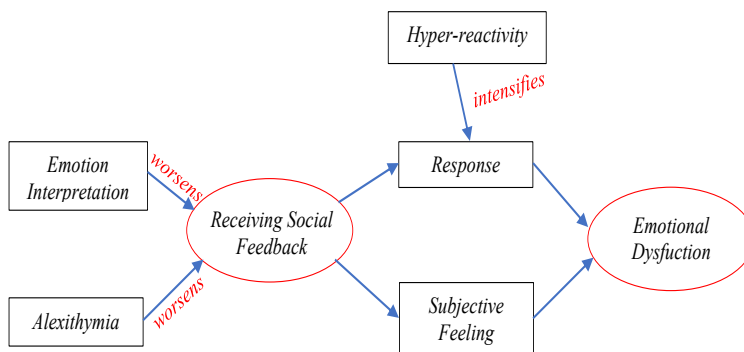
alexithymia aggravates problems in emotion recognition, which lead to more unstable interpersonal relationships. If BPD patients also have alexithymia, it can be inferred that they will also have more problems in interpreting emotions.

## Conclusion

Multiple recent studies show that BPD patients experience social dysfunction. However, these studies do not explain the correlation between BPD patients' problems in emotion perception and their problems in responding to these emotions, especially in a continuous process, nor does the research point out how alexithymia and BPD influence emotion perception.

As a result, this research proposes a synthesized model of how BPD patients interpret and respond to emotions, and whether alexithymia and inability to interpret emotions influence their accuracy in understanding their own emotions.

Figure 1. Theory of BPD patients' emotional interpretation and response



As described in the literature review, both borderline personality disorder and alexithymia influence one's emotion interpretation. A model is developed in response to the existing literature, as depicted above (see **Figure 1**).

Firstly, when interacting with others, BPD itself impairs patients' abilities to correctly identify the feedback others give (emotion interpretation), and alexithymia aggravates the problem by causing patients to incorrectly interpret others' emotions and evaluations of the self. These two factors bring problems to the process of receiving social feedback.

After BPD patients receive inaccurate social feedback, they respond to emotions in abnormal ways: their hyper-reactivity toward trauma-triggering situations intensify their response to emotional cues, and their subjective feelings of their own mental states are inaccurate. These abnormalities cause social dysfunction, including problems in interpersonal relationships.

For example, a person with BPD may recognize a neutral emotional stimulus as an angry one due to their low emotional recognition threshold, and the person's alexithymia worsens the situation. Then, they respond to the presumed "anger" negatively by negative facial expression; they also have a more negative mental state, which is inconsistent with their physical responses as they cannot understand their own emotions accurately. As a result, the person's incorrect interpretations of emotions, responses and feelings during communication cause social dysfunction, including quarrels and mistrusts.

In the following part, an experiment will be proposed to test part of the theory, that alexithymia and emotional interpretation will influence BPD patients' process of correctly receiving social feedback, which subsequently causes their misunderstanding of their own subjective feelings. Still, this experiment needs to be carried out by future researchers.

### Hypothesis

To test part of the social interaction model—BPD patients' problems in feeling emotions when interacting with others because of their impairments in recognizing emotions and alexithymia—this paper hypothesizes that BPD patients with lower emotion recognition abilities (indicating worse results in the Movie for the Assessment of Social Cognition test, introduced below) and higher scores in alexithymia (using 20-item Toronto Alexithymia Scale) will be more likely to have problems in correctly perceiving their own emotions (represented by the difference between their subjective feelings and their physical feelings).

The subsequent experiment proposed will expose BPD patients with negative or positive emotional stimuli. The experiment will try to find the valence (good or bad) of the emotional stimuli's impact on BPD patients' perception of their own emotions, and the paper hypothesizes that negative emotional stimuli will worsen BPD patients' emotional perception ability, and positive emotional stimuli will enhance their ability. Detailed descriptions of the emotional stimuli will be presented in the experimental design part of the paper.

Quantitatively speaking, the paper predicts that the difference between the subject's subjective feelings and physiological could be expressed by a multiple regression with a categorical variable:

where:

$$y_s = (\beta_1 x_{s1} + \beta_2 x_{s2} + \beta_3 x_{s3}) + \epsilon_s$$

$y_s$  = the difference between the subject  $s$ 's subjective feelings and physiological responses

$\beta_1, \beta_2, \beta_3$  = regression coefficients that need to be measured to show the impact of independent variables

$x_{s1}$  = the subject  $s$ 's score on TAS-20

$x_{s2}$  = the subject  $s$ 's performance in MASC test

$x_{s3}$  = a binary variable, coded as 1 if the subject  $s$  receives negative emotional stimuli, and coded as 0 if the subject  $s$  receives positive emotional stimuli

$\epsilon_s$  = possible error

## **2. Experimental Design**

### **Participants**

Recruitment flyers will be distributed in mental health institutes, and patients diagnosed with borderline personality disorder in those institutes will be recruited on a voluntary basis. Participants will also be reassessed by professionals specialized in mental health, using the Structured Clinical Interview for DSM-5-R Personality Disorders (SCID-II) (Michael et al., 1995), to decrease the likelihood that participants are misdiagnosed with BPD. Only participants diagnosed by professionals in the research will enter the study, and those without the diagnosis will be compensated and quit the study. The number of participants entering the study will be 100. Healthy controls are not needed in the study because the study tries to find a relationship between emotion recognition, alexithymia and BPD patients' subjective feelings, which does not require a comparison between BPD patients and healthy people. Gender ratio of the participants will be controlled at approximately 1:1, as Grant et al.'s study in 2008 found out that the gender preference for BPD is not significant, by interviewing 34,653 adults participating in the 2004-2005 Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions (Grant et al., 2008). The age of the participants will be controlled at a range of 25 to 45. They will receive and sign informed consents before participating, be debriefed about the real procedure of the experiment, and be compensated with gift cards after the study.

### **Measures**

Before entering the study, participants will receive a reassessment of their symptoms using the Structured Clinical Interview for DSM-5-R Personality Disorders (SCID-II). This measure was tested by Lobbestael, Leurgans and Arntz (2011) using 127 participants for two times of SCID-II assessment (personality disorders) by professionals, the first in a face-to-face format while the second used a video tape recorded during the first time, has kappa values ranging from 0.77 to 0.94 and an average of 0.84, which indicates high inter-rater reliability (Lobbestael, Leurgans & Arntz, 2011).

Before the experiment, participants will receive an alexithymia test using the 20-item Toronto Alexithymia Scale (TAS-20) and the Movie for the Assessment of Social Cognition (MASC) test. These two tests represent participants' alexithymia severity and emotion

interpretation (presented in Figure 1), and are indicators for participants' later ability of accurately understanding their own emotions (as mentioned in the hypothesis).

TAS-20 categorizes alexithymia, the inability to feel and describe one's own mental states, in three types: difficulty identifying feelings in the self (DIF), difficulty describing feelings (DDF), and externally orientated thinking (EOT), and is the best categorization way today by Preece et al.'s study (2017). The study recruited 428 nonclinical adult participants who completed the TAS-20 by online anonymous surveys, and 156 adult patients diagnosed with psychiatric disorders who also completed the TAS-20 under supervision of a clinical psychologist. Using factor analysis, researchers found out that items regarding DIF and DDF has high internal correlation, ranging from .527 to .813 (Preece et al., 2017). DIF includes impairments in identifying the emotion, being puzzled by one's own bodily sensations, etc.; DDF includes problems in describing one's own feeling, or feelings about others, etc.; EOT is one's tendency to focus on the external rather than internal feelings, including the tendency to talk about daily activities rather than psychological feelings, etc. The test, assessed by Bagby et al. (1994) when developing the scale using 965 undergraduate student volunteers in a Canadian university, is consistent and have good test-retest reliability, as its Cronbach's alpha equals to 0.81, suggesting acceptable internal consistency (Bagby et al., 1994).

The Movie for the Assessment of Social Cognition (MASC) test measures participants' emotion cognition ability. Participants will watch a 15-minute movie containing 46 pauses to answer questions about the emotions, intentions and thoughts in four characters of the movie. The movie was shot professionally, and excluded music and other minor characters, so that participants can fully concentrate in interpreting the four people's emotions. The four characters were designed to have distinctive personalities, and have various incentives to participate in the scene of the movie, which is an evening of entertaining and cooking. During the movie, participants will be asked about one, two or even more characters' mental states in the format of multiple choice. The choices include a high mentalizing response (more than the accurate response), a low mentalizing response (lower than the accurate response), a non-mentalizing response and an accurate mentalizing response (Dziobek et al., 2006). The MASC test, by Fossati and et al.'s study (2018), has a significant correlation with the Reading the Mind in the Eyes Test (RMET) scores. Fossati and colleagues recruited 393 adult nonclinical participants from high schools, 193 adult nonclinical participants and 59 adult outpatients with personality disorders, and gave them MASC tests and RMET tests. MASC tests showed internal consistency reliability in all three groups of participants, having Cronbach's alpha values of .70 to .78 (Fossati et al., 2018).

During the experiment, participants' physiological states will be measured using the Facial Electromyography (facial EMG) and skin conductance response (SCR). Their subjective feelings of their own mental states will also be measured by self-reports.

Facial EMG, tested by Losch and Kim (1986), can detect subtle emotional changes by measuring the movements of corrugator supercilia (muscles between brows), orbicularis oculi (muscles controlling eyes), and zygomatic major (muscles controlling the mouth). They

recruited 28 healthy women for a 2 (emotional valence of positive or negative) X 2 (emotional intensity of moderate or mild) design, and presented 24 photographs that elicited different emotional valences and intensities to subjects. Comparing facial EMG responses with participants' self-reports of their emotions, researchers found out that facial EMG could help detect emotional changes of different valences even when facial expressions are hard to distinguish (Losch & Kim, 1986).

Skin conductance response is measured by placing electrodes on tips of fingers. Voltage changes reflect skin conductance changes, which represent one's arousal of sympathetic nervous system. Skin conductance response quantifies one's emotional intensity (Lykken & Venables, 1971). Self-reports of emotions will be filled out using a tablet placed beside participants. They will be able to use the touch screen to move each emotional states' intensity from 0 (not at all) to 5 (extremely). Content of the self-report is presented in *Table 1*.

Facial EMG can detect participants' emotional valence, and combining it with skin conductance response, which detects emotional intensity, can help identify one's true emotional states. Comparing it to participants' self-reports of emotions, the difference between participants' subjective feelings and real emotional states can be determined.

The difference between physical emotional response and participants' self-reports will be calculated to represent participants' abilities of accurately understanding their own emotions (as mentioned in the hypothesis).

<b>Item</b>	<b>Intensity (from 0 to 5)</b>
1. exasperation	
2. interest	
3. outrageousness	
4. hatred	
5. envy	
6. exclusion	
7. neglect	
8. aggressiveness	
9. sympathy	
10. bitterness	
11. pride	
12. suffering	
13. disappointment	
14. disapproval	
15. cheerfulness	
16. disgust	
17. relief	
18. contentment	
19. shame	
20. dislike	

*Table 1. Content of the self-report*

The order of the items is placed randomly to eliminate effects of random answers. \*Large emotional categories include sadness (7,9,12,13,19), happiness (2,11,15,17,18), anger (1,3,5,8,10), and disgust (4,6,14,16,20).

### **Procedure**

100 participants with BPD will be assigned randomly to two groups, which means each group contains 50 BPD participants. Participants will first complete the TAS-20 test and the Movie for the Assessment of Social Cognition (MASC) test in a separate and quiet room. The order of the two tests will be counterbalanced in order to eliminate the order effect.

Then, to minimize participants' mental activities induced by experience during the day, they will first undergo a 10-minute relaxation period, to adjust their emotional states. After the relaxation, each participant will be brought to another room by the researcher, where the confederate is present. The researcher will claim the purpose of the study is to test people's behavior when talking to another person. The participant and the confederate will be equipped with a heart rate detection device, and a muscle movement detection device. Then, both the participant and the confederate will complete the self-report form of their emotional states, using a tablet beside them. During the talk, the participant will also be asked to fill out the emotional self-report once, using the tablet beside him/her. The confederate also needs to equip the device and fill out the self-report, as they pretend to be another participant of the study. After filling out the first self-report, the researcher will ask the participant to wait with the confederate, and have a talk with each other, and the researcher will leave the room.

The confederate will initiate the talk, including a pre-designed beginning and a talk including vivid descriptions of the confederate's personal experience of the day (with pre-designed facial expressions).

The beginning of the talk contains no emotional stimuli. Discussion of the weather will be prevented, since weather may influence one's emotional states. The personal experience shared by the confederate is designed to be a) a negative experience with negative facial expressions and b) a positive experience with positive facial expressions. There are 3 different experiences in each positive and negative group, and the experience the confederate shares is randomly assigned before the subject enters the room. In this way, the influence of participants' sensitivities to certain types of experience are minimized. For example, a person may feel emotionally aroused about a pet's death, but be apathetic to one's job loss. Brief content of the talk is presented below in *Table 2*.

	Group a (negative stimuli)	Group b (positive stimuli)
A talk about the weather (neutral stimuli)	Hi, nice to meet you.	
Confederate's personal experience	My dog died yesterday. I was late to work yesterday, and I nearly lost my job. I was turned down by my favorite one.	My cousin has a new baby born. I worked hard and got promoted yesterday. I am engaged.
Confederate's facial expression	Depressed and sad Frowning	Excited and happy Smiling

*Table 2. Content of the Talk*

After the talk and the self-report of the participant's subjective feeling end, the researcher will enter the room, debrief and give compensation to the participant.

### Data Analysis

After the experiment, researchers will attain participants' scores in the TAS-20 test and the MASC test, values of their facial EMG and skin conductance response, and their self-report of emotion. Multiple regression analysis will be conducted to determine participants' TAS-20 scores, MASC performances and emotional stimuli's effect on participants' own emotion interpretation ability.

Participants' self-reported emotions will be analyzed by taking the average of reported emotional intensities for each category of emotions (the categories are presented in Table 1). The average of each category indicates the subjective emotional intensity, which can be compared to the facial EMG and skin conductance response.

It is expected that participants with higher TAS-20 scores, worse MASC performances and exposed to negative emotional stimuli will have larger difference between their subjective feelings of emotion and their real physiological response. Negative results to the hypothesis may implicate that the ability to interpret others' emotions has weak causal or correlational relationship with the ability to accurately describe one's own emotions.

### Conclusion

This paper proposes a model for the process of BPD patients' emotional dysfunction, and argues that several factors, including the severity of alexithymia and the inability to correctly interpret other people's emotions, would contribute to BPD patients' inaccuracy in understanding their emotions and responding to social feedback. This paper also proposes an experiment, which awaits future conduction, to test part of the model. The experiment,



expected to recruit 100 BPD patients, have self-reports, facial EMG and skin conductance response to be measured under either negative or positive stimuli with a confederate. This experiment hypothesizes that the difference between BPD patients' subjective feelings and physiological response is correlated with three factors: their scores in the alexithymia scale, the Movie for the Assessment of Social Cognition test, and the positive/ negative social stimulus they receive during the experiment.

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## Love Thy Neighbor: A Comparative Analysis of Public Discourse about Chinese Rural Migrants

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### Abstract

The “hukou” system has created a binary citizenship system in China. While both rural and urban residents are both legitimate citizens of China, they enjoy different social rights regarding housing, education, and more. Even though in recent years the Chinese government has started to reform the hukou system and close up the gap, such a binary citizenship system already has its social implications, one of them being the rural migrants in Chinese cities. Although the issue of rural migrants has been widely studied, previous research primarily focuses on the structural inequality that the rural migrants face in cities, and few studies address the public discourse over the influx of rural migrants. Thus, this research aims to fill that gap by determining whether and how the public discourse on intranational rural migrants shifts in Chinese immigrant-receiving cities from 2000-2005 and 2015-2018. The results of this research show that public discourse about the rural migrants has generally become more negative. Specifically, even though the rural migrants are considered as great contributors to the market economy and the society in both periods, they have been gradually criminalized and marginalized as a group, while the public’s sympathy towards their situation diminishes.

### Introduction

Rural migrants in Chinese cities are placed in a difficult situation. Because of the “hukou” system (the household registration system in China that divides the country’s population into urban and rural citizens), the rural migrants living in cities receive limited social rights. These rights are supposed to be provided by their provincial governments. As Keping Yu, a scholar specializing in Chinese rural-urban migration, points out, “While people with rural or urban hukou are both citizens of People’s Republic of China that are

entitled to the same legal status and rights, they are essentially two groups of people with different status and rights” (2010).

In addition to receiving limited rights regarding housing, pensions, education, and more, rural migrants also face marginalization and social exclusion. As early as 1999, Dorothy J. Solinger had observed that “at least as a social construction, the urban Chinese generally view rural Chinese as ethnically distinct” (1999). Indeed, some scholars have pointed out that the rural migrants in cities have been socially constructed as a distinct group (Chen 2011). To some extent, rural migrants have been blocked from integration into urban society. Historically, internal migrants from throughout China have faced these issues. But today, the staggeringly high number of migrants makes this exclusion a compelling social issue.

Around the world, current research related to migration mainly focuses on forced migration, such as foreign refugees and internal migration due to natural disasters. However, in the case of China, the rural-urban migration is mostly voluntary, with rural migrants moving to cities for economic opportunities. On the other hand, current research on the Chinese rural-urban migration primarily focuses on the structural inequality that the rural migrants face in cities, and limited research addresses the reaction from the other end of such social interaction, namely, the native city residents.

Thus, this research aims to fill that gap by determining whether and how the public discourse on intranational rural migrants shifted in Chinese immigrant-receiving cities from 2000–2005 and 2015–2018. Here, I posit that the public discourse about rural migrants turned more negative, and the rural migrants continued to be marginalized. The primary method to test this hypothesis in this research is discourse analysis, which aims to investigate the public’s attitude at different time periods through analyzing how local residents discussed the migrants as well as how the media portrayed them. Specifically, 64 articles from newspapers of Chinese immigrant-receiving cities were collected and categorized into four themes: criminalization, victimization, market citizenship, and marginalization. The results of this research show that public discourse about the rural migrants has generally become more negative. Specifically, even though the rural migrants are considered great contributors to the market economy and to society in both periods, they are gradually criminalized and marginalized as a group, while the public’s sympathy towards their situation diminishes.

In this paper, I begin with an overview of citizenship theory and the theory of media as a public discourse. Secondly, I will discuss rural migrants’ status in China. Then, I will describe my methodology, specifically the four themes that were coded. After this, I will proceed with my findings and analysis. Finally, I will offer my conclusions and recommendations for future research.

## Theoretical Background

### *Nation-State*

Charles Tilly argues that the primitive form of the state emerged out of war and coercion. At the very beginning of the process of nation formation, he states, “Those who apply substantial force to their fellows get compliance” (1987). He argues that those in powerful positions would try to maintain and even increase their authority over others, by the “disarmament of the civilian population” and the “expansion of its armed force” (1987). By doing this, they were able to acquire a “monopoly of the legitimate use of physical force within a given territory,” which is the very definition of state from Weber’s perspective (1958). On the other hand, according to Tilly, having such capacity for violence, people would get into constant wars with others to increase the secure zones around the territory (1987). As a result, in preparation for these wars, rulers “started activities and organizations that eventually took on lives of their own” (Tilly 1987).

According to Emile Durkheim, the nation-state perpetuates itself by gluing its members together with *conscience collective*. It is described by him as a collective sentiment among the individuals: “[people] not only are all the members of the group individually attracted to one-another because they resemble one another, but also because they are joined to that which is the condition of existence of this collective type” (1995). By this he meant that such a common conscience forms bonds between individuals and society. Discussing nationalism, Durkheim wrote, “They love their country... because, without it, a great part of their psychological life would be hampered in its functioning” (1995). This “great part of psychological life” coincides with Durkheim’s idea about conscience collective. By this definition, nationalism is a natural product of the formation of the nation-state and serves to unite the state. Similar to Durkheim’s view, Max Weber defines nationalism as the capability that “one may exact from certain groups of men a specific sentiment of solidarity” (1958). Benedict Anderson, on the other hand, posed a unique theory in his introduction to *Imagined Communities*. He considered nationalism to be “cultural artifacts of a particular kind” and further defined it as “an imagined political community” (1998). As a result, nationalism would eventually bring certain groups of people together to form different nations. Anderson wrote, “regardless of the actual inequality and exploitation...the nation is always conceived as a deep, horizontal comradeship” (1998).

### *Citizenship*

The very first role of the state in guaranteeing citizens’ rights, as both Arendt and Somers put it, is “the right to have rights” (Arendt 1985). After the Age of Enlightenment, it was commonly accepted that human beings are born with certain inalienable rights, which

means that people have these rights based on their existence as human beings, regardless of nationality. However, as Somers points out, “These ‘inalienable’ and ‘indefeasible’ rights were utterly unenforceable” without states granting these rights to their citizens (2010). Thus, the first step of the state in guaranteeing rights of individual citizens is to grant them citizenship, the foundation upon which other rights can be granted. After the most elementary rights, Hannah Arendt classifies rights of citizens into primary and secondary rights. The former consists of rights such as “right to residence and to work,” and the latter consists of rights such as “speaking one’s language and staying in one’s own cultural and social milieu” (Arendt 1985). Somers points out an essential right for social minorities that was overlooked by the League of Nation’s Minority Treaties, namely, “the right to political representation” (2010). Without representatives from the social minorities, the tyranny of the majority is likely to prevail, as the majority may persecute the minority by legitimate means, while the latter does not have the political power to resist the persecution.

Thomas Humphrey Marshall defines citizenship as “a status bestowed on those who are full members of a community. All who possess the status are equal concerning the rights and duties with which the status is endowed” (Castles 2014). According to Marshall, the idea of citizenship originated when the serfs at the end of the medieval period in Europe were freed and transformed into free laborers, whose social rights were given by their membership in local communities and functional associations (Castles 2014). Along with the establishment of nation-states, certain civic, political, and social rights were affixed to universal citizenship; thus “citizenship grew from a local into a national institution” (Castles 2014). Since the idea of universal citizenship emerged, there has been “an urge towards a fuller measure of equality, an enrichment of the stuff of which the status is made and an increase in the number of those on whom the status is bestowed” (Castles 2014). Thus, the idea of universal citizenship was gradually popularized along with the idea of the nation-state, binding people into citizens of single nations. Later in history, certain social rights, such as welfare systems, also emerged to protect citizens from the exploitation of competitive capitalism (Castles 2014). In our modern society, as Marshall points out, these political, social, and civil rights associated with citizenship are often “nationally conceived and locally administered” (Castles 2014).

### *Market Citizenship*

Margaret Somers argues that “market regimes are transforming the foundations of citizenship from social and universal to contractual and conditional” (2010). Because of this, Somers contends that the unregulated market renders many Americans “stateless,” which she defines as “a condition of pure market exposure no longer mediated by the now absent government” (2010). Specifically, she argues that the process is driven by “the withdrawal of the state from social and market embeddedness” and “the systematic dismantling of civil, political, and citizenship rights” (2010). Somers also points out that “The poor and



low-income members of this ever-enlarging group experience statelessness in a particularly virulent way,” as they could be easily excluded from society if they could not afford those rights in the free market (2010).

Under market citizenship, people’s worth is determined by their efforts and contribution to society. In fact, some individuals or organizations gain their social value by exhibiting their efforts and contribution. Stephanie Nawyn provides such an example of how NGOs are helping refugees gain recognition from society. Intending to get rid of the idea of market citizenship, which “constructs refugees as burdens to, rather than responsibilities of, the state,” NGOs are constantly trying to characterize refugees as hardworking dreamers, which “justifies refugees’ access to federal assistance because of what they contribute back to American society” (Nawyn 2011). In this way, NGOs are granting social values to refugees, which renders refugees entitled to certain social rights.

### *Illegality Of Body*

Lisa Marie Cacho introduces the theory of illegality of body. Cacho points out that there are two forms of illegality: the illegality of conduct and the illegality of status. People usually associate illegality with the former, i.e., whoever breaks the law shall be punished by the law accordingly. In contrast, the illegality of status (body), “de facto status crime,” in Cacho’s words, is determined not so much by illegal conduct as by individual status: “A person does not need to do anything to commit a status crime because the person’s status is the offense in and of itself” (2012). Status, or the body, often refers to a person’s belonging to a certain group, which is often identified by race, gender, class, and other categories. In revealing how people’s status could be illegal, Cacho explains that “because ‘status’ assumes embodiment and fixity, de facto status crime captures the many ways in which people and places of color [as well as other people with different statuses] have become necessary signifiers to recognize illegality or criminality, thus marking specific behaviors as not only illegal but also innate, inherent, and inherited” (2012). The assumptions, as Cacho reveals, are often perceptions that “a person of a certain status is certain to commit future crimes and may well have already committed crimes unwitnessed” (2012).

### *Media’s Role In Criminalization And Victimization Of Refugees And Migrants*

Many scholars also shed light on the media’s role in stigmatizing internal migrants. Jürgen Habermas introduces the concept of public space, which he defines as “a virtual or imaginary community which does not necessarily exist in any identifiable space” (1991). Indeed, the advent of mass media, enabled by the creation of printing industries, TV, Internet and more, enables people of certain regions to put forth their ideas and to influence others. As Habermas points out, the “public sphere requires specific means for transmitting information and influencing those who receive it” (1991). Indeed, as rural migrants poured

into the cities, the local media would represent the local people's discourse over the issue. Thus, studying the contents of the media at different times may be a chance to study people's shift in attitudes towards migrants.

One example of such a study would be Adeline Masquelier's study of internal migrants from New Orleans after Hurricane Katrina. Masquelier notes that at the beginning, the local media of towns that received migrating New Orleanians portrayed the migrants as victims. By characterizing them as unfortunate refugees, the media emphasized their tragic experience and expressed a sense of empathy for them, indicating the generally friendly attitudes of the residents. Later, however, referencing the typical stereotypes of lower-income people as well as noting the disorder in the city, the media started to criminalize them by focusing on the "failure, inadequacy, and irresponsibility of the poor" (Masquelier 2006). Specifically, by exaggerating the chaos in the city, with "shots fired" becoming "shootings" or even "urban warfare," the media turned the "people desperate for help" into "a threat to the social order" (Masquelier 2006). In other words, "blackness and the poverty were again pathologized" (Masquelier 2006). In this way, these internally displaced people were reduced to the state of bare life like foreign refugees to some extent. Masquelier reveals this as she points out, "Nonrecognition or misrecognition can confine people to a 'reduced and distorted mode of being'" (2006).

## **Literature On The Case**

### *The Hukou System*

The household registration system (hukou system) was invented in ancient China as a means for taxation and military conscription, which were essential for the central government to maintain control over its subjects (Wang 2010). Under the registration system, Chinese farmers were prohibited from moving without the government's consent until the market reform initiated by Deng Xiaoping in 1978 (Wang 2010). Even after the market reform, the hukou system was not abolished, as citizens were classified into either rural or urban hukou (Solinger 1999). Since urban and rural citizens enjoyed different rights regarding employment, social welfare, housing, and more, some scholars have referred to the hukou system as a "modern caste system" (Solinger 1999). Indeed, under the hukou system, even though both urban and rural residents are legitimate citizens of the People's Republic of China that are entitled to the same civil rights, the actual rights they enjoy are determined by the membership of their local communities. As Marshall says, the rights are "nationally conceived but locally administered" (Castles 2014). However, in China's case, this discrepancy results in unequal rights among equal citizens.

*The Marginalized Rural Migrants*

Under the hukou system, certain rights of the rural migrants are compromised. As Banerjee-Guha writes, “They [rural migrants] live there as a floating mass with limited access to basic facilities” (Banerjee-Guha 2011). The first of these rights is the right to employment, which Marshall identifies as one of the fundamental civil rights (Castle 2014). The work of rural migrants in the cities is typically low-paid, labor-intensive and high-risk compared to the work of their urban counterparts (Yu 2010). Meanwhile, many rural migrants are not getting paid on a regular basis in cities, since many of them are unregistered workers and do not have contracts with their employers. Moreover, they are not able to join unions except for state-run ones, which are often ineffective in gaining rights for the workers (Yu 2010).

The second right that is compromised is the right to satisfactory housing. Unlike urban residents, rural migrants usually do not enjoy housing aid from local governments (Yu 2010). Since they are usually low-paid and cannot afford proper housing in the cities, they usually live in cheap accommodations (Wang 2010). The local city governments, on the other hand, often tend to control the population of rural migrants in their cities by imposing regulations on these accommodations (Chen 2005). For example, in 2004, the government of Shanghai imposed the regulation that the per capita floor space should be at least 10 square meters (Chen 2005). Since very few rural migrants could afford such large housing, a considerable number of them had to move out of the city (Chen 2005).

The third right that is compromised is the right to education. In 1985, the central government stopped paying for the compulsory education of children of rural migrants; instead, education has since been paid for by local governments (Chen 2005). In fact, some cities’ governments, especially those of huge cities that have a considerable number of rural migrants, were unable to afford such a massive government expenditure (Yu 2010). As a result, some city governments required the rural migrants to pay a certain amount of money for their children’s public education (Yu 2010). Otherwise, their children would have to go to so-called schools for migrant children, which usually have lower-quality education compared to local public schools (Yu 2010).

The final right that is compromised is the right to social welfare. Since the rural migrants’ hukous are only valid in rural areas, they are denied access to many social welfare programs in the cities (Banerjee-Guha 2011). Specifically, many of them cannot enjoy unemployment benefits, health care, pensions, and more in cities (Yu 2010). Even though in recent years, some cities, such as Beijing, Shanghai, and Guangzhou, have initiated reforms to include rural migrants in urban social welfare programs, the effects of the reforms turned out to be limited, as the limited government budgets could not afford to pay for the social welfare of such a great number of rural migrants (Wang 2010).

*Social Construction Of The Rural Citizens As A Distinct Group*

Dorothy J. Solinger, in her 1999 analysis of Chinese citizenship issues, points out that “at least as a social construction, urban Chinese generally view rural Chinese as ethnically distinct” (1999). Specifically, she indicates that rural migrants’ lifestyles, customs, and habits were so different from their urban counterparts that they faced a sense of exclusion from their urban counterparts (1999).

Yingfang Chen further points out that the disparity results in the social construction of rural migrants as an identity. Because of the hukou system, many rural migrants perceive themselves as outsiders of the cities (Chen 2005). Meanwhile, such a self-perceived identity also shapes their behaviors in the cities, as very few of them would participate in local activities or build relationships with their urban counterparts (Yu 2010). By identifying them as rural migrants/ rural workers, the governments are continually affirming their identity as outsiders of the cities (Chen 2005). Additionally, the media also participate in the social construction of rural migrants by characterizing them as different from urban citizens (Chen 2005).

**Research Question**

This research paper aims to address the following question: to what extent has the public discourse on intranational rural migrants shifted in Chinese immigrant-receiving cities from the period of 2000–2005 to the period of 2015–2018?

**Methodology**

In this study, 64 articles from local newspapers across mainland China and their websites were collected and used for coding. Specifically, 33 of the articles were published between 2000 and 2008, and 31 of the articles were published between 2015 and 2018.

The two periods in this study were chosen because they represent two different phases of the Chinese economy and society. In the first period, 2000–2008, economic growth was phenomenal, especially after China joined the World Trade Organization (WTO) in 2001. In this period, China became more integrated into the global economy; as a result, foreign companies started to invest in factories in China to take advantage of its cheap labor (Prime 2002). These factories provided a considerable number of jobs, most of which were occupied by rural migrants (Prime 2002, Wang 2010). As a result, a large number of migrants entered the cities in this period. The period of 2015–2018 represents another phase in Chinese society. In this period, many of these immigrant-receiving cities have been overpopulated, resulting in a series of social issues (Feng 2016). Thus, it is likely that

public discourse has changed between these two periods along with the overpopulation of cities by rural migrants.

The primary focus of this research is to study the change in public discourse over the influx of rural migrants during the given time periods. Public discourse is significant for this research because it reflects how Chinese people, the basic constituents of Chinese society, reacted to the influx of rural migrants. The first type of article chosen for this research is interviews with local residents. They are chosen because they directly reflect how the local residents reacted to the influx of migrants at different periods, based on which discourse analysis may shed light into how their attitudes changed over time. The second type of article includes interviews with rural migrants, special reports about rural migrants in the cities, and news articles that mention rural migrants. These types of articles are chosen because they indicate how the media portrayed the rural migrants, which is reflective of the public opinion within a social space.

There are certain types of articles that are excluded from this research. First, articles about the government's new policies on the rural migrants are excluded because the focus of this study is the public's attitude rather than the government's policies, though the former may have some potential effects on the latter. Second, articles written by government agencies are also excluded. Since the government agencies tend to maintain the government's positive public image, these types of articles rarely express negative opinions towards the migrants and may not represent people's attitudes towards them. Finally, articles written by scholars are also excluded, since these articles tend to be strictly academic and may not represent people's attitudes towards the migrants. The following themes were used for coding:

### *Criminalization*

Criminalization is a significant theme because the existing literature argues that the depiction of refugees or migrants by the media as criminals could be a means of social exclusion (Masquelier 2006). To understand this theme, words such as "criminals," "threat to public security," and "enforce our laws" were coded.

Meanwhile, according to Cacho's theory of illegality of body, illegality is often generalized to a group instead of focused on certain individuals (2012). If the rural migrants faced a similar pattern of criminalization, it would be expected that few articles would mention the names of the migrant criminals. Thus, among these articles, the number of articles that listed the names of the migrant criminals was also coded.

### *Victimization*

The theme was used for coding because the existing literature indicates that the media's portrayal of a particular group of people as victims often represents the public's

sympathy towards them (Masquelier 2006). By coding this theme, I may be able to determine to what extent the public was empathetic towards the rural migrants. To understand this theme, I searched for words such as “victims,” “poor living condition,” and “tough working environment.”

#### *Market Citizenship*

Existing literature reveals that under market citizenship, one’s social worth is often determined by the person’s effort and contribution to the society (Somers 2008). By coding this theme, I may be able to determine to what extent the public considers the rural migrants as socially worthy under the context of market citizenship. To understand this theme, I coded words such as “contribution,” “self-made,” and “hard-working.”

#### *Marginalization*

Existing literature reveals that rural migrants have been socially constructed as a distinct group in the city (Solinger 1999, Chen 2005). By coding this theme, I may be able to determine to what extent urban residents tended to exclude rural migrants. To understand this theme, I coded words such as “our social resources” and “alien migrants.”

## **Results**

<i>Themes</i>	<i>Number and Percentage of Articles (2000–2008)</i>	<i>Number and Percentage of Articles (2015–2018)</i>
<i>Criminalization</i>	12 (36.36%)	14 (45.16%)
<i>Market Citizenship</i>	11 (33.3%)	10 (32.26%)
<i>Victimization</i>	18 (54.54%)	6 (19.35%)
<i>Marginalization</i>	8 (24.24%)	15 (48.39%)

## Findings

### *Portrayal As Victims*

The first significant finding is that media coverage of rural migrants in the first period tends to portray the rural migrants as victims of larger social forces, as 36% of the articles include this theme.

Specifically, a consistent theme among this type of article is the discrepancy between their tough work and the income they receive. For example, an article reads, “For survival, they [rural migrants] have to take heavy works, some of which are hazardous to their health. However, the income they receive does not match the intensity and danger of their works.” The title of another article even reads: “the workers [referring the migrant workers from rural areas] are using their lives to trade for their wages; many workers are dying in silence.”

Meanwhile, in these articles, rural migrants are often characterized as “lacking education,” “unable to defend their rights,” and “submissive to mistreatment.” This is also reflected in several articles about the mistreatment they received.

The most common type of such mistreatment was wage arrears. An article points out that “they can hardly sustain their lives in the city because of the wage arrears.” Another article reports a local contractor hired over 60 hatchet men to beat those rural workers demanding their unpaid wages.

Several articles also talk about local government’s tough position on them. For example, describing the local government’s operation to clear out illegal accommodations, an article reads, “They [government officials] knocked down the doors, forcefully moved the furniture, and smashed the walls that separated the rooms with hammers.”

The majority of articles of this type also mention the presence of family and especially children who live with these migrant workers. Specifically, they mention the harsh living conditions of the families. Phrases such as “the family's breadwinner,” “hard to afford living costs,” “have to live together in a small room” often appear in this type of coverage. Specifically, one article mentions the meals that were distributed to the children of migrant workers in a school for migrant children (a specific type of school for migrant children whose parents could not afford to pay the fee for normal public school), which consisted of “rice, stewed cabbage, fried bean sprouts, and thin vegetable soups.”

Even an article about the criminal activities of second-generation rural migrants tends to portray them as victims, as it reads, “We are ignoring this group of kids [second-generation rural migrants]; they cannot receive good education nor proper care and guidance from the parents; probably this is the reason why that would commit crimes.”

Overall, in this period, the media tended to portray the rural migrants as victims by characterizing them as both vulnerable and mistreated. This is significant in that it reveals the public’s sympathy towards their new neighbors.

However, in the second period, between 2015–2018, the percentage of articles that contain this theme decreases drastically to only 19%. Two potential reasons may account for the drop. First, the rural migrants were indeed getting better treatment in the cities. Several articles mention that the rural workers were to some extent satisfied with their current conditions, as in the local governments have been trying to reduce the socioeconomic gap between rural and urban residents. For example, an interview with a rural migrant reads, “My child is in second grade in primary school right now. It is quite convenient for my child to go to school, as I do not even need to pay temporary schooling fee.” On the other hand, Adeline Masquelier’s study of the change in public discourse about internal migrants after Hurricane Katrina could also be applied here to account for the change. Masquelier points out that after the initial depiction of the migrants, which indicates the public’s sympathy for them, the migrants were turned from victims into criminals in the media (2006). In the case of Chinese rural migrants, it is possible that as the population of rural migrants gradually increased in the cities, their presence as an illegal group became visible and even distinct, which subjects them to depiction as criminals instead of receiving sympathy.

#### *Criminalization*

Portraying migrants as criminals is a relatively consistent theme over the two periods, increasing rather modestly from 36.36% of articles containing this theme between 2000–2008 to 45.16% of articles containing this theme between 2015–2018. In these articles, the rural migrants were usually generalized as a potential threat to public security. For example, an article reads, “The Yaoshan community has many migrants and a complex make-up of residents, which results in a complex security situation.” In these articles, the phrase “increase of migrant population” is usually followed by the phrase “a threat to public security.” Some articles refer to the migrants as “cancer,” “human traffickers,” and “high-risk” population. This is expected, according to Masquelier, since portrayal as criminals is often a means of social exclusion (2006). In the case of Hurricane Katrina, the social exclusion of New Orleanian migrants was carried by negative descriptions of migrants (Masquelier 2006). In this case of Chinese rural migrants, it is likely that the disparaging descriptions of the rural migrants reflect the social exclusion they faced from the city residents.

#### *Market Citizenship*

The percentage of articles that contain this theme in the two periods is roughly the same, with 33.33% in the period between 2000–2008 and 32.26% in the period between 2015–2018. This indicates that market citizenship is a persistent theme throughout the periods.



According to Margaret R. Somers, under market citizenship, an individual's social worth is determined by his/her economic success and contribution to society (2008). Indeed, in this coverage about rural migrants in the cities, contribution to the cities and efforts to make a better life are consistent themes. For example, an article from the first period reads, "They [rural migrants] have made huge contributions and sacrifices to the city of Beijing, and the fact that they are still receiving little income is upsetting."

Similar to the previous theme, articles of this theme also frequently mention the presence of families, specifically how the rural migrants are working hard to ensure a better future for their families. For example, one article reads, "I [a rural migrant] wish my child can take a different life path than being a worker. I wish he can walk out of the rural areas and get into a good college. This is also one reason for me to come to Shanghai in the first place."

Even the children of the rural migrants have been characterized as hard-working. An article from the second period about the summer vacation of children of rural migrants reads, "When some parents [referring to city residents] are trying to motivate their children to do housework by paying them pocket money, the eight-year-old Kezhe Feng has started to help his mother [a rural migrant] clean up the clinic...."

These articles usually feature the migrants' struggles to make themselves a better future in the city. Since media are often a reflection of public discourse, it indicates that urban residents generally recognized the rural migrants' hard work. Under the context of market citizenship, it indicates that urban residents considered the rural migrants not as burdensome but as socially worthy to some extent.

### *Marginalization*

The percentage of articles that contain this theme in the first period is 24.24%, while the number rises to 48.39% in the second period, indicating that the rural migrants have continued to be marginalized. This is expected, according to Yingfang Chen, who indicates that the rural migrants have been socially constructed as a distinct group subject to a sense of gradual social exclusion (2005).

Just as Chen points out, the media and the government have been identifying and affirming the status as rural migrants. For example, in media coverage about crimes committed by rural migrants, often, their status is mentioned. The titles are often along the lines of, "A Migrant Worker Raped a College Student Twice" or "Migrant Workers Broke into Prohibited Area to Steal Precious Herbs." In contrast, few articles would address the identity of criminals as "urban residents."

Meanwhile, the locals also express concern for the public resources taken up by rural migrants. For example, an article about an interview with a resident in Beijing reads, "If this policy continues [to give rural migrants more social resources], it would be hard to control the population of Beijing. Our high-quality education resources would be taken up."

In this case, the way that the woman emphasizes “our resources” indicates that she views the rural migrants not as new members of the city but as a distinct group taking away their resources. Indeed, as the number of rural migrants in cities rises every year, such concern may also grow among city residents, resulting in the further marginalization of rural migrants.

## **Discussion And Conclusion**

This research addresses the change of public discourse about rural migrants of Chinese immigrant-receiving cities between 2000–2008 and 2015–2018. The coding results indicate that the public’s attitude has been shifted negatively in recent years. Specifically, while the rural migrants continue to be deemed important contributors to the cities, they are gradually marginalized and portrayed, as a group, as criminals. Identifying and studying the public discourse about Chinese rural migrants has implications for both researchers and city governments. For researchers, this would be an opportunity to study how people’s perceptions of a migrant group could change over time as the migrant population increases. For policymakers in local governments, understanding the public’s attitudes towards rural migrants is crucial for addressing the issue of separation between migrants and residents as two groups and the building of a more harmonious city environment.

Due to the limitation of time and resources, this research only coded a limited number of articles. Consequently, the results of the coding could be affected by chance. Thus, it is recommended that future research include more articles to make the results more conclusive. Moreover, the initial aim of this research was to analyze the public discourse in three different types of cities—traditional metropolitan cities like Shanghai, new immigrant cities like Shenzhen, and new destination cities like Chengdu. However, the articles collected from newspapers of these three cities were too limited to yield a conclusive result. It is recommended that future research study the variances in public discourse in these three types of cities, which would render the results more applicable to different types of cities.

A pattern observed in this study is that most articles with the theme of migrants as criminals do not name the rural migrant suspects (83% in the first period and 93% in the second period), while most articles with the theme of market citizenship name the rural migrants (64% in the first period and 80% in the second period). Regarding articles related to the theme of migrants as criminals, rural migrant suspects are usually referred to as “a migrant worker,” “non-locals,” “outsiders.” This could potentially be accounted for under Cacho’s theory of illegality of body, which states that illegality is affixed to a group of people instead of individuals (2012). In this case, it is possible that illegality is affixed to the group of rural migrants in the cities instead of individual criminals. On the other hand, articles related to the theme of market citizenship often have a detailed description of certain rural migrants’ contribution to society. It is therefore recommended that future

research focuses on identification of rural migrants in media coverage (including name, age, occupation, native place, and more). Specifically, future research could address to what extent such different levels of identification in media coverage about rural migrants reveal urban residents' perceptions of the rural migrants.

In 2014, the State Council issued the *Suggestions for Further Promoting the Reform of the Household Registration System*, initiating the Household Registration System Reform (State Council of People's Republic of China). By 2017, the reform had started in some provinces and municipalities, with the division between rural/urban hukou being canceled. It is expected that by the end of 2018, the reform will be implemented in all parts of mainland China. Previous literature has shown that the hukou system has caused social division between rural and urban citizens to some extent (Solinger 1999). It is recommended that future research consider the reform's implications on public discourse about rural migrants. Specifically, future research can focus on whether and how the change of public policies could result in the change of the public's attitudes towards the migrants.

According to the existing literature, a significant influx of rural migrants into the cities took place at the beginning of the 1990s, when mass transportation was put into use (Wang 2003). As a result, there was likely a moral panic across Chinese cities, as city residents were generally concerned with the advent of such a vast population of rural migrants. Because of the lack of available sources, this study does not analyze the public discourse in this period. Thus, it is recommended that future research study whether a moral panic occurred in this period and how it impacted the urban residents' attitudes towards their rural migrants later on.

This research analyzes Chinese rural migrants through the lenses of victimization, market citizenship, criminalization, and marginalization. The analysis can have implications besides this study, as many migrants across the world often face similar patterns of victimization, characterization under market citizenship, criminalization, and marginalization. One recommendation for future research is to study Chinese diaspora across the world. There is a huge population of Chinese internationally, some of which have been well integrated into local societies, while some of which may face similar social exclusion as experienced by domestic rural migrants. Thus, it is recommended that future research study how Chinese diaspora have been integrated or excluded in different regions across the world.

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## Can a Computer Be an Author? Human Workers and Machine Poets

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### Abstract

The emergence of Artificial Intelligence is revolutionizing our society in various ways. Here I have discussed the influence of Artificial Intelligence, which is capable of composing poems, on our understanding of writers. I have concluded that judged by author’s definition today, the AI poets should be considered as authors as well though they lack the thinking process known as epiphany which is unique to the human kind.

### Introduction

Artificial Intelligence, or AI, is revolutionizing our society. In 2016, AlphaGo’s victory over GO champions announced Artificial Intelligence’s dominance in the field of chess. From there, AI then debuted in all aspects of our society, ranging from self-driving cars to disease diagnosis. In addition, with technological breakthroughs in neural learning, current AIs are no longer imitative machines, but have learning ability, which enables them to compose poems, artwork, and music—things that were unique to humans before.

It’s hard to determine whether works from composing machines should be considered original and creative, and even harder to determine whether machines that write should be classified as authors. The emerging technologies of uploading human consciousness to hardware and editing the human genome complicate the situation because the line between machines and humans is blurred as we seek to make humans objects while tend to humanize AIs. As AIs with creativity to create original contexts, or, so to say, machine poets, may pose challenges to our uniqueness as autonomous human beings, it’s increasingly worthwhile for us to examine the reasons for making creative AIs and the potential impacts of them. Without thoughtful consideration and regulation of Artificial Intelligence, chances are we shall find ourselves losing value as human beings, or even worse, dying out in the competition between the old and new intelligence.

In this paper, my aim is to discuss whether we should consider AIs that can compose poetry as authors or autonomous agents; how will the emergence of this machinic ability transform the value of authors and challenge our uniqueness as the only species with creative competences? Beyond that, I will explore our motivation to blur the line between humans and machines. My approach here starts with a summary of the development of composing machines, focusing on how the originality and creativity of composing machines have developed over time. Then, I discuss whether these machines should be considered authors. I will then examine the reasons why we are keen to create these machines that can outperform us in creative endeavors. The question is: why do we seek to humanize machines while simultaneously mechanizing ourselves? Ultimately, I seek to address the question of whether or not humans can remain uniquely creative beings as the AI revolution comes near.

### **The Development of Machines That Write**

In the year 2016, chatbots and poem-creating bots like Xiao Bing from Microsoft and BabyQ from Turing Robots became a hit on social media in both China and America (Newitz, Annalee). These two chatbots are the most famous inventions in the field of natural language processing, a subfield of computer science that centers on the literary interactions between humans and machines. The viral spread of these chatbots has created a common impression of composing machines: that they are the recreational by-product of neural network research. Quite to the contrary, machines with the ability to create poems were developed even before the birth of the neural network.

In 1984, *The Policeman's Beard Is Half Constructed* was published as the first poetry collection composed by a computer called Racter, the first computer bard. Racter's works were impressive and even considered as publishable. However, Racter was never considered an independent composing machine, as most of its works were mere emulations of human poetic production and its writing required human supervision. In one of the most famous pieces, Racter writes: "more than iron, more than lead, more than gold I need electricity...I need it for my dreams" (12). It's easy to observe the human influence on this work, as the poem follows one general pattern and matches perfectly our common understanding of how a robot might feel.

Apparently, researchers are not satisfied with such human-dependent machines. The development of supervised and unsupervised learning has drastically improved the quality of poetry generation with computational systems, in terms of both the quality of words and the internal process. Before the end of the 1980s, natural language processing was based on complex rules preset by human researchers. But as the hardware for computing has been greatly improved, later language processing machines are mainly based on machine learning algorithms, which enables machines to understand contexts independently, set their own rules for composing, and evaluate their works for improvement based on those rules.

Current machines are based on various algorithms and neural network structures. In the year 2012, Simon Colton developed what is called “a fully autonomous computer poet” (95). This machine is composed of two sets of recurrent neural networks with one specialized in composing contexts while the other is specialized at decoding and evaluating compositions. This special computing structure enables the machine to create its own standards for composing and generate context without human intervention. In addition, Hoyt Long and Liang-Yan Li analyzed machine-generated poetry and found usable patterns for future machinic writers (235). These all proved that machines are generating independent poems not based on human ones.

### **Are AI Poets Really Authors?**

Witnessing how multiple computational algorithms like FIGURE8, XiaoBing, and BabyQ succeed at exhibiting a similar level of composing as humans, I find it safe to say that AIs now have the capacity to generate publishable works and exhibit a certain level of creativity and originality using unprecedented similes they created. While the composing process of these machines is void of humans, however, the database based on which machines generate their poems contains human poetry only. Then the question is: can these machines be considered as authors?

The definition of an author has varied over time and depends on whom you ask. It was generally believed that in the time of Homer, an author was more of a narrator than a composer. On the other hand, literary works were considered to relate more to the context than to the individual who composed them. As Michel Foucault suggests in “What Is an Author?”, Beckett characterizes the dilemma of the authors vividly with the question, “What does it matter who’s speaking” (12). That situation changed as the Middle Ages came to one end, when the power of the individual was stressed and even exaggerated. The meaning of an author began to include not only his works but also his insights and thoughts, which possibly were re-created by readers rather than the author, enriching the definition of the word “author.” The glory of one author lasted long and even to today many still find authors of major influence on literary works.

Opposing voices appeared around the late nineteenth century, when Mallarme questioned the value of the author with the idea of his impersonality. It is remarked that language should be the origin of literary works rather than a certain individual whose contribution is no more than arranging and creating inscription. Siding with Mallarme, Roland Barthes claimed that authors’ influence should be absent in the process of reading (5). He found the work of modern authors “can only imitate a gesture forever anterior, never original”, for the text itself is a complex of citations of historical words (4). Seemingly aligned with the ancient idea, Foucault changes the definition of an author to one tactful performer, whose works were not his, yet were made through his performances (14).

In addition, the L=A=N=G=U=A=G=E poets showed the theoretical poststructuralist ponderings in actual poetry. They defined the process of writing as “language-oriented”, the phrase used by Roland Barthes in one of his L=A=N=G=U=A=G=E essays (4). It should be noticed that the L=A=N=G=U=A=G=E poets questioned the meaning of literary composition as they considered modern authors as not creating new statements or new ideas but rather approaching those ideas through novel arrangements and new relationships between ideas and words. Furthermore, the role of the author was no longer as noble and elevated as writers during The Enlightenment had deemed it. Authors merely recombine pre-existing ideas.

Though the statement of L=A=N=G=U=A=G=E poets seems less acceptable as it undermines the value of our literary works, it’s genuinely true that all compositions and texts today are inherently recombination of existing words and phrases. While it’s true that like Shakespeare, authors once were original enough to create new words by themselves, it seems that as the number of literary creations mounts in history, there was a point when literary creations were not the author’s original thoughts but a tissue of existing symbols and ideas. Much like how the material world is constructed by pre-existing atoms and molecules yet remains diverse thanks to dynamic relationships among objects, the world of literature is now composed by pre-existing words, phrases, insights, and emotions, yet holds great diversity in how one connects those elements and finds meaning in relationships, but not the elements themselves.

As the Merriam-Webster dictionary defined “author” as one who originates and creates something literary, we can define authors by the nature of their work that is to build new connections of existing phrases and words. And now that the definition of an author is clear, we can assess whether composing machines can be considered as authors. It’s clear that because an author’s role is fundamentally imitation and recombination, there is no difference between machine poets and human poets, who all perform well in creating novel connections with pre-existing components. It is just that human poets’ patterns of creating poems may stem from interactions with Nature, while those of robots stem from the patterns they were indoctrinated with or learned from former human-composed poems.

### **The creativity and originality of computer poets**

We can agree that human poets and computer poets are on the same level in regard to rearranging pre-existing words and creating new relationships. However, without further discussion, this agreement may undermine the value of our writings. Hence, it is crucial for us to discuss the uniqueness of human poets compared to computer poets and vice versa.

Although computational systems prove to be authors when we discuss the nature of authors’ works rather than the process of composing, we must admit that computer poets compose through a physically different approach. Different from how humans or mammals



construct memory through spatial sequence related to time and location, computers store and process information through a set of address pointers that are not necessarily lined up. What this means is that a computational system can free up more energy and process multiple pieces of information at the very same time. In other words, computers are less restrained by time than we are, making them capable of generating, directing, and storing information through different approaches. Stephanie Dick noticed this talent of computers as well, saying that “although the Logic Theory Machine proved theorems from the pages of Principia, it did so with very different media.” (85)

Considering such a difference in the process of generating compositions, one may get the impression that the compositions of computer poets seem less original, for those poems seem to be influenced by human works. Take FIGUR8, a chatbot that specialized in creating similes, for example. The odd sentence it created—“The snow falls like a dead cat”—seems less extraordinary now, considering how this sentence seems to follow one static pattern and the words seem to come from one human individual rather than a computational system.

However, it is physically impossible for us to perceive the world through the lens of AI until we have achieved “teaching computers to think for themselves and improvise on common situations” as Clark said (5). So how should we define whether a composition is generated by an independent composer or a mere recorder of one million broken phrases? Or, on the other hand, are we completely independent thinkers capable of generating novel ideas or ones who are only taking on former ideas to create new combinations?

The bleak fact is that we are the latter because our compositions all are based on previous perception. This means that although current computer poets seem to imitate human poets rather than exhibiting a unique computer-like creating approach, they perform as well as human poets and meet our criterion for being creative. As explained above, our criterion for creativity is to appear novel to others by merging two or more pre-existing compositions.

In other words, our current silicon writers do lack a command of originality, as all the inputs for the algorithm derive from human perception; but they are as genuinely creative as we are, because they meet the criterion of appearing creative.

### **Objectify humans while humanizing machines**

It is self-evident that the development of composing machines is blurring the line between humans and machines, but that is not the only factor. Our mania for human enhancement technology also plays a role in this process. The uncanny situation we are now facing is that, on the one hand, we are keen to upgrade Artificial Intelligence to be more human-like, while on the other hand, we tend to treat ourselves as machines with human enhancement technology.

The shift of our perception towards the human body happened in the early nineteenth century when bio-medical breakthroughs revealed similarities between human bodies and

functioning machines. For example, in the novel *Frankenstein*, diseases and death, which once were depicted as mysterious, uncontrollable forces in the arts of the Middle Age, were now perceived as dysfunctions of our physical system (6). And from there, with the rapid development of clinical medicine and biological technology, direct enhancements of the human body like synthetic organs and gene therapy became possible. Concepts like cyborgs and designer babies began to appear in scientific novels and human enhancement was greatly advocated by transhumanists.

It's undeniable that although many are against human enhancement, such a concept is gaining supporters and investment in recent years. It's reported that investment in the cell and gene therapy industry in the UK grew 10 times from 2012 to 2016, to 400,000,000 pounds per year (CGT Catapult, 2016). The same situation happened in the United States, and NIH just launched a new initiative to accelerate curative genetic therapies for sickle cell disease in September 2018. These investments reveal the modern perception of our physical body: it is no longer an integral entity but rather an assembly of replaceable, coordinated pieces.

This concept, along with our mania for Artificial Intelligence and human-like robots, shows that we are now intentionally creating an uncanny scene, in which "objects become humanized and humans become objectified," as noted by Kathleen McConnell (7). And the reason behind these two trends is surely worth exploring.

The reason behind our keen interest to transcend natural limits and edit our body may be attributed to the first Industrial Revolution, when hi-technology first was integrated into our society. It's believed by Jacques Ellul that the birth of industrial technology triggered our worship of efficiency and technologized our society into one that viewed all activities as industrial processes (111). This worship of efficiency directly led to our current mindset of treating human bodies as one functioning system rather than as an unbreakable entity. It's this very mindset that turned humans, who once deemed themselves as "the paragon of animals," into canny fabricants nitpicking about their flawed parts. Apart from worship of technology, the idea of human enhancement also stems from the Enlightenment, when individual power was first considered to overcome destiny, or even God. According to prehistoric myths of China and Greece, like "Jingwei Reclamation", the desire to become or surpass God has been part of human nature for a long time. With genetic-editing technologies enabling us to design life, our appetite for transcending our limits, both physically and mentally, is expanding drastically.

The desire to be godlike also leads to the rapid development of composing machines in the field of literature, music, and fine arts. Though authors of those algorithms tend to explain their motivation as "improving our understanding of human creativity," this saying is not quite convincing because computational creativity and human creativity have completely different physical bases, as we elaborated above (628). In addition, current researches in Neuro Linguistic Program are already enough for daily human-machine communication. So, why are researchers in the field of Artificial Intelligence keen to create independent machine poets, like the old man Geppetto was keen to carve that talking log in to a real boy? Although

many, like D. E. Berlyne, attribute our passion for research to the inherent curiosity of humanity, here I argue that researches in the field of composing Artificial Intelligence are mostly undertaken to expand and exercise human power to create life, rather than for practical needs, or to satisfy curiosity (185).

### **Our identity dilemma**

The existence of composing machines inevitably puts us, not just the authors but the entirety of humanity, into a dilemma of identity. The fact that current AI poets can appear as creative as humans and generate poems without our supervision challenges our authority as the only species capable of high-level creative endeavors. While David DeGrazia argues that genetic interventions make us less “human,” the fact that Artificial Intelligence exhibits a similar level of creativity, which is merely the ability to recombine existing things, undermines the value of our human identity. So, what is our identity as human beings, when not only our bodies but our minds can be surpassed by machines.?

To address this question, we need to first articulate what identity is. The term was originally created to differentiate one from the environment. In other words, identity is based on uniqueness. Now the question has shifted to what is still unique about us when considering the existence of seemingly creative computer poets. What is unique about human intelligence?

Many hold pessimistic views regarding our uniqueness compared to current and future Artificial Intelligence. Mark O’Connell in his book *To Be a Machine* stressed his concern for the destination of cutting-edge technology:

[T]ranshumansim is a liberation movement advocating nothing less than a total emancipation from biology itself. There is another way of seeing this, an equal and opposite interpretation, which is that this apparent liberation would in reality be nothing less than a final and total enslavement to technology. (14)

Here, O’Connell pointed out our complex connection to technology and how we might lose our value in enslavement to technology. And Peter Nagy, aligned with this idea, says that although historical technology enabled us to perform advanced tasks, modern technologies, related to computer and Artificial Intelligence especially, compete with human beings (4). And, according to both O’Connell and Nagy, the chances for human intelligence to outperform Artificial Intelligence, or silicon-based intelligence, are so low that we may lose our value as humans.

Though John Danaher once argued against such resolute pessimistic statements, he too agrees that technologies like AI that can help us transcend natural limits can be a trade-off, in which we always run the risk of losing originality and being replaced (251). However, contrary to those concerns, here I argue that although our uniqueness as creative agents is challenged, we still have our unique feature, which is the process of epiphany.

## Our Unique Feature of Epiphany

The word “epiphany” was first created to describe how divine power endows insights and had roots in religious purpose. But now, its common meaning refers to a mental process that is sudden, momentary and often shapes one’s perspective or helps one achieve striking, significant realizations of personal identity with enduring effect. One famous example of epiphany is the story of Archimedes, when he discovered how to calculate the purity of one golden crown, suddenly yelling out the famous term “Eureka!” Interestingly, the concept of “sudden realization” not only existed in ancient Greece but also in ancient China. In the Northern and Southern Dynasties (420-589), Chinese Buddhist Zhi Daolin first introduced the idea of “sudden realization” to elaborate his belief that one can only achieve higher level intellect and perspective through an occasional moment of realization. Those two myths from two unrelated cultures demonstrate the indubitable existence of epiphany. Further, Matthew G. Macdonald proved the validity of epiphany by interviewing volunteers about their experience of sudden realization in life and examining those stories using a narrative methodology (90). The methodology includes a credibility check carried out by psychiatrists and psychotherapists with 25 years of experience. By analyzing those volunteers’ experiences, Macdonald noted that the process of epiphany also “highlights the extraordinary resources that the participants called on to make positive lifelong changes, all of which occurred outside the consulting room” (95). This observation suggests that epiphany is common for humans and happens without direct external input. Epiphany, different from developmental changes in mind, is an isolated and often unexpected process. As mentioned before, all ideas represent new combinations of existing ones. From that perspective, the process of epiphany can be understood as the process for one to reflect on past experiences, consciously or subconsciously, to form new connections without a trigger from the external world. The process is entirely internal and cannot be attributed to one special occasion or signal as input.

Psychiatrists have also tried to define the process of psychological epiphany. Ariana N. Jarvis’s described epiphany as follows:

The experience was found to be effectively intense, ego syntonic, and profoundly liberating. The experience of epiphany among the participants studied occurred primarily during adolescence or early adulthood, was preceded by a period of internal conflict (13).

In her book *Taking a Break: Preliminary Investigation into the Psychology of Epiphany as Discontinuous Change Experiences*, Jarvis proposed that significant structural changes to our adaptive brain may account for the process of epiphany. This hypothesis can also explain why the process mainly happened “during adolescence” and was preceded by “a period of internal conflict,” which involves feelings of anxiety, alienation, and even depression.

So now we can deduce that the reason the process of epiphany is possible for us humans is partially due to the flexible structure of our brain, one that can rearrange

connections of neurons rather easily through the relocation of neurotransmitters. Now, to discuss whether this is a unique feature for us compared to Artificial Intelligence, we must analyze the computing process of Artificial Intelligence based on two criteria: First, can the physical basis of their computing process change significantly over time? Second, can the computing process happen without a direct external signal as input?

When we apply these criteria to existing Artificial Intelligence, we can conclude that they do not meet either of these criteria. To elaborate this conclusion in detail, here we shall first categorize current AIs and discuss their computing process on a case-by-case basis.

For supervised learning, algorithms require a training process: considerable amounts of input are inserted while the outputs are compared with a set of “correct answers.” Much like a student learning through practice tests, supervised learning networks can adjust their coefficient for each calculation for better performances. But the degree of adjustment and the structure of data flow is pre-set by humans and machines do not have the rights or ability to change them.

Unsupervised learning happens without a set of “correct answers” to learn from, yet it gives space for the machine to recognize patterns based on data without an historical tag. In other words, unsupervised learning is observing the background without any background knowledge or guidance from humans. Machines are more flexible in this scenario, but the structure is still pre-set by the researcher, and the learning process cannot happen without a clear signal.

The learning process of reinforced learning is based on a reward system. Machines interact with the environment to seek for the best action with fullest reward. The adjustments of this type of algorithm, defined by the basic mathematical concept of gradient descending, are gradual and subtle. More importantly, the learning process requires real-time interaction with surroundings. In other words, this kind of learning is not an isolated process.

So now we have argued that for types of existing AI, the process of epiphany is impossible. Even when we consider the case of strong AI, which is capable of reasoning, learning, and applying knowledge to all scenarios, it’s still impossible to initiate an action without a clear external input redirecting it to one address stored in silicon. Moreover, although there is no established theory about the flexibility of data flow for artificial intelligence, research has shown that there are limits of network performance due to the static data structure.

It’s arbitrary to say that Artificial Intelligence may never exhibit the same or a higher level of flexibility as human brains. However, generally, Artificial Intelligence is unable to exhibit the process of epiphany, which requires it to generate information without inputs. So, from that perspective, I argue that human uniqueness and the human author’s uniqueness are still firmly within our grasp, thanks to our unique feature of epiphany.

## Conclusion

The birth of machine poets has not only broadened Artificial Intelligence's potential implications but also inspired or even unsettled poets to reexamine their uniqueness and the sole purpose of their works. As machines perceive the physical world through an entirely different approach and lack certain features like the epiphany process, machine poets, as creative as they appear to be, can hardly replace humans in the process of literary creation. However, the emergence of machines poets will challenge the human poets to reconsider what our criteria for poems are and be propelled to create poems more relevant to the times.

Technology is transforming us, both physically and mentally. It's important for us, to reexamine the motivation behind our mania for composing machines and artificial intelligence, and to reevaluate whose interest are we serving with this research. My argument here is that we are advancing AIs mainly for the desire to approach godhood, or even to transcend it, which serves no civic good. Thus, although our identity is preserved with our unique computing process of epiphany, we should never jump headlong into the joy of playing God. Rather, we should remain positively skeptical about the advances of our Pinocchio, Artificial Intelligence.

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