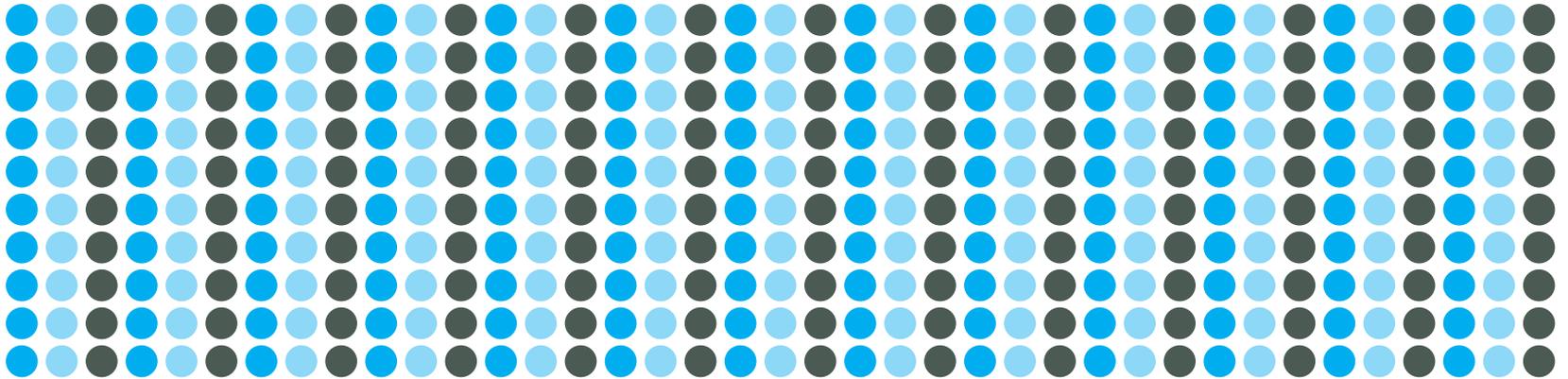


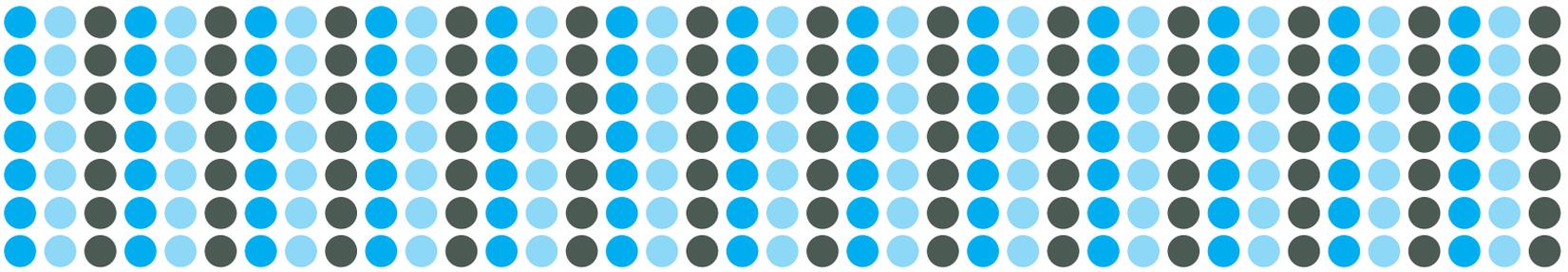
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Elements, the undergraduate research journal of Boston College, showcases the varied research endeavors of fellow undergraduates to the greater academic community. By fostering intellectual curiosity and discussion, the journal strengthens and affirms the community of undergraduate students at Boston College.

Elements

Spring 2016





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QUESTIONS & CONTRIBUTIONS

If you have any questions, please contact the journal at elements@bc.edu. All submissions can be sent to elements.submissions@gmail.com. Visit our website at www.bc.edu/elements for updates and further information.

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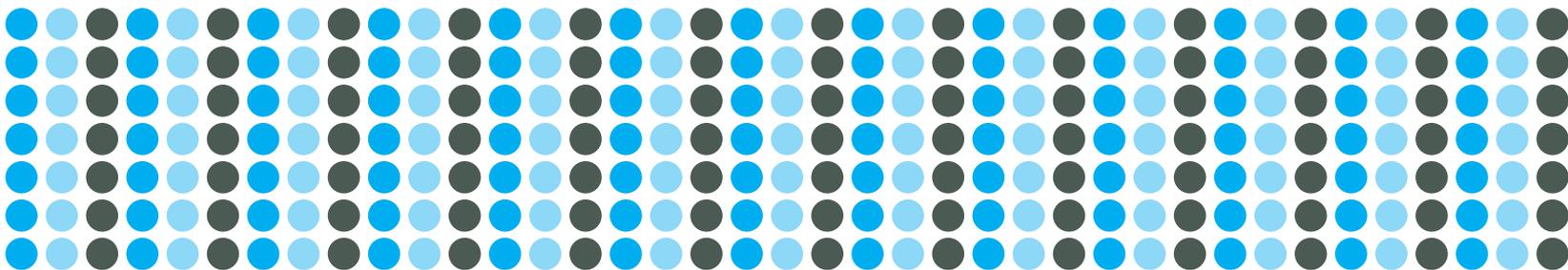
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EDITOR'S NOTE

Dear Readers,

Students at Boston College are often invited to reflect on their academic and personal development in the context of the university's Jesuit tradition. Here at *Elements*, we are often prompted to ask ourselves, "how does our journal incorporate and advance the Jesuit mission?" With this goal in mind, we seek to provide a platform for undergraduates to share their intellectual pursuits, increase awareness on complex yet critical scientific, ethical, and social issues, and foster an environment that encourages thought, discussion, and ultimately action. This issue of *Elements* presents a more diverse collection of research topics than ever before, in an attempt to draw your attention to the myriad facets of human experience, no matter how familiar or distant from your everyday lives.

In our cover article, "Who Would Hire A Blind Poet?", author Christopher Kabacinski contrasts traditional representations of blindness in literature with the life writing of the partially blind American poet Stephen Kuusisto. He highlights Kuusisto's effort to move out of the shadow of Oedipus and Tiresias, and re-present the blind man in his embodied, lived personhood that transcends any labels society can impose. Daniel Park and Clara Lee examines a similar struggle between definition and identity in "Divisions Dissected" by focusing on the notion of the "Asian Bubble" and its impact on the experience and self-perceptions of Asian American students at Boston College. In "Convict the Deviant," Katherine Quigley uses criminal narratives of accused rapists to highlight cultural standards of masculinity and the association of rape with unmanly deviance in the patriarchal society of early America. Meanwhile, "Two Separate Persons" by Jennifer Heine extends this discussion of gender perceptions to Anthony Trollope's novel *Phineas Finn*, which employs gendered ethnic stereotypes to illustrate the duality of its main character's identity. A close read of this set of articles encourages us to reconsider the relationships between external perceptions and self-understanding, and between societal norms and personal identity.

Despite tensions between the individual and society, there are unresolved questions that the human race has a collective stake in. In "On the Wrong Side of the Tracks," Natalie Panariello evaluates the ethical implications of needle resale by assessing the case of a needle black market seller who uses his profits to feed his drug addiction. Juliana Butron considers an equally

pressing social issue in "A Climate of Inaction," as she attributes the lack of effective response to climate change to the limitations of a relational understanding of morality. In addition, Alessandra Luedeking, author of "Titan of Terror," presents the film *Godzilla*, not as mere science-fiction, but as a physical embodiment of the destructive forces of nuclear bombings in Japan.

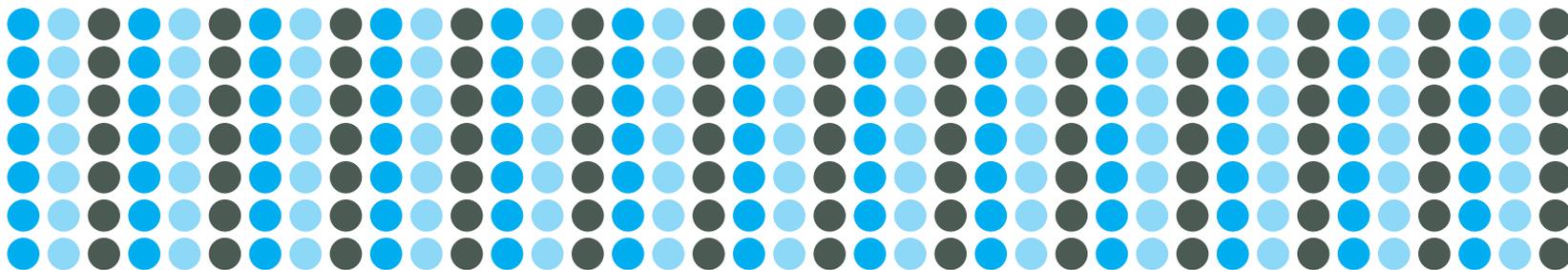
Jesuit education aims to promote intellectual inquiry and dialogue across disciplines, and *Elements* upholds this principle by continuously expanding into new subjects. Rebecca Moretti's article, "The Psychological Puzzle," provides a unique perspective on how the psychology of policymakers may both consciously and unconsciously lead to the top-down politicization of intelligence. Katelyn Johnson investigates the distribution of TMX and CLO residues across various locations of Stroubles Creek in Blacksburg, VA, to determine their impact on "The Dirt and The Bees." In "Dreibens Modulo 7," the first Mathematics research published by our journal, Arthur Diep-Nguyen analyzes the divisibility of strings of 3's and 7's (dreibens) by 7 as a first step in the search for prime dreibens.

Inspiring and fulfilling the desire to know has always been an essential component of Jesuit education. As the new *Elements* editor-in-chief this year, I hope our journal will continue to play a role in igniting undergraduates' intellectual curiosity. Our Spring 2016 issue invites you to consider important questions that your fellow students raised, examine the conclusions that their research suggested, and bring your own experiences and insights to our perpetual search for truth, meaning, and justice, even after you turn the last page of our journal!

Happy reading!

Best,

BETTY (YUNQING) WANG
Editor in Chief



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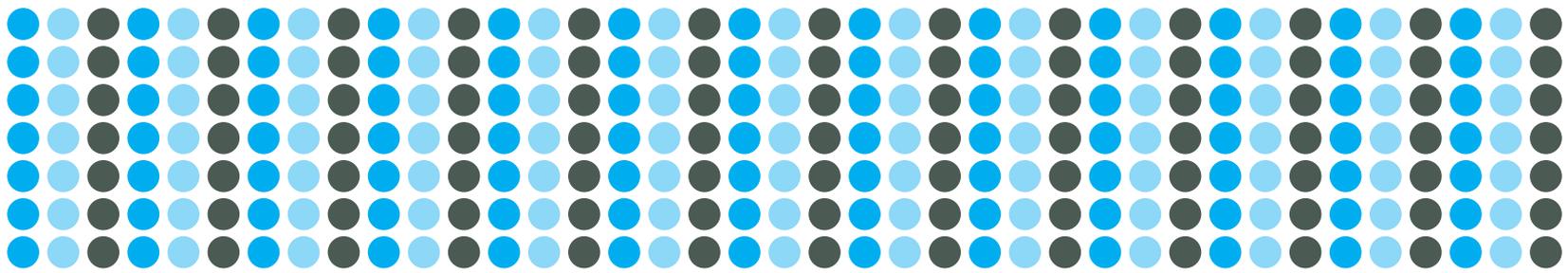
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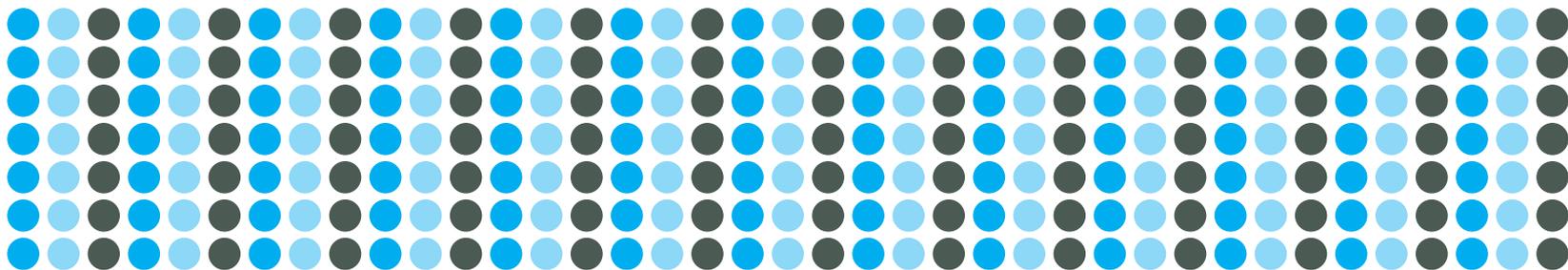
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ON THE WRONG SIDE OF THE TRACKS? *Ethical Considerations of the Needle Black Market*

NATALIE PANARIELLO

SINCE THE LATE 1980S, NEEDLE EXCHANGE PROGRAMS (NEPs) HAVE BEEN GREAT RESOURCES FOR INTRAVENOUS DRUG USERS (IDUs), AS THEY PROVIDE BOTH CLEAN NEEDLES WITH WHICH IDUS CAN INJECT AS WELL AS BASIC HEALTH SERVICES, INCLUDING HIV TESTING AND COUNSELING. HOWEVER, FOR REASONS SUCH AS INCONVENIENCE AND FEAR OF CRIMINALIZATION, MANY IDUS OPT INSTEAD TO PURCHASE THEIR NEEDLES FROM ILLICIT STREET SELLERS WHO ACQUIRE NEEDLES IN BULK FROM NEPs. THIS ESSAY CONSIDERS THE ETHICAL PERMISSIBILITY OF THE SELLERS' ACTIONS, FOCUSING SPECIFICALLY ON THE CASE OF A MAN FROM PHILADELPHIA WHO USES THE MONEY HE OBTAINS FROM NEEDLE RESALE TO FEED HIS ADDICTION. IT IS ULTIMATELY ARGUED THAT THE MAN'S ACTIONS ARE, IN FACT, ETHICAL, AS HIS RESALE OF NEEDLES POSITIVELY CONTRIBUTES TO THE COMMON GOOD BY REDUCING THE SPREAD OF DISEASE. ILLICIT NEEDLE SELLERS SUCH AS THE ONE DESCRIBED IN THIS ESSAY SHOULD BE EMBRACED BY THE PUBLIC HEALTH COMMUNITY SINCE, WITH PROPER TRAINING, THEY CAN HELP TO FACILITATE HEALTH PROMOTING EDUCATION FOR THEIR PEERS.

Every Friday afternoon, men and women of all ages gather in the hallways of Prevention Point Philadelphia to exchange their used needles for new ones. For each dirty needle a user brings, they receive one clean needle in return. While many participants come to Prevention Point with just a few needles to exchange, others come with hundreds. Many resell the needles they receive from Prevention Point on the street of Philadelphia.

One Prevention Point client, who will be referred to in this essay as Michael, resells the clean needles only a half-mile from the site of the needle exchange program. He has chosen this territory because it is a block away from where users buy and shoot drugs and so the clientele are desperate. The needles sell for a dollar per piece, and with enough needles sold, Michael can afford to buy himself a bag of dope. While the resale of needles is illegal in Pennsylvania, Philadelphia law enforcement is tolerant toward black market sellers like Michael.

In this country alone, approximately 800,000 individuals aged 13 or older inject drugs each year.² These intravenous drug users (IDUs) are at high risk of HIV infection, as injection is a major route of transmission of the disease. In fact, about 7% of the estimated 47,352 diagnoses of HIV in 2013 were attributed to intravenous drug use, with an additional 3% attributed to a combination of male-to-male sexual contact and IDU.³ In Philadelphia, the rates of infection via injection are similar to those of the nation, with 7.7% of AIDS cases and 4.4% of HIV cases diagnosed in 2013 resulting from infected needle sharing.⁴ As an urban



CLEAN HYPODERMIC NEEDLES AND SUPPLIES FOR INJECTION (COURTESY OF WIKIMEDIA COMMONS)

city, Philadelphia has approximately 26,400 IDUs in its population of 1.5 million.⁵

A large percentage of IDUs throughout the United States obtain at least some of their needles from illicit salespeople on the street.⁶ For example, in Baltimore, Maryland, which is just two hours away from Philadelphia by car, 85% of IDUs obtain a number of their needles from street sellers despite the existence of well-established needle exchange programs.⁷ These IDUs purchase needles from illicit sellers due to the convenience of the exchange as well as their fear of criminalization and stigmatization. Although concerns about the sterility of these needles sold on the street do exist, studies have shown that these needles are generally safe. In some cities, there even exists self-policing where sellers hold each other accountable for distributing clean needles. In Washington D.C., for instance, the resale of used needles is disparaged by most sellers, and those who do sell used needles face backlash from their peers.⁸ Therefore, the disease risk associated with street purchases is relatively low.

Prevention Point Philadelphia (PPP), the needle exchange program from which Michael obtains his needles, has been in operation since 1991 and is recognized by the city of Philadelphia as a major reason for the decline of HIV/AIDS diagnoses among IDUs. Since 2004, the IDU population of Philadelphia experienced a decrease in infection rates of more than two-thirds, the greatest drop among all high-risk groups (i.e., IDUs, men who have sex with men, and high-risk heterosexuals).⁹ PPP attributes this drop not only to the clean needles they provide at the exchange, but also to the health care, safe needle education, HIV testing, case management, and referrals to drug treatment they offer.¹⁰ However, the organization recognizes that its reach is limited, as some users are unwilling to visit the exchange due to the stigma associated with injection drug use, while others simply find it inconvenient. These individuals constitute Michael's market.

In the United States and elsewhere, intravenous drug use is oftentimes considered a marker of dissolute character. Intravenous drug users are considered to be social deviants, and, as a result, are subjected to discrimination and exclusion. The United Nations notes, "A system appears to have been created in which those who fall into the web of addiction find themselves excluded and marginalized from the social mainstream [and] tainted with a moral stigma."¹¹ Intravenous drug users must navigate this environment of marginalization and stigmatization, and they

most commonly do so by skirting to the edges and remaining unseen. They may avoid the shame of stigma through hiding, but this retreat inhibits IDUs from receiving the help that they need. As a woman interviewed on the streets of Philadelphia admits, “I haven’t talked to [my family] since I’ve been down here for a month and a half now. I just...I’m too embarrassed, I guess, to call. That’s all I want to do, though, is call them ‘cause I know they’d be there for me in a heartbeat, but I’m just too...too ashamed.”¹²

The criminalization of illicit drugs also contributes to IDUs’ desire to remain out of sight. In fact, the Joint United Nations Program on HIV/AIDS (UNAIDS) considers criminalization to be the number one reason why IDUs are being left behind, as fear of arrest deters IDUs from accessing HIV and other drug-related services.¹³ However, considering Michael’s story, it seems as though the situation in Philadelphia is uniquely different. The practice of needle resale remains largely unpunished in the city, allowing Michael and others to sell needles with little fear of repercussion. Indeed, Philadelphia has what the media has referred to as a “cop-free heroin zone,”¹⁴ where hundreds of addicts congregate to publicly buy and do drugs. In these areas, and specifically on Philadelphia’s Kensington Avenue, it is not uncommon to openly sell needles and prescription pills to hustle enough money for a bag of heroin.¹⁵ While the Philadelphia Police Department claims that this cop-free zone does not exist, Michael and his fellow IDUs who spend their days and nights hustling and injecting on the street prove otherwise.¹⁶

Unlike the sale of drugs themselves, it seems that the sale of needles contributes positively to the common good, which is defined as “the sum total of the conditions of social living whereby persons are able to reach their perfection.”¹⁷ On Kensington Avenue and the nearby “Tracks,”¹⁸ a stretch of wooded railway commonly inhabited by IDUs, used and possibly infected needles can be found by the hundreds on the ground. A desperate addict looking for a fix could very easily use one of these needles to inject; alternatively, he could share a needle with a fellow addict who might very well be HIV positive. In anthropologist Philippe Bourgois’s book *Righteous Dopefiend*, a man named Frank tells of his experience with needle sharing: “We always try not to share needles but we still do it. Hey, if you’re sick you’re not gonna worry about it. When you gotta fix, you gotta fix.”¹⁹ What Michael is doing, then, is providing needles exactly where they need to be at exactly the right time—to those addicts on the streets when they

need a fix, right before they go to inject. He also removes hundreds of used needles from the streets by collecting them for trade at the exchange, thus contributing further to the common good by fostering a clean environment. In fact, Michael’s actions have even received praise from public health officials in the city of Philadelphia; they note that “Philadelphia’s strong network of people spreading needles from the exchange plays a big role [in the drop of new diagnoses of HIV].”²⁰

Thus, city officials in Philadelphia have shifted their focus from policing the exchange of needles to keeping people healthy.²¹ The city of San Francisco, meanwhile, attempted the opposite approach, but it proved to have detrimental effects on the city’s IDU population. In 1997, San Francisco mayor Willie Brown instituted a zero-tolerance drug policy under which anyone carrying more than two needles could be charged with “possession of controlled paraphernalia with intent to sell,”²² a felony charge. As a result, the homeless IDU population stopped carrying multiple needles at a time, thus reducing their stash and fostering the sharing and reusing of needles.²³ In addition, they stopped their frequent visits to their local needle exchange program, which was their source of not only clean needles but also basic health services.²⁴ Mayor Brown’s actions proved to be a public health catastrophe, encouraging high-risk behaviors and discouraging treatment. The unjust criminal system proved detrimental to the population of homeless IDUs in the city. Indeed, his criminalization of needle possession serves as an example of structural violence.

It seems, then, that Philadelphia should be commended for essentially decriminalizing illicit needle resale and possession. In fact, Michael’s sale of needles on Kensington Avenue does not seem fundamentally different from the legal sale of needles at pharmacies throughout the city. In 2009, the Pennsylvania Board of Pharmacy adopted an amendment allowing needles and syringes to be sold at pharmacies throughout the state without a prescription.²⁵ The justification for this amendment was harm reduction and the promotion of public health. This same rationale could be used to defend Michael’s actions. Although Michael’s motives are selfish, he nonetheless “fills an important risk reduction niche” in Philadelphia by meeting the demand for clean needles in a way that Prevention Point and local pharmacies cannot.²⁶

Although he ultimately contributes to the common good, there are a number of ethical questions that one might

“In alignment with the principle of subsidiarity...public health initiatives could be designed to train illicit needle sellers to provide their clients with health promoting education.”

grapple with when considering the morality of Michael’s actions. Examples of possible concerns (C) and corresponding responses (R) are outlined in the following list:

C. Michael is selling what he got for free, which is ethically questionable.

R. In fact, many needle exchange advocates are offended by the resale of free needles.²⁷ However, Michael is providing a service to his clients by collecting and exchanging the needles, and, like in any service economy, he should be paid for his work.

C. Michael’s resale of needles is simply wrong because it is illegal.

R. As was discussed above, Michael’s actions do contribute positively to the common good. Alternatively, he could be stealing or working as a john to support his habit, both of which would be harmful to society. His “opportunistic entrepreneurship,”²⁸ though illegal, provides clean needles to people who would otherwise inject with a used needle.

C. Michael could be an unreliable seller who is selling used needles.

R. While it is true that Michael could sell used needles as if they were new, he lacks a reason to do so. Since Prevention Point Philadelphia will provide Michael with as many clean needles as he can trade for, he does not lack supply.

C. In typical needle exchange programs, one used needle gets you one clean needle. In Michael’s case, one dollar gets you one needle. Maybe people wouldn’t otherwise have the needle.

R. If an IDU were to purchase a needle from a pharmacy, it would also entail an exchange of money. If that IDU could not purchase a needle from a pharmacy (or from Michael), he would likely inject with a used needle obtained from a fellow IDU or discarded on the street. As Paul Yabor, a Prevention Point educator and ex-drug addict, notes, “The cold, hard reality is that someone with a habit, or under the influence of [drugs] is going to go to extreme measures to inject.”²⁹

C. Michael’s selling of needles is enabling his own addiction.

R. Any source of income Michael might have would enable his addiction. His selling of needles is not unique in that way.

Above all, in evaluating the morality of Michael’s actions, it is necessary to acknowledge that he is exercising the virtue of self-care. Theologian Roger Burggraeve explores a growth ethic in which one must strive for a particular goal, or “ethical optimum,” while at least employing the necessary measures, or “ethical minimums,” to ensure his or her safety.³⁰ Thus, each clean needle that Michael provides must be seen as an “ethical minimum” that upholds the dignity of the needle’s recipient and prevents the spread of HIV.³¹ The clean needle allows addicts to remain free of disease as they work toward the “ethical optimum” of ridding themselves of their addiction.³² According to Bourgois, many of Philadelphia’s addicts will eventually recover, and clean needles protect their health until they do.³³ Thus, in the long run, Michael’s needles contribute positively to the flourishing of others. When the addict is finally able to live a life without drugs, he is also able to live a life without the burden of HIV.

It is problematic, however, that Michael does not provide the health services that the IDU would receive had he vis-



MARKET-FRANKFORD LINE, KENSINGTON AVENUE, PHILADELPHIA PA (COURTESY OF WIKIMEDIA COMMONS)

ited the needle exchange program himself.³⁴ Ideally, each exchange is an opportunity for intervention and the initiation of rehabilitation and recovery processes. Michael does not offer such services to his clients, and, thus, they are less likely to get treatment for their addiction or even discover their HIV status. This lost opportunity should be seized. In alignment with the principle of subsidiarity, which states that matters should be handled at the most immediate level, public health initiatives could be designed to train illicit needle sellers to provide their clients with health promoting education. Since Michael holds an important role in his community and is in such frequent communication with drug users, he has a great opportunity to spread information and be heard.

Despite being recognized as a highly effective harm reduction strategy, needle distribution is a widely disputed topic. The needle black market, then, takes the dispute one step further, as it allows intravenous drug users to profit from the addictions of their peers. Nonetheless, illicit street sellers contribute greatly to their communities by removing used and possibly infected needles from their environment and providing IDUs with clean needles with which they can safely inject. Since 2004, IDUs in the city of Philadelphia have seen an incredible drop in rates of HIV/AIDS infection, and this is undoubtedly due, at least in part, to Michael and his fellow street sellers. Social and logistical barriers, such as the fear of facing stigma and accommodating hours and location of operation, limit needle exchange programs' and pharmacies' ability to provide IDUs with the materials they need. Street sellers, however, are conveniently located where users are injecting at the very moment they wish to inject. By providing IDUs with clean needles, street sellers protect the addicts' health by ensuring that they do not inject with an infected needle, thus contributing to the common good. Illicit street sellers should be embraced in cities across the United States as individuals who can deliver not only needles, but also important messages regarding harm reduction and even treatment information. Making the best use of these resources is a logical step forward in the effort to improve public health.

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CONVICT THE DEVIANT

Masculinity and Rape in Early America

KATHERINE QUIGLEY

IN THE LATE EIGHTEENTH CENTURY, THE PROPER EXPRESSION OF MASCULINITY WAS ESSENTIAL FOR CITIZENSHIP AND ACCEPTANCE INTO THE PATRIARCHAL COMMUNITY. RAPISTS WERE CONSIDERED TO BE PRIME EXAMPLES OF UNMANLY DEVIANTS EXPRESSING THEIR SEXUALITY OUTSIDE OF CULTURALLY ACCEPTABLE NORMS. DESPITE THIS, RAPES OFTEN WENT UNPUNISHED OR IGNORED, AS RESPECTABLE AND OFTENTIMES WEALTHY MEN SERVING AS JUDGES AND IN JURIES STROVE TO PROTECT THEIR ACCESS TO WOMEN. THE FEW MEN THEY CHOSE TO PROSECUTE AND EXECUTE FOR RAPE WERE OVERWHELMINGLY MARGINALIZED PEOPLE WHO REFUSED TO CONFORM TO ACCEPTABLE STANDARDS OF MALE BEHAVIOR. THROUGH CRIMINAL NARRATIVES, ACCUSED RAPISTS—OFTEN WITH THE INPUT OF A MINISTER—EXPLAINED THEIR CRIMES IN THE CONTEXT OF THEIR PAST ACTIONS AND CIRCUMSTANCES, AND WARNED OTHERS TO CONFORM TO ACCEPTABLE STANDARDS. THE USE OF CRIMINAL NARRATIVES TO EMPHASIZE THE GENDER AND SOCIALLY DEVIANT BEHAVIORS OF CONVICTED RAPISTS POPULARIZED THE BELIEF THAT IT WAS PRIMARILY UNMANLY OUTSIDERS, RATHER THAN RESPECTABLE PATRIARCHS, WHO COMMITTED SUCH CRIMES.

In the highly patriarchal context of colonial Massachusetts, the expression of a proper form of masculinity was crucial to one's position in the male community. Rape is a particularly important example of the ways in which masculinity and power interacted, as it expressed gender and sexual deviance, but at the same time, remained unpunished by judges and juries. An overwhelming majority of late eighteenth century men agreed that convicted rapists were not properly masculine, and less respectable men who rejected gender norms earlier in their lives were more believable rapists. Earlier expressions of deviant masculinity influenced the court's decision to convict accused rapists, as it made them less sympathetic to the (presumably respectable) men on juries who decided their fate. Average men saw sexual deviants as more likely to commit rape because they did not belong to the male community that strived to protect one another and the social system from which they all benefitted. Unmanly and sexually deviant rapists, both due to their committing rape and their past actions, were social outsiders who clearly did not accept community standards of behavior and thus threatened the patriarchy.

Criminal narratives or autobiographies of convicted rapists are crucial in highlighting the connections between deviant masculinity, rape, and social order. These criminals detailed their life stories and connected their past transgressions of masculine norms to their rape and imminent executions. A publisher or minister often provided moral commentary or otherwise edited the narratives to emphasize the dangers of sin or socially unacceptable behavior.¹ They warned other young men to live proper manly lives within the bounds of societal norms in order to avoid becoming rapists themselves.



THE OLDEST WOODEN JAIL IN AMERICA, BARNSTABLE, MASSACHUSETTS (COURTESY OF WIKIMEDIA COMMONS)

Most historians have argued that marginal men were more likely to be prosecuted for rape for a number of reasons, including their inability to reformulate coerced sex as consensual and the fact that it was less believable that women would consent to sex with undesirable men. In this paper, I will synthesize this approach with scholarship about masculinity in order to demonstrate that gender performance and sexual behavior were just as central to the construction of certain men as rapists, as was socio-economic status or race.

Historians also largely agree that elite men insisted on retaining privileged access to women, and therefore attempted to restrict lower status men from accessing these women. This resulted in an extremely low rate of executions for rape overall, but ensured that the overwhelming majority of the men convicted of rape were lower class or marginal in some way.² While this is certainly true, there are few scholarly works that analyze the impact of criminal narratives on the achievement of this goal. Elite men's continued focus on certain types of rape cases improved their own access to women. Popularizing the stereotype of the poor, nonwhite, sexually deviant rapist masked their own participation in sexual violence and emphasized women's need for patriarchal protection.

In order to understand criminal masculinity, one must first understand more prevalent and accepted forms of eighteenth-century masculinity. The most respected position to which a man in colonial America could aspire to was that of a patriarch. This sort of man was independent; no one could control him, and he was able to exert control over others, particularly women.³ Patriarchs had the authority to use force and intimidation to compel their dependents to obey, but they also had to provide them with protection and support.⁴ In order to achieve this balance and effectively exert control over others, an ideal patriarch had to be in complete control of both his body and his mind.⁵ A man could only become a patriarch or a head of household through financial self-sufficiency. In the eighteenth century, this meant that he had to own his home and land.⁶ At this time, the masculine man became increasingly involved in the activities surrounding his home. While women were responsible for household labor, men controlled important domestic decision-making.⁷

Not all men could attain this patriarchal manliness, whether by virtue of their personal failings, their socioeconomic status, or their race. However, they could still reach a level of respectability through obedience to manly patriarchs.

“Through the confessions of convicted rapists, one can see how the rapist connected himself to larger concepts of masculinity and society.”

Low-status men could demonstrate their limited manliness by conforming to the “natural” social order and obeying their fathers, masters, or employers.⁸ This idea, while not overwhelmingly popular during the Revolution, gained increasing support during the constitutional period, as Federalists promoted the idea that all citizens, while independent, still needed to be under the control of more competent and educated men who had the ability to govern effectively.⁹ While many men accepted or at least lived in accordance with this model, some slaves believed that the best way to reclaim their masculinity was through rebellion or by assaulting their masters as doing so demonstrated their own manly independence and power.¹⁰ One can see examples of idealized independent masculinity, as well as hierarchical obedience, in criminal narratives, through the rapists’ actions as well as in the life paths they rejected.

The narratives of these convicted rapists existed in a context in which very few women reported rapes, and of these reported cases, very few resulted in convictions.¹¹ Rape was connected to lesser sexual sins and thus very difficult to differentiate from ordinary illicit sex.¹² Eighteenth-century men and women expected that men would use violence and force in sex regardless of a woman’s consent.¹³ Masculine sexuality was dominating and aggressive (although ideally, men would practice restraint), while feminine sexuality was submissive and dedicated to the man’s pleasure.¹⁴ The belief that a woman, if she were respectable, would feign resistance even in a consensual sexual encounter made it even more difficult for women to prove the occurrence of a rape.¹⁵ Eighteenth-century jurists believed that women could and would easily lie about rape. Consequently, women needed to satisfy a number of criteria in order to be understood as legitimate victims, as did their rapists to appear as believable aggressors.¹⁶

Often, claims of rape did not lead to convictions and executions. The men who published criminal confessions were exceptional cases that did not fit the norm in New England at this time. Generally, men were unwilling to execute other men for sexual crimes, even in situations of clearly non-consensual intercourse.¹⁷

Women rarely reported rapes because rape victims did not often receive justice in the courtroom and they faced severe consequences if their communities did not believe their accounts.¹⁸ Because of cultural assumptions about force in consensual sexual relationships, accused rapists often defended themselves by asserting that the sex was consensual, that the female accuser did not physically struggle, and that their accuser was of poor moral character (and was thus more likely to consent to sex).¹⁹ While there were obstacles to prosecution, courts did accord respect to the testimony of certain victims, particularly if they were white and strangers to the rapist.²⁰ Courts would most likely believe a woman if she accused someone with whom they thought she would never consent to sexual relations.²¹

Rapists who fit this description of the sexually undesirable deviant were among the exceptions who wrote criminal narratives. Cultural representations of rape portrayed outsiders, including men of color, men of lower social status, foreigners, and non-Protestants, as more plausible rapists. Such portrayals impacted the types of men initially brought to trial as well as their conviction rates.²² Because these men did not submit to the control of a normatively masculine patriarchy, rapes committed by them not only threatened the safety of women, but also challenged the dominance of the patriarchy itself.²³

The greatest concern in the prosecution of rape cases was not the disruption that rape caused in the lives of women, but rather, as Thomas Foster has argued, its impact on patriarchal authority and orderly social relations. The rapist’s primary crime was going against male hierarchical structures and social order, not harming the victim.²⁴ It is for this reason that rapes committed through patriarchal power (the rapes of slaves and children, for example) often did not go to trial.²⁵ Through the confessions of convicted rapists, one can see how the rapist connected himself to larger concepts of masculinity and society.

Although one cannot take the confessions of convicted rapists at face value, statements such as these can provide valuable insight into both how these men viewed them-

selves and, perhaps more importantly, what they believed their community members wanted to hear. These confession narratives often followed a similar format wherein the accused connects the crime for which he was executed to socially unacceptable behaviors. After his conviction, he repents, asks God for forgiveness, and calls on others to refrain from immoral activities in order to save themselves from the same fate. The formulaic nature of these narratives make it difficult to ascertain the sincerity of these men's regret about their actions, but a close examination and comparison of these documents reveals differences in style and content that gives some insight into how these convicted rapists understood their crime.

One must be wary not only of the influence of others on these narratives but also of the rapist's own motives for publishing their life story. In many cases, ministers wrote these confession stories with the convict's input, and as a result, the final product often reflected the ministers' interests in promoting order and religion.²⁶ Because the narratives are supposedly first person accounts from the rapists themselves, one cannot expect them to be objective accounts of facts, but rather reflections of the authors' perceptions of the world.²⁷

These criminal narratives originated in New England in the late seventeenth century, but they began to focus more on sexual crimes toward the end of the eighteenth century.²⁸ While earlier narratives paid more attention to criminal submission and did not go into much detail about the criminal's life, these later narratives placed more importance on childhood development and, to some extent, celebrated the criminal's defiance of authority.²⁹ This was also a time of increased popularity of criminal confession narratives. In contrast to the late eighteenth century, when they were published in conjunction with execution sermons, publishers began to sell them independently as broadsides and chapter books.³⁰ Criminals described their

lives and characters in an attempt to explain why they committed their horrific crimes.³¹

These autobiographies functioned as both warnings and "sensational human interest stories."³² Even the earliest criminal confessions strove to satisfy a "hunger for sensationalism and story" through the use of taboo subject matter and vivid imagery.³³ These narratives allowed criminals to brag about their sexual exploits and their adventurous lives.³⁴ Despite this literary function, the ministers and publishers who guided their production also desired to impart moral lessons to their readers. This is especially true of the confessions made by black criminals, who often ended their narratives by warning other black people to remain obedient slaves, while the confessions of white criminals served as warnings to the entire community.³⁵ Black criminals' examples also promoted an association between blackness and criminality. This association would ideally deter white criminality, as the ministers assumed that white people would recoil from behavior associated with black people.³⁶

In the following pages, I will examine the confession narratives of three different men who committed their crimes and were executed in Massachusetts between 1768 and 1779. They came from different backgrounds and lived very different lives, but all of them possessed deviant masculinities that contributed to their convictions and executions for rape. These men, as outsiders, did not have the social power to use sexual force and violence against women without consequences.³⁷ While these cases were exceptions, as very few rapists were successfully prosecuted, they are valuable sources that recount the taboos and behavior that constructed certain men as believable rapists at a time when very few men were seen as such.

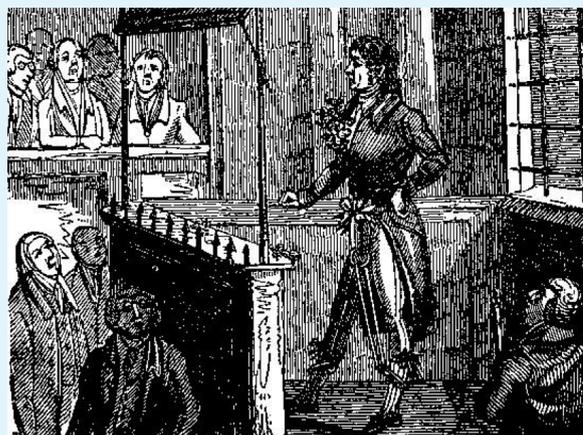
Each of these cases represents a different type of man who was convicted of rape and also a different sort of deviant

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masculinity that corresponded to his outsider status. The first case, that of Arthur, represents one of the most typical cases of convicted rape: the rape of a white woman by a black slave. This account portrays him as a rebellious slave, unmanly by virtue of being black and dangerous because he rejected the constraints of white society. Robert Young's case is also fairly typical because he was a British soldier, which designated him, in American eyes, as more likely to be a rapist and sexual degenerate.³⁸ Brian Sheehen does not fit so easily into the era's stereotypes of sexual predators. While he was disreputable and sexually deviant, he could appear superficially to be an ordinary white man. His case is relevant not because he is representative of an obvious subset of men who were more believable rapists, but because in his narrative he or a ghostwriter made a point to emphasize his unmanliness, sexual deviancy, and outsider status—characteristics that eighteenth-century Americans did not consider essential to his identity. The cases of these three different cases of rapists show the importance of constructing rapists as outsiders.

Arthur was a twenty-one-year-old runaway slave who was executed in 1768 for the rape of a white widow, Deborah Metcalfe. Although black-on-white rape did not automatically warrant the death penalty in the colonial period as it did after the Civil War, the majority of the men executed for rape between 1700 and 1820 were black.³⁹ Black rapists like Arthur were simultaneously rebellious slaves and examples of “human depravity,” and thus threatened white masculinity itself.⁴⁰ The rape of a white woman by a black man indicated a sense of manly independence that was highly threatening to white men living in a race-based hierarchy.⁴¹

When reviewing Arthur's narrative, one must understand his actions within the context of the slave system that Arthur actively rebelled against. His community saw black-on-white rape as a form of resistance to slavery; Arthur's story served as a confirmation of this assumption. His rape of a white woman was only the last of his rebellious actions in a lifetime of resistance to his masters' control.⁴² Parts of his story even seem to glorify his past misdeeds and sexual promiscuity, although the narrative (either through Arthur's change of heart or a minister's intervention) ultimately rejects this rebellion in favor of orderly white control.⁴³ He subverted his masters' authority by stealing from them, running away, and otherwise living his life contrary to white Christian social norms. While he claimed that he



AN EARLY DEPICTION OF A MAN ON TRIAL IN THE LATE 18TH CENTURY (COURTESY OF WIKIMEDIA COMMONS)

was well treated by one of his masters, he continued to drink, have illicit sexual relations, and steal, thus contributing to the stereotype of the degenerate black man. At this time, New Englanders believed that by committing a small sin, a person became more willing and likely to commit a more serious transgression, particularly with regard to sexual sins like fornication and rape.⁴⁴ His race added another dimension to his crimes, as it was worse for a black man to disobey his Christian master whose efforts to Christianize and control his slaves would deliver them from Hell.⁴⁵

Arthur recounted his sexual past as an explanation for his rape of Metcalfe. Like his contemporaries, he “regarded rape and attempted rape as the end point on a continuum of sexual offenses.”⁴⁶ He had sex with women of different races, including white and Native American women, and portrayed himself as a man unable to control his lust, which fits into the narrative of the sexually aggressive black man common in New England at the time.⁴⁷ His Native American sexual partner, “who like the rest of her sex was of a very fruitful Invention,” encouraged him to run away, and it was only because this woman was unavailable that Arthur decided to rape Deborah Metcalfe. Other accounts of rape in colonial New England also portrayed non-white women as accomplices to the rape of white women, and Native Americans in particular as leading white and nonwhite men away from God.⁴⁸ This part of Arthur's narrative portrayed rape as a crime of sexual desire, which fit into the common eighteenth century understanding of the crime.⁴⁹

At the end of his confession, Arthur warned “those of my own Colour, as they regard their own souls, to avoid Desertion from their Masters, Drunkenness and Lewdness.”⁵⁰ This admonition connects directly to the very beginning of his life story, where he recalled his very first crime that led him down a path of sexual misconduct and crime: running away from his master. He instructed other black people to obey their masters and accept white authority in order to live a long moral life. Black people should not desire freedom and instead be content with their lives of obedience to white masters; Arthur’s story was an example of the consequences of desiring liberty.⁵¹ He associated rape with a broader rejection of white authority, although his account of the actual act of rape did not examine the racial dynamic of a black-on-white rape, as would have been the case in the nineteenth century.⁵² In his warning, Arthur connected his fate to racial power dynamics, as he blamed his own rebellion for his execution. In this narrative, the rape was only one of a long list of crimes that he committed against white people and white authority.⁵³

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While it is impossible to know if Arthur truly accepted white domination and repented for his crimes against white people and the white-dominated social order, it is quite possible that the ministers who helped him write this confession encouraged him to frame his crime in this way to discourage other black men from subverting white men’s authority. Arthur thanked Reverend McCarty for his “unwearied pains... to awaken me to a proper sense of my miserable and wretched condition,” and it is likely that this minister coached his testimony.⁵⁴ It is difficult to believe that a man who spent his whole life avoiding slavery and disobeying his masters would alter his views so dramatically, even when confronted with death.

Another preacher, Aaron Hutchinson, also used Arthur’s story to warn others, particularly black people, against following Arthur’s rebellious example.⁵⁵ Reverend McCarty’s own sermon following Arthur’s execution was highly sympathetic to Arthur and preached pity and forgiveness.⁵⁶ He emphasized a lack of control over one’s fate and God’s forgiveness. Neither preacher reveled in the execution of a black man for the rape of a white woman, and even the

victim herself did not want Arthur to be hanged.⁵⁷ These ministers portrayed Arthur’s execution as an essential both punishment and a warning to other black people to stay in their place. While an individual black man’s execution for rape was regrettable, it was necessary to maintain a social order that had a considerable stake in white supremacy.⁵⁸

Another man with a far different, yet nevertheless marginal, position in colonial Massachusetts’s social hierarchy was Robert Young, an Irish-Catholic deserter of the British army who was executed in 1779 for the rape of a child. Like Arthur, Robert Young saw this rape as the result of a life of sexual immorality and sin, a view that ministers of this time professed.⁵⁹ From his youth, Young claimed, he “was much inclined to the company of women.”⁶⁰ He repeatedly mentioned his seduction and ruination of numerous women throughout his life and made it clear that he would go to extreme measures to satisfy his lust, something that placed him outside of the community of respectable men.⁶¹

He saw his crime in a broader context of sexual deviancy and a lack of regard for women. Every place he went, Young “studied to deceive the fair sex, and betrayed a young woman in each of them,” an indication of his talent for seduction.⁶² Although at the end of the narrative, he predictably repented and asked other young men to avoid alcohol and lewd women, throughout his story, he bragged about his sexual conquests and did not show any remorse for his negative impact on many women.⁶³

Regardless of his previous sexual exploits, Young’s history as a British soldier immediately associated him with sexual immorality and corruption.⁶⁴ He joined the army because of his excessive sexuality. When he still lived in Ireland, Young’s employer threatened to tell his parents about his immoral activity. Young refused to give up alcohol and illicit sex and devote himself to business, choosing instead to enlist. He even cited the moment he joined a British regiment as the time when he “gave myself up to all manner of debauchery.”⁶⁵ Americans saw British soldiers as rapists and, like black men, they were overrepresented in print accounts of rape.⁶⁶ The rape of innocent American

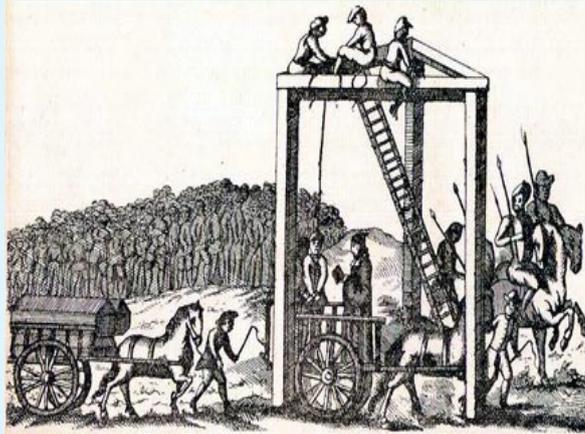


ILLUSTRATION OF THE TYBURN GALLOWES (COURTESY OF WIKIMEDIA COMMONS)

women and girls by the lecherous agents of a corrupt political system was a powerful tool that Americans used to justify their disregard for British authority.⁶⁷ While this may not have been the prime motivation for Young's conviction and execution, this unforgiving image of British soldiers nevertheless impacted how members of the jury and public thought of Robert Young.

According to literary scholar Keith Lawrence, Young's sexual behavior reflected his lack of regard for "communalism." Not only was he an outsider in New England, but his actions also showed his contemporaries that he was also a moral outsider, as he did not care what impact his actions had on the community.⁶⁸ This disregard was particularly important at a time when community regulation of individuals, particularly with regard to sex, was a crucial foundation of societal order. In the previous century, the supervision and control of young people likely made rape less common, and although societal control was weaker in the eighteenth century, town leaders were unfriendly towards outsiders who took advantage of their daughters and sisters.⁶⁹ While other men had communities and families that protected them from prosecution for rape, Young had no one to defend him.⁷⁰ His marginal status prohibited him from manufacturing consent in his sexual exploits.⁷¹ Rapes committed by lower status outsiders and transients whom patriarchs could not effectively monitor "signaled the disruptive effects of geographic mobility" on social order.⁷² A lack of familial and social connections put Young outside of the community of respectable men and, although he was still

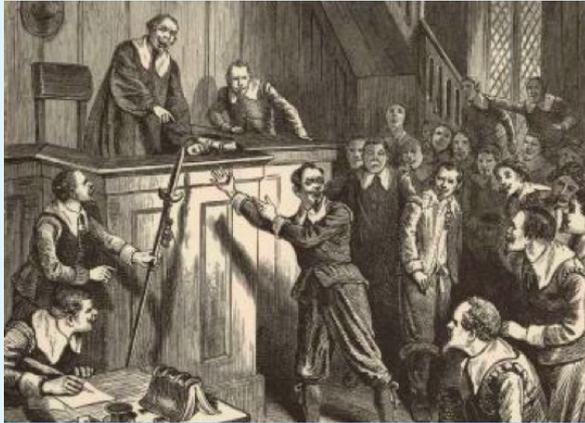
a man, Young's identity as a poor, sexually deviant, transient army deserter served as a threat to patriarchy.⁷³ Like Young, the majority of the men convicted for rape were "outsiders or marginal men" who threatened to bring disorder to established patriarchs.⁷⁴

Ultimately, Robert Young portrayed himself as a man unrepentant and unconcerned with the women he harmed. He even blamed his early associations with lewd women for his drinking problems; while he was originally "an absolute hater of all sorts of strong liquor," once he began to associate with "lewd women," he "learned to drink to excess."⁷⁵ He paid noticeably little attention to the rape that would lead to his death. Instead, Young focused more on his young victim's older sister, who was also his fiancée, a woman he "loved without deceit." He claimed that he wanted to stay faithful to his fiancée, Anne Green, but he was incapable of restraining his sexual desires. He did not reflect on Jane Green, his eleven-year-old victim, but instead apologized to Anne. He did not see his victim or the women who he seduced as people whose feelings and pain were important, but rather as vehicles for his sexual desire. Nor did he truly have any regard for Anne Green, as evidenced by his rape of her sister.⁷⁶

Although his marginality in colonial New England was partially attributable to his poverty and hidden status as an army deserter, Young's confession mainly focused on how his sexual behavior differentiated him from the rest of society. While one can understand this focus as bragging over past sexual conquests, it shows the connection between unrestrained sexual urges and rape both in Young's eyes and in the eyes of readers. This narrative, along with others like it, simultaneously drew from and reinforced this cultural assumption. It emphasized the nature of rape as a crime committed by unmanly social undesirables unable to control their lust, rather than by the powerful men who were able to use their positions in society to redefine their own coercive sexual actions as consensual.⁷⁷

Robert Young's case is particularly interesting because in addition to his short autobiography, he also wrote a poem recounting his life and crime. This poem contains many of the same themes that he wrote about in his confession. He placed responsibility for his fate on his earlier life of sin, his lack of regard for religion and his inability to control his lust. Throughout the poem, he warned other men to avoid a sinful life.⁷⁸ While in his confession a reader may even see the appeal of living as Young did, this poem was

more religious in nature and emphasized Satan's destructive role in his life, as it was "the grand deceiver" who "led [Young] to commit a horrid crime."⁷⁹ Young approached his life differently in this poem, to make himself appear more pitiable. He was a young man "in blooming life" who was forced to "write these lines in a gloomy cell" and come to terms with his impending death.⁸⁰ It is primarily a warning to other men not to follow in his path, as it could only lead to unhappiness, as well as a plea for pity and sympathy. While this poem makes it appear as though Robert Young saw his execution as inevitable, it also shows that he still wanted others not to think the worst of him and perhaps even come to his aid and petition for a commutation of his sentence.⁸¹



AN EXAMPLE OF AN 18TH CENTURY TRIAL, SIMILAR TO THE ONE THE DEFENDANTS IN THIS STUDY FACED (COURTESY OF WIKIMEDIA COMMONS)

The 1772 case of Brian Sheehen is another example of a marginal and unmanly man's conviction for rape. Like Young, Sheehen was immediately an outsider in New England society upon his arrival, as he was raised Catholic in Ireland. When he came to Massachusetts for work, he hated attending church with his employer's family, and he performed his religious duties "with carelessness and reluctance, as being in a different way from what he had been used to," which Sheehen identified as an example of his immorality.⁸² Because eighteenth century New Englanders considered devotion to Christianity a bulwark against sexual violence, Sheehen's refusal to worship properly could have explained his crime to others.⁸³ His lack of piety (specifically worship in one of the "right" churches) immediately made him less sympathetic in the eyes of his

Protestant neighbors.⁸⁴ Additionally, his reluctance to attend church with his employer's family marked him as a disobedient servant and, thus, "a rebel against law and proper social ordering."⁸⁵

His sexual behavior, although not so brazen as that of Robert Young, marked Sheehen as a failed patriarch who differed from respectable men. Although he was married and had a child, he chose a sexually immoral wife whom he later learned was also married to another man.⁸⁶ In the eighteenth century, a husband was usually at fault for his wife's infidelity because it showed his failure as both a patriarch (who was supposed to be able to control his dependents) as well as a sexual partner (because he was unable to completely sexually satisfy his wife).⁸⁷ Unable to properly control his wife, Sheehen left her and his child after nearly killing his wife's second husband. Sheehen may have intended for this story to gain him sympathy as a man wronged by a sexually deviant woman.⁸⁸ However, his account of his wife's sexual behavior likely harmed his reputation and set him apart from more reputable men who successfully governed their families.

In addition to his religion and disreputable family life, Sheehen admitted that he was infamous for his "wicked profligate" character.⁸⁹ While a bad character could mean any number of things, as he did not define his specific actions in great detail, the inclusion of these elements in Sheehen's narrative shows that bad character and disreputability were just as important for the men who were charged with rape as they were for the women who filed charges.⁹⁰

In contrast, Brian Sheehen's victim was a reputable married mother who suffered physical injuries and cried out for help. For members of this community, this assault was a clear case of a disreputable, irreligious outsider's rape of a reputable woman. The narrative is different from many others, as it focuses a considerable amount of attention on the victim and the actual act of rape, as Sheehen recounted the events of the night in detail.⁹¹

The Attorney General proclaimed that he had never seen a clearer case of rape than this one. Not only was the woman respectable and the physical act fulfilled all of the necessary legal requirements to be considered a rape, but Sheehen had an admittedly bad reputation and he was an outsider in the community. Brian Sheehen was the perfect example of degenerate manhood: he was an Irish Catholic, he had

previously been in jail, and he had no family ties or dependents.⁹² While Arthur and Robert Young were threats because they operated outside of and in opposition to patriarchy, Brian Sheehen tried to achieve respectable masculinity but was ultimately a failure of a man. This case reveals the importance of a man's failure to fulfill masculine ideals to the public's image of him as a criminal.

In the time between his conviction and when this narrative was published, Sheehen claimed to renounce his Catholicism and show an interest in proper Protestant religion, but it is unlikely that his conversion was authentic given the religious function of these confessions. The man, likely a minister, who helped Brian Sheehen put together this autobiography, would clearly have used this occasion to bring as many sinners as possible to Christ.⁹³ There was no better example than a sinning Catholic to show that anyone could find the true religion.

Despite their differences, all of these confessions follow a similar format and contain many of the same forms of gendered behavior. Each of these narratives conform to societal assumptions about rape. The convicted rapists all represent a rejection of or a failure to attain a prescribed masculine identity. From the first lines of their narratives, it is clear that they are disreputable men. Arthur was a

alcohol, and the infidelity of Brian Sheehen's wife humiliated him and ruined his efforts to be a proper patriarch. All of these components of the narratives signal that these men were marginal and outside of the bounds of acceptable male behavior.⁹⁵

These autobiographies also contain examples of proper patriarchal and masculine behavior to contrast with the condemned rapists. All of these men scorned society through their rejection of the kind and forgiving patriarchs who gave them many opportunities to live respectable lives. Even after he ran away for a year, Arthur's master "received [him] kindly;" Brian Sheehen's employer tried to save his soul and bring him to Christ despite his lack of interest; and Robert Young reacted to his early employer's and parents' concern over his illicit sexuality by enlisting in the British army and leaving Ireland.⁹⁶

At the ends of their lives, upon reflection of their misdeeds (or at the behest of the others who contributed to the writing of these narratives and wanted to put forth a message promoting community order and stability), these men accepted ministerial authority through repentance. Although their disobedience and lack of respect for patriarchs had only brought them pain and hardship in this world, their eventual acceptance of patriarchal authority by apologizing

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slave, the lowest position in colonial New England's social hierarchy, and Sheehen and Young were Irish Catholics, religious deviants and ethnic outsiders. Throughout their lives, these men exhibited unchristian behavior through fornication, indulgence in alcohol, theft and deception. Their inability to control themselves and their willingness to go to extremes to satisfy their desire showed their lack of masculinity.⁹⁴ While these narratives primarily placed the blame for their fates on the criminals themselves, they also employed female temptresses who hastened their path to sinfulness. Arthur ran away with the aid of his Native American mistress, women taught Robert Young to enjoy

and thanking ministers for reforming them, presumably would help them find peace in the next life.

The average eighteenth century man could likely identify with these criminals and the patriarchs they rejected. Because these narratives functioned both as moral warnings and sensational adventure stories, men could simultaneously identify with the criminals, feel superior to them and use their story as a cautionary tale.⁹⁷ These criminals exhibited what Thomas Foster called a “masculine counter-norm” of individuality that readers might have considered legitimate.⁹⁸ Although they were unable to restrain

themselves, as good and masculine men would, their aggressive sexuality was typical and virile.⁹⁹ While a modern reader may associate sexual aggression with rape, to law-abiding men as well as these criminals, this powerful sexuality was the most socially acceptable part of these narratives.¹⁰⁰ They all clearly showed an intense desire to have a woman, both as a sexual partner and as a dependent they could control. Although they showed no indication of wanting to protect and provide for a woman, they did accept certain aspects of their expected role as patriarchs. Arthur sexually mastered his “squaw,” Robert Young planned to marry Anne Green, and Brian Sheehen was already married and had a son. Just as respectable men would, these rapists used women’s bodies to assert their masculine identities. But in this case, because they did not have women readily available to them to satisfy their lust, they instead resorted to rape.¹⁰¹ For the readers of these confession narratives, these qualities indicated that these rapists were masculine, at least to an extent, and they could thus identify with these “anti-heroes.”¹⁰²

At the same time, however, a critical component of all of these narratives was the rapists’ lack of other markers of masculinity, a factor that considerably impacted the outcomes of their lives. It made them more believable rapists, precluding any sort of community defense, and increasing the feasibility of a rape accusation. For example, while they may have exhibited a desire to control women and families, none of these men cared for dependents. Arthur had many sexual partners but, because he was a slave, could never have a socially acceptable family or dependents. Robert Young showed some interest becoming a husband and father with community roots, but he sabotaged his own efforts at achieving an appropriate masculine identity by raping his fiancée’s sister. Brian Sheehen came closest to approaching respectable masculinity, as he was married and had children, but his wife’s infidelity brought his manhood into question.¹⁰³ Because a man’s respectability as a citizen was tied to his marital status and possession of dependents, the lack of a traditional family life among these men at the time of their trials made them particularly suspicious.¹⁰⁴ Their sexual behavior was, in the eyes of other eighteenth century men, linked to this lack of family life because they did not have the “self-mastery” necessary to head and maintain an orderly household. And because they were not properly married, their masculine sexual energy could only be directed towards immoral purposes.¹⁰⁵ Their bachelor status, even before they were accused of rape or any of the details of their sex lives became public knowledge, made them suspected sexual deviants.

These men could not be proper husbands because of their lack of self-control and because they were not husbands, they had no proper outlet for their sexual desires.¹⁰⁶

These rape narratives indicate that accused rapists knew that their lifestyles did not meet the standards of respectable male behavior. Even accounting for the influence of ministers, these rapists’ lives contradicted social norms in almost every way. They were not acceptable husbands and fathers, they were not independent householders, and they did not exercise restraint in their sexual lives.¹⁰⁷ Their lack of masculinity precluded these men from full acceptance into the male community and made them outsiders in an extremely community-oriented society. Because male sexuality was naturally aggressive, men either needed to be able to control themselves or be under the protection and control of a man who could. Convicted rapists both proved themselves incapable of self-mastery and were, at the time they committed their rapes, independent and uncontrolled. This understanding of rape made Arthur, Robert Young and Brian Sheehen appear more likely to be rapists, and certainly contributed to their deaths.

By telling their stories (or having their stories told) in these criminal autobiographies, these rapists contributed to the conception of a rapist as a deviant outsider. Because these narratives reached such a large audience, they were extremely effective in reinforcing popular understandings of rape and solidified the association between certain unmanly men and rape. This made it even more difficult for people to accept patriarchs and elite men as rapists, as the sexual deviance and outsider status associated with rapists were not consistent with the image of a respectably masculine patriarch.

By blaming rape on unmanly, low-status men, elites could continue to coerce women into sex without understanding these sexual encounters as rape. It was not until second wave feminism that women began to question this assumption and demand a change in how society views sexual assault. Even today, it is difficult for people to conceptualize of ordinary men as rapists. Many still assume that outsiders, modern versions of Arthur, Young and Sheehen, are responsible for the majority of rapes when, in reality, women are most vulnerable to attacks by acquaintances, friends, family, and romantic partners.¹⁰⁸ Criminal narratives played an important role in reinforcing the construction of rapists as false men, and thus allowed real rapists, both past and present, to escape suspicion.

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A CLIMATE OF INACTION

Limitations of a Relational Understanding of Morality

JULIANA BUTRON

REDUCING GREENHOUSE GAS EMISSIONS IS THE ONLY WAY TO MITIGATE THE CONSEQUENCES OF CLIMATE CHANGE. IN SPITE OF THIS KNOWLEDGE, CURING THE WORLD'S ADDICTION TO FOSSIL FUELS HAS PROVEN TO BE A HERCULEAN TASK. INTERNATIONAL AGREEMENTS ARE LIMITED IN SCOPE, AND NATIONAL GOVERNMENTS HAVE FAILED TO ENACT LAWS THAT WOULD SUFFICIENTLY REDUCE DOMESTIC EMISSIONS. IN ADDITION, MOST INDIVIDUALS ARE HESITANT TO MAKE THE NECESSARY SACRIFICES THAT WOULD REDUCE PERSONAL EMISSIONS. WHILE POLITICAL, ECONOMIC, AND TECHNOLOGICAL FACTORS ARE THE MOST APPARENT BARRIERS TO REFORM, CLIMATE CHANGE CAN ALSO BE UNDERSTOOD AS A MORAL FAILURE. FROM A PSYCHOLOGICAL STANDPOINT, MORALITY IS AN EMOTIONAL BELIEF THAT STEMS FROM INTERPERSONAL RELATIONSHIPS. THE UNPRECEDENTED SCOPE OF CLIMATE CHANGE HAS EXPOSED THE LIMITS OF THE RELATIONAL UNDERSTANDING OF MORALITY. WE HAVE BEEN UNABLE TO FRAME OUR RELATIONSHIP WITH THE BIOSPHERE IN A MANNER THAT ELICITS A STRONG ENOUGH MORAL RESPONSE TO LEAD TO DECISIVE ACTION. THIS PAPER DOES NOT ATTEMPT TO OFFER A SOLUTION, BUT HOPES INSTEAD TO REVEAL THE MORAL IMPLICATIONS OF CLIMATE INACTION.

“[I]t is humanity’s inability to reconcile its relational sense of morality with the unprecedented scale of climate change.”

30

In December 2015, the United Nations Climate Change Conference was hosted in Paris. Delegates from 195 countries reached an agreement that would commit most of the world’s nations to reducing greenhouse gas emissions. Regarding the deal, President Barack Obama said, “We’ve shown that the world has both the will and the ability to take on this challenge.” The participation of nearly 200 countries in the Paris Agreement shows that the global community certainly has the “will” to combat climate change, but whether it has the “ability” to do so remains to be seen. Even though the Paris agreement is a step in the right direction, climate scientists acknowledge that it will not limit global greenhouse gas emissions sufficiently to be able to prevent the most disastrous consequences of climate change. However, even this admittedly limited agreement can be considered a diplomatic miracle, since similar talks in Copenhagen in 2009 ended in failure.¹

The rise of the environmental movement has motivated individuals and policy actors, both national and international, to seek solutions to environmental problems. The modern environmental movement came about in the 1960’s. Consequently, today’s adults are more likely to be aware of the environmental impact of their choices than their parents or grandparents. In the 1970s, the United States Congress responded to these growing concerns by chartering a sprawling regulatory apparatus: the Environmental Protection Agency, or EPA. In the 1980s, the United Nations responded to the issue of ozone depletion by chartering the Montreal Protocol. The countries of the United Nations, plus Vatican City, have all ratified the treaty, which entails limiting the production and emission chemicals that are harmful to the ozone layer.² While the Montreal Protocol shows global environmental cooperation is certainly possible, crafting an effective response to climate change has been extremely difficult. When placed in the context of the catastrophic effects of climate change, even the much-lauded Paris Agreement proves inexcusably inadequate. International and domestic efforts to reduce carbon emissions lack impact. This governmental failure should come as no surprise. Government actors are hardly keen on spending their political capital on policy that would demand immediate costs and delayed benefits.

That being said, the blame does not fall on politicians alone. Individuals have failed to make the necessary sacrifices that would reduce personal emissions. It is no secret that human behaviors have caused irreparable damage to the biosphere, yet persistent inaction betrays an atmosphere of feigned ignorance. On the surface, the response—or lack thereof—to climate change reflects either an inherent deficiency in the moral sense, or some widespread moral decline. Morality plays a major role in the way we understand climate change, but environmental apathy is not borne from immorality. In order to properly understand the issue, it is essential to unwrap the role of the moral sense in the decision-making process. In doing so, it becomes evident that it is not a lack of morality that has caused our failure to implement comprehensive global climate change reform. Rather, humanity’s inability to reconcile its relational sense of morality with the unprecedented scale of climate change bears the blame.

The philosophical and theological notion of morality is couched in an abstract notion of divine perfection. Consequently, immorality can be understood as deviation from divine perfection. In contrast, anthropologist Alan Fiske explores morality by studying relationships. Fiske found that moral beliefs across cultures could be categorized into four relational models.³ The relational models classify the myriad of social interactions that elicit moral sentiment, and they unpack the evolutionary basis of moral norms. The first model, *communal sharing*, reflects the open exchange of resources within a group. The second model, *authority-ranking*, encourages morality through linear hierarchies.⁴ The third model, *equality-matching*, views morality in reciprocal terms, and the final model, *market-pricing*, defines morality through legal systems and economic valuation.⁵ While the global climate crisis has been thoroughly investigated through scientific and economic framework, this paper will attempt to unwrap the issue using Fiske’s relational models. This paper’s understanding of Fiske’s work is based on cognitive scientist Steven Pinker’s understanding of the relational models as described in his book *The Better Angels of Our Nature*. The models explain certain behaviors which influence decision making, while also revealing certain biases which hinder



MAN HUGGING REDWOOD TREE IN NATIONAL PARK
(COURTESY OF WIKIMEDIA COMMONS)

the decision-making process. By exploring these associated behaviors and biases, it becomes apparent that morality has the potential to both encourage and encumber effective action in the global climate crisis.

To begin with, communal sharing encourages the free sharing of resources within a given group. The group is seen as eternal; thus, no record is kept of how resources are exchanged, nor are resources given with the expectation of anything in return. The group is seen as pure, and anything that threatens the group is perceived as contaminating its sanctity. In certain communities, this sense of morality is rationalized through creation myths that sanctify land, kin relationships, and spiritual beliefs.⁶ Relationships based on communal sharing tend to prompt feelings of comfort, unity, and love. Arguments in favor of conservation find their moral bedrock in the communal

understanding of morality. In the United States, the act of Congress that created the first federally managed public park provides no justifications for the land's conservation. Instead, it reads that land, which would eventually become Yellowstone National Park, must be "dedicated and set apart" for exclusively "the benefit and enjoyment of the people."⁷ The National Parks system is based on the idea that certain untouched terrains are part of the nation's patrimony. The right of the American people to enjoy these spaces exceeds any profits from the terrain's hypothetical use and development. Their existence is not contingent upon any extraneous factors because they are understood as common heirlooms. As symbols of a shared national heritage, they are imbued with emotion. The idea of stuffing the Grand Canyon with nuclear waste, hacking California's redwoods for timber, or covering Yosemite Valley in cul-de-sacs feels repulsively immoral. Irresponsible waste management, logging, and urban development ceaselessly besmirch pristine wilderness the world over. Thus, it would be inherently immoral to threaten their purity according to the communal sharing model.

Altruism may have evolved as a result of shared interests. Humans were more likely to survive in groups; therefore it is in an individual's best interest to support the individual members of said group. When feelings of sympathy, empathy, and guilt are especially strong, individuals are motivated to alleviate this suffering. Doctrines of human rights stem from the theoretical expansion of a "circle of empathy" to the entire global community. The communal sharing model can be applied to climate change if we view it through the lens of human rights. Each member of our global community, present and future, is entitled to a certain environmental standard of living. As global citizens we have the ability to empathize with our fellow humans by virtue of our shared humanity. The problem with altruism lies in its limited scope. Our circles of empathy are strongest within prescribed circles of familiarity.⁸

Herein lies the dark side of communal sharing. The same feelings and behaviors that strengthen community bonds also serve to minimize the needs of individuals outside of the community. Patriotism is the result of geopolitical

"The crucial caveat of communal sharing is that resources can only be freely shared when the community does not feel threatened."

knowledge filtered through feelings of national unity. However, while it encourages a communal sense of responsibility for the entire nation, patriotism could easily devolve into xenophobic jingoism. If we understand the nation as a communal group, anyone outside of the prescribed community is labeled an outsider. The crucial caveat of communal sharing is that resources can only be freely shared when the community does not feel threatened. When resources are abundant, the network can share resources without fear and even expand its circle of care to include outsiders. When resources are threatened, the needs of the community are paramount to the needs of outsiders, which may also explain why norms tend to be more rigid in times of crisis and relaxed in times of stability. If resources are especially scarce, former insiders might find themselves on the margins, or worse, excluded altogether. Before the advent of agriculture, cycles of abundance and scarcity were nearly impossible to predict. Communities with the ability to exclude ensured their members' survival, thus passing this trait on to subsequent generations. In the past, exclusion ensured a community's survival. Today, elements of *kin protection* create biases that limit cooperation.

If resources are understood as scarce, one group's survival is contingent upon the failure of another. The “mythical fixed-pie” is the result of this understanding of scarcity. If two groups understand that resources are limited, they each view their situation as a zero-sum game. Any benefit for the other group is perceived as an inherent loss—hence the “fixed pie” metaphor. This negates the existence of mutually beneficial tradeoffs.⁹ The “fixed-pie” fallacy is especially cumbersome in environmental conflict resolution, because every hypothetical solution involves some sort of a mutually beneficial tradeoff. International climate change negotiations are a minefield of mythical fixed-pies. No nation would eagerly decrease its standard of living in order to increase the standard of another. This understanding fails to grasp the global scope of the issue. Our community-based thinking limits our ability to grasp the full implications of the universal problem. The potential harm of continued inaction is far worse than any sacrifice.

It is beyond any scientific doubt that greenhouse gas emissions cause global warming, yet neither international institutions nor national governing bodies have created policy that sufficiently cuts emissions. Any responses, on an individual level, have been far too limited to constitute a trend towards reduction. There are many reasons for an individual or governing body to oppose emission reduction,

but the communal sharing model of morality helps explain why those who theoretically support emissions reductions are hesitant when it comes to action. The issue with climate change is that the scale is so large that it is easy to view those who will suffer as “other.” For the vast majority of the world's emitters, the impact of climate change is either geographically or temporally distant. It is difficult for people to sacrifice the immediate needs of the group for the needs of outsiders because those needs are perceived as less important than the needs of the immediate community.

Empathy, sympathy, guilt, and trust are the emotional pillars of communal sharing relationships. The communal sharing model helps explain the moral dimensions of the emotions associated with intimacy; therefore, this model's scope is largely limited to individuals and their immediate communities. The communal sharing understanding of morality is often the first to emerge in a given society. Once a community exceeds the boundaries governable by communal sharing, the authority-ranking model of morality emerges to govern our relationships with individuals outside of our circle of empathy. The second of Fiske's models, authority-ranking, is less intimate in its scope. Relationships based on authority-ranking understand morality as respect for a linear hierarchy. It is considered immoral to violate authority paradigms, whether they are based on age, gender, physical appearance, wealth or any other signifier of importance.¹⁰ The moral weight of hierarchy might stem from a primordial need for protection. Group dynamics played a fundamental role in human evolution. As previously mentioned, the survival of the individual is contingent upon the survival of the group.



GLOBAL ACTION DAY IN COPENHAGEN (COURTESY OF WIKIMEDIA COMMONS)

It may have been in an individual's best interest to respect a hierarchy of physical dominance to ensure the group's survival, and as such the survival of the individual. An unwise challenge to the hierarchy could mean expulsion. Authority-ranking became especially important, as societies grew to a scale no longer governable by communal sharing. Monarchies, theocracies, and dictatorships maintained political control through a hierarchical understanding of morality—it is immoral for an individual to question one's superiors. Though the importance of authority-ranking has waned, these relationships emerge in the feeling of respect. An individual may know that theft is wrong, but when the victim is elderly, the crime feels especially heinous. We are taught to respect the elderly, and any violation of that respect feels inherently immoral.

Aspects of climate change inaction find their roots in similar behavioral fossils. While corporate and political interests are massive hurdles, respect for the authority of these forces is not the cause of inaction. The scale and scope of the climate crisis is such that it requires political action. It is impossible for individuals, families, and communities to reduce their greenhouse gas emissions without the government playing a role. Individuals will only use public transportation if there is a practical and efficient option in their area, and even then, it is still the government's responsibility to regulate the fleet's emissions. It would be naive to think that businesses small and large would risk their economic viability to reduce their emissions unprompted. The government has an essential role to play; yet, for the most part, it has been absent. Some politicians and government officials explicitly deny the overwhelming evidence linking it to man-made greenhouse gas emissions. Others believe the science, but continue to give other issues precedence. According to philosopher Hans Jonas, the government cannot meet the needs of this "new imperative" because the scope of politics is limited to the present.¹¹ In contrast, the scientific community understands the urgency of this issue and vehemently encourages reform, but finds itself powerless without the support of the government. Understanding and discovery are the primary objectives of scientific research; it is not the place of scientists to make their findings palatable to the general public. Scientific findings must be mediated through social disciplines in order to fully understand their implications for society at large. Scientific concepts are difficult for the general public to understand, meaning that it is also difficult to glean emotion from data sets.¹² The issue is a lack of authority, and a failure on the part of interested parties—namely, scientists—to fill the gap. This authority

vacuum may be the result of a vestigial sense of respect for political authority. Politicians have the power to act; therefore, it is their responsibility to do so. Because politicians are the authority regarding law and social cohesion, they yield greater social authority; consequently, their apparent inaction on climate change reverberates across society.

The third of Fiske's models, equality-matching, is based primarily on the rationalization of feelings associated with fairness. Equality-matching relationships express morality through reciprocity. It may have evolved as a form of strengthening group commitment through reciprocity. The Code of Hammurabi—one of the earliest documented codes of law—was based entirely on a reciprocal understanding of moral behavior. In our own interpersonal relationships, equality-matching is often expressed through language of fairness: the fairest way to decide between two individuals is to flip a coin, or allow everyone to take turn, but it is unfair, and thus immoral, to allow all but one person to take a turn. Equality-matching also establishes the core of various religious moral dogmas in the form of "the golden rule"; one should treat others as one would like to be treated.¹³ While communal sharing helps explain empathy within prescribed groups, equality-matching helps explain why people feel empathy or sympathy towards others outside of their immediate communities.

Questions of resource management and environmental justice are primarily framed through the reciprocal understanding of morality. It is perceived as unfair for the cost of a product to exclude its environmental impact. Equality-matching in environmentalism is especially apparent in the realm of sustainability. It is unfair, thus immoral, to sacrifice the environmental stability of the future for the comfort of the present. Conservatives, while not necessarily against sustainability, tend to oppose regulation. Political psychologists propose that conservatives might register environmental degradation as inherently unfair to future generations, but place equal importance upon moral beliefs such as sanctity and respect for authority.¹⁴ Conservatives might perceive regulation as a threat to the freedoms espoused by traditional liberalism, the purity of which is more important than protecting the environment from harm. Increased regulation might also prevent the nation from achieving its full economic potential, which would reduce the nation's wealth, and potentially threaten American exceptionalism. In an op-ed in *The New York Times*, Professor Robb Willer proposes that conservatives could be persuaded to prioritize environmental issues if the issues were framed in terms of communal sharing or au-

“Global cooperation is a Herculean task because nations are paralyzed by the fear of agreeing to an unfair deal.”

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thority-ranking.¹⁵ While this rhetorical reframing could potentially add legions of environmentalists, as previously shown, communal sharing and authority-ranking are also rife with biases that limit reform.

Equality-matching demonstrates the manner in which suspicions of unfair behavior may hinder cooperation between potential allies. A study of fairness in capuchin monkeys reveals the extent to which perceptions of unfairness could sabotage negotiations. In the experiment, two groups of monkeys were given tokens to purchase food. Some monkeys would insert a token and receive sweet and delicious grapes, while others would receive presumably less desirable cucumbers. Once the ‘cucumber’ group became aware that they were getting a worse deal than the ‘grape’ group, the monkeys refused to cash their tokens and flung them at the researchers out of spite.¹⁶ The rational choice would have been to begrudgingly enjoy the cucumbers, because being fed beats hunger. Instead, the monkeys chose to go hungry, rather than acquiesce to this unfair deal. Sometimes it feels better to suffer than to endure the indignity of injustice. The capuchin experiment serves as a microcosm for some of the conflicts that plague earth systems governance. Global cooperation is a Herculean task because nations are paralyzed by the fear of agreeing to an unfair deal. Any sort of climate change reform involves sacrifice, but no one nation wants to feel that it is sacrificing more than another. Like the capuchins, a state would rather sabotage negotiations by refusing to cooperate than agree to an unfair deal. The baggage of colonialism reflects the difficulty of earth systems governance. The former imperial nations have greatly benefited from the development spurred by environmentally inefficient industrialization. If emission regulations were applied uniformly, the former colonial nations would bear an unjust burden. Regulations would mean that the less “developed” nations of “the global South” would have to sacrifice their own development to cover the environmental costs of the “global North’s” rapacious development. Any sort of deal would need to take this climate of economic inequality into consideration.¹⁷ Earth systems governance cannot be perceived as a new form of Imperialism. The challenge lies in crafting regulations that suit each nation’s particular need and stage of economic development. Even so, this

would not solve the problem for fairness because the appropriation of resources is rife with distributional conflicts. No one wants to receive the short end of the stick in an unfair deal.

The final model of morality responds to these discrepancies in valuation. Fiske’s fourth model of morality, market-pricing, is contingent upon civil society. This model depends on applied knowledge of literacy and numeracy.¹⁸ Market-pricing involves the uniform application of values. This is most apparent in the development of systems of currency. Both a ten-dollar bill and hundred-dollar bill cost the same amount of money to produce, but the hundred-dollar is imbued with greater value by the US Treasury. It would be immoral, and extremely confusing, for someone to adjust the value of a certain bill based on circumstances. Cognitive scientist Steven Pinker believes that market-pricing is tied to German sociologist Max Weber’s rational-legal mode of social legitimation, which describes a system of norms based on reason and implemented by laws. Like Fiske’s market-pricing, Weber’s rational-legal mode places value upon social interactions. Both market-pricing and rational-legal refer to the same type of morality, because they both use reason to designate value. These models are especially pertinent in the rule of law. Communal sharing relationships are not concerned with law, because resources are freely shared without the expectation of anything in return. Law dictated by authority-ranking would designate an illegal act as one that subverts the hierarchy. Codes of law based on equality-matching would define justice as “an eye for an eye.” Rational-legal systems place values upon certain behaviors, and execute justice accordingly. Punishment based on equality-matching would parallel the crime, while punishment based on market-pricing is based on the legal system’s valuation of the crime.

The basis for the market-pricing understanding of morality manifests itself in the rational organization of civil society; market-pricing is morality couched in reason. Laws and obligations characterize the market-pricing model. Such values are socially constructed; they must be learned and taught. Market-pricing provides the basis for any rational organization, corporation, or system of law. Population

control would also fall into this category, because it involves the valuation of individual lives in relation to the earth's ability to sustain those lives. Furthermore, the mere concept of earth systems governance is contingent upon this understanding or morality. Rational proposals for emission regulation, whether cap-and-trade, taxation, carbon offset or pricing reform, involve some sort of valuation—or revaluation—of carbon emissions. The philosophical underpinnings of earth systems governance are based on utilitarian morality. Utilitarian morality falls under the framework of market-pricing because the value of morality is determined by the ability to do the greatest good for the greatest number.¹⁹ Successful earth systems governance is measured through this utilitarian metric. The problem becomes defining “the good” and determining the particular definition of “the most good.” The participation of 195 countries in the Paris agreement reflects the consensus that reducing greenhouse gas emissions would do the most good for the most people—present and future. It is no longer a question of whether governments, institutions, and individuals should respond to the global climate crisis, but a question of how these players will respond. The definition of a “good” response would require rational analysis, but even the most diligent of analysts are not immune to bias.

The trolley dilemma shows how certain evolutionary predispositions impact the application of utilitarian morality.²⁰ A runaway trolley, full of passengers, can only be stopped by pulling a lever. This lever would activate another trolley on a perpendicular track, halting the first trolley. A single passenger sits in the second trolley. By pulling the lever, the passenger in the second would die upon impact; consequently, the group of passengers on the first trolley would survive. Most people involved in the scenario would survive, ensuring the greatest good for the greatest number. When faced with this dilemma, most people would choose to pull the lever—making the rational choice. In the second part of the dilemma, there is no longer a lever or a second trolley. Instead, there is an especially large person standing next to the track. Pushing this person into the tracks would stop the packed runaway trolley—making it the rational choice. Yet most participants faced with second scenario would be unable to make this choice. Cognitively, participants knew that the best outcome would stem from pushing the large person in front of the trolley, but they could not bring themselves to hypothetically kill an innocent person. The thought of hypothetically pushing someone in front of a trolley is felt with far greater emotional immediacy than merely pulling a lever.²¹ Pulling the lever

feels like the more rational choice, but pushing someone into a trolley's path feels like an immoral choice.

The trolley dilemma shows that while the theoretical idea of utilitarian morality is based on reason, the particulars of implementation are complicated by unavoidable emotion. The same applies to rational solutions for the global climate crisis. Rational solutions work well in the abstract, but the implementation of rational solutions requires individual choices. The trolley dilemma shows that individuals are more likely to understand morality in terms of their personal choices, as opposed to the net outcomes of those choices. While conventional wisdom argues that emotional decision-making is inherently irrational, rational choices are inextricably linked to emotion.²² Probabilistic considerations are filtered through the mind, which charges raw external information with emotional meaning. Processes that appear rational and calculated are actually based upon unsettlingly unquantifiable factors. Market-priced systems of valuation only “make sense” because our emotions define them as such. Perhaps market-pricing is not necessarily more rational, but merely rationalized in a more sophisticated way.

Fiske's frameworks constitute environmentalism's moral bedrock, but they do so without the emotional immediacy of interpersonal relationships. Communal sharing explains our love of natural spaces, but it is hard to imagine anyone dying for a national park. Authority-ranking might



GERMAN COMIC DEPICTING A POLITICIAN DENYING CLIMATE CHANGE, SAYING, “CLIMATE CHANGE? IT DOESN'T EXIST” (COURTESY OF WIKIMEDIA COMMONS)

spur some to take responsibility for the environment, but preexisting hierarchies dissuade many more from taking action. Equality-matching explains doctrines of environmental justice, but individuals are unlikely to be motivated unless they are personally victimized by said injustice. Doctrines of environmental regulation are contingent upon market-pricing, but they fail to address the emotional complexities that define rational choices. The relational models evolved over time to allow for the creation of moral relationships outside of an individual's immediate circle; yet, the trolley dilemma shows that the emotionally immediate trumps the abstract. Decisions are contingent upon emotion, and that which is immediately present dictates an individual's emotional purview.

The failure to limit climate change elucidates the limitations of a relational understanding of morality. While its impact will be felt across the political, economic, and social landscapes, climate change is also a moral issue. Fiske's models shows that morality is determined through emotions elicited by interpersonal relationships, and the intensity of our moral feelings are determined by the immediacy of the relationship. Climate change is an issue that violates a relational understanding of morality. Our limited moral scope has not caught up to the reach of our actions.²³ In the past, judgment was a matter of immediate causality. It is difficult to judge the behaviors associated with climate change as immoral because the impact of our actions are not felt with the same emotional immediacy as the relationships outlined in Fiske's models. The issue is that these models depict moral norms; environmentally detrimental behaviors do not necessarily violate moral norms. There is no perception of immorality.

The solution to climate inaction rests in overcoming the relational understanding of morality that characterizes human relationships. Relational morality no longer applies to the new anthropocentric paradigm. Without a broader understanding of morality on the part of the individual, attempts at reform at the institutional level are doomed to fail. Rethinking morality is a herculean task, but not entirely unprecedented. Every successive relational model arose as a matter of need. *Communal sharing* is a product of humanity's inherent sociability, while subsequent models are the product of its adaptability. *Authority-ranking* and *equality-matching* emerged in response to the growing needs of developing societies. In Europe, *market-pricing* began its current dominance during the age of reason. When societies enter periods of relative stability and survival is all but assured, definitions of "the good life" be-

come more complicated. Human definitions of morality, or valuation of one relational model over the other, are constantly in flux. Morality can be adapted and adopted to ones given circumstance, and thankfully, humans can be quite adaptable.

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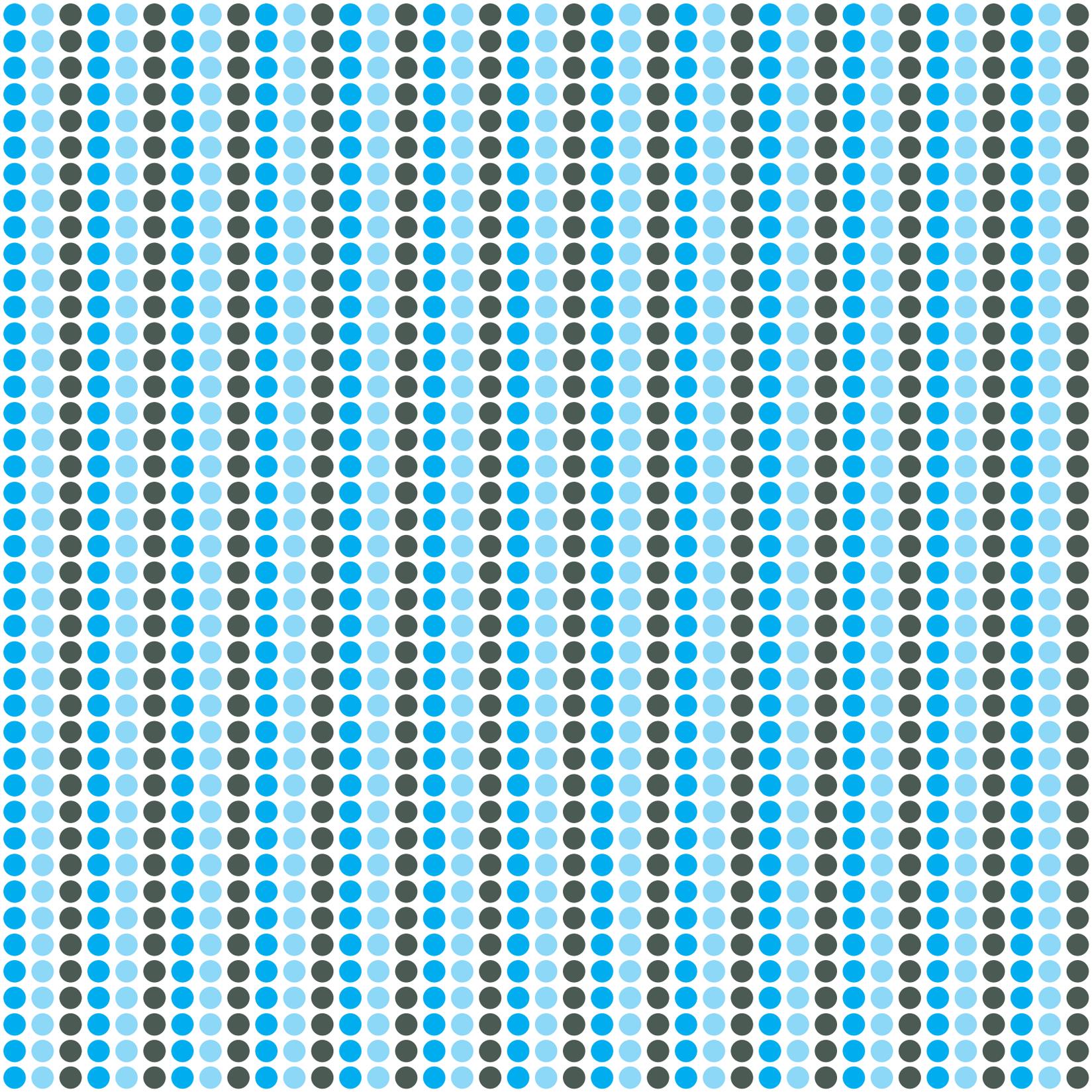
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THE DIRT AND THE BEES

The Epidemiology of Neonicotinoids

KATELYN JOHNSON

NEONICOTINOIDS, SUCH AS THIAMETHOXAM (TMX) AND ITS METABOLITE CLOTHIANIDIN (CLO), ARE WIDELY USED INSECTICIDES COMMONLY COATED ON PLANTING SEEDS. DUE TO THEIR CONTAMINATION OF WATERWAYS, THEIR ACCUMULATION IN AQUATIC ORGANISMS IS OFTEN LETHAL AND POSSIBLY CONTRIBUTES TO THE DECLINE OF HONEY BEES. IN ORDER TO UNDERSTAND THE DISTRIBUTION OF TMX AND CLO IN AN AGRICULTURAL-URBAN-MIXED IMPACTED STREAM, THEIR LEVELS IN SEDIMENTS FROM SEVEN LOCATIONS ALONG STROUBLES CREEK, BLACKSBURG WERE INVESTIGATED. THE SEDIMENT SAMPLES WERE EXTRACTED USING LIQUID/SOLID EXTRACTION, CLEANED UP USING PSA, AND ANALYZED ON A LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETER (UPLC/MS/MS). THE FOLLOWING STUDY SUGGESTS THE ABILITY OF INSECTICIDE TO TRAVEL THROUGH THE SOIL TO THE CREEK, SHOWS LOWER LEVELS OF CLO THAN TMX, AND REVEALS THE NECESSITY OF FURTHER RESEARCH IN REGARDS TO CLO CONCENTRATION. OVERALL, THIS STUDY RE-AFFIRMS THAT TMX CAN TRAVEL INTO AN ADJACENT AQUATIC SYSTEM, WHICH HONEY BEES USE FOR THEIR WATER FORAGING NEEDS.

INTRODUCTION

Given the widespread use of insecticides, their correlation with honey bee decline warrants further investigation. Neonicotinoids are highly soluble insecticides applied to soil and seeds to target arthropods on crops. First marketed in 1998, TMX, a second generation neonicotinoid, is an ingredient in the pesticides Platinum, Actara, Centric, Cruiser, Flagship, and Helix produced by Syngenta.¹ CLO, a metabolite of TMX, is also used as an insecticide. Though neonicotinoids are mainly used for agricultural purposes, other uses include structural pest control, landscaping, and pet treatment for fleas and ticks.² They are widely used to the point where all corn seeds and a third of soybean seeds in the U.S. are treated with neonicotinoids.³

Notwithstanding its extensive usage, several concerns about neonicotinoids' environmental impacts have arisen. Most notably, these pesticides are thought to be a cause in the sharp decline of honey bees in recent years. Due to its use on crops, the European Food Safety Authority determined that the risk of CLO dust drift from drilling sugar beet seeds was enough to indicate a low acute risk for honey bees. Furthermore, the application rate of CLO on sugar beets was determined to be significantly less than the rate of use on maize and other crops.⁴ Although there is no direct evidence that neonicotinoids in surface water are harmful to honey bees, concentrations of 0.14 to 18 ppb are sublethal to non-target aquatic arthropods and have been found in 80% of surface waters across nine countries.⁵

To understand the occurrence of neonicotinoids in wetlands adjacent to fields harvesting various types of crops, a study in the Prairie region of Canada analyzed both water samples and sediment samples for neonicotinoids. The water samples, which were central in the wetlands and distant from vegetation and surrounding plants, indicated that neonicotinoids were present in 62% of wetlands' water after seeding occurred in the fields. Where detected, there was 2.3 ng/L to 121 ng/L of TMX and 0.8 ng/L to 142 ng/L of CLO. Simultaneously, only 6% of the wetlands had sediment that contained neonicotinoids, with 20 µg/kg TMX and 2.8 µg/kg CLO to 4.4 µg/kg CLO where detected.⁶ The frequency of neonicotinoids in water is higher than that in sediment; thus, it is assumed that they are

more likely to be in a body of water than in the sediment at the bottom. Despite this, the concentration of the compounds is significantly higher in sediment than the concentrations in the water samples, suggesting that neonicotinoids accumulate more readily in sediment than they do in water. Both the solubility of neonicotinoids in water and the high fluidity of water itself cause neonicotinoids to move more throughout the liquid. The neonicotinoids adsorb the sediment at the bottom of surface streams, the extent of which varies based on the composition of that particular sediment. Through adsorption, the insecticides have a greater ability to accumulate in the sediment at those places which warrant it.

Due to the high usage of these pesticides, the length of time they survive in the soil before degradation is important in understanding the possibility of accumulation in both soil and water sources. In a lab setting of normal field conditions, the half-life of TMX in lab soil is 34-75 days. However, half-life could triple with unfavorable conditions, such as dry soil with less microbial activity.⁷ TMX tends to adsorb more into the soil with time, causing it to bind and become immobiler. TMX has shown to degrade in water with a half-life of 24-44 days in anaerobic conditions and 8-16 days in aerobic conditions,⁸ while CLO has shown a degradation of 148 to 1155 days in soil and 27 days in anaerobic aquatic conditions.⁹

Although TMX is shown to become less mobile in soil with time, some of the compound is still able to move away from the intended area and into surrounding water sources before the applied TMX becomes completely adsorbed. This is possible because TMX has a high water solubility of 4.1 g/L, making it highly mobile in water.¹⁰ According to a study in Ontario, the main reasons for this transfer are carry over soil residues from previous applications, spilled seed, planted seed, and contamination of excess planter dust on the soil surface.¹⁰ Puddles of standing water were analyzed within and outside maize fields during the planting season. The concentration of neonicotinoid residue was found to be consistent outside of the fields, yet within the fields, the concentration increased during the first five weeks after planting and after a rain event.¹⁰ Another study on potato fields showed how accumulation of leachate occurs due to irrigation of water runoff from the fields and

“Most notably, these pesticides are thought to be a cause of the sharp decline of honey bees in recent years.”

rainfall. The killing of vines during potato production causes more leachate to mobilize in the soil.¹¹ Collectively, substantial evidence suggests that neonicotinoids are capable of eliciting unforeseen consequences in their transport and accumulation.

A study in the Midwestern US found TMX in 47% of 79 stream flow water samples collected at nine sites, and CLO was found in 75% of the samples.⁸ The TMX and CLO concentration ranged from 5.6 ng/L to 185 ng/L and 6.3 ng/L to 257 ng/L, respectively. Since TMX degrades rapidly under aerobic, aquatic conditions, it not considered a high threat to non-target species, such as vertebrates. However, TMX has shown to metabolize readily to CLO on leaves and insect larvae. It was even shown after a soil drench in TMX that the concentration of CLO on the leaves was twice that of the TMX.¹² CLO has been shown to be more antagonistic to non-target species than TMX and its degradation is not as rapid. Thus, it is imperative that TMX/CLO transport efficiency is characterized for a better understanding of their potentially deleterious effects.

The occurrence of TMX and CLO residues was investigated across seven locations of Stroubles Creek in Blacksburg, VA. As suggested through previous studies of the solubility and mobilization of these compounds, there is the possibility that they are detectable in the sediment of Stroubles Creek at locations where it receives runoff and leachate from an adjacent cornfield. In addition, the aerobic transformation rates of TMX and CLO in both sediment and soil were investigated.

MATERIALS AND RESEARCH METHODS

Sediment Collection

Sediment submersed in the creek was collected from seven locations along Stroubles Creek (Fig. 1). The sediment was then separated from water in a centrifuge in vials containing 40 mL of sediment each, at the following parameters: temperature 8°C, 4000 rpm, and 10 minutes. The water was taken out of the vials and the sediment was then freeze dried overnight. The freeze dried sediment was combined with all the sediment from its corresponding location, which was about 100 g total sediment. Two grams of sediment sieved through a 2 mm sieve were used for each sample during the extraction, cleanup, and analysis process. Rocks and other debris were removed in order to detect a more accurate representation of the concentration of neonicotinoids in the sediment.

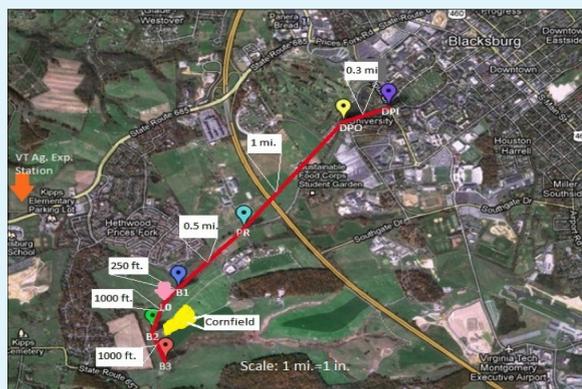


FIGURE 1. SAMPLE LOCATION MAP ADDRESS OF VT. AG. EXP. STATION: 3192-3262 PRICES FORK RD, BLACKSBURG, VA 24060

- 1) VT. AG. EXP. STATION (ORANGE ARROW)
- 2) DUCK POND IN (DPI, PURPLE PINPOINT)
- 3) DUCK POND OUT (DPO, YELLOW PINPOINT)
- 4) PLANTATION ROAD (PR, TEAL PINPOINT)
- 5) BRIDGE 1 (B1, BLUE PINPOINT)
- 6) LOCATION O (LO, PINK ARROW)
- 7) BRIDGE 2 (B2, GREEN PINPOINT)
- 8) BRIDGE 3 (B3, RED PINPOINT)

Neonicotinoids

Thiamethoxam (TMX), purchased through Sigma Aldrich and manufactured by FLUKAR, has a purity of 99.6%. A white powder with a molecular mass of 291.71 g/mol, TMX in acetonitrile stock solution of 11.52 mg/mL was prepared for use. Clothianidin (CLO), purchased through Sigma Aldrich and manufactured by Chem Service, has a purity of 99.5%. A white powder with a molecular mass of 249.68 g/mol, and a CLO stock solution of 10.49 mg/mL were prepared. Stock solutions were prepared by adding 5.76 g TMX or 5.25 g CLO to 500mL of acetonitrile. Then it was serially diluted 10X to prepare usable concentrations of the compounds, the lowest concentrations of TMX and CLO prepared were 1.152 ppb and 1.049 ppb, respectively. Both the TMX and CLO stock solutions were used to prepare standards for use on the LC-MS/MS.

Sediment Incubation Study

Moist sediment that had been submersed in the creek was collected from LO of Stroubles Creek (Figure 1), separated from its water content, and then frozen for future use for the sediment incubation study to investigate TMX and CLO transformation .

Using nine wide mouth mason jars with 1 inch deep of sediment each, three treatments were set up in triplicate to determine the degradation of TMX and CLO in sediment in natural conditions. The three sediment treatments consisted of blank sediment, a concentration of 57.6 ng TMX per gram of sediment and water, and a concentration of 52.5 ng CLO per gram of sediment and water. The jars were kept at 23°C and covered tightly with lids to keep conditions consistent. TMX or Clothianidin was added to the sediments, then stirred to thoroughly incorporate the compound in each jar. The sediment was covered in 2 inches of water from the same location where the sediment was collected.

Sampling occurred on days 0, 3, and 10. A micro spoon was used to collect about 12 g of soaked sediment from each jar. The samples from each jar went into a test tube to be freeze-dried overnight and 1 g each was to be extracted for the target analytes at a later date.

Soil Incubation Study

The soil used for the degradation study was obtained from the Virginia Agricultural Experiment Station (Figure 1). No pesticides were used on this soil before, making this soil free of neonicotinoid concentrations. The soil was air dried, sieved through a 2 mm sieve, and then ground for the incubation study for TMX transformation.

A water holding capacity test was performed on the soil in order to determine the soil moisture content at its 70% water holding capacity, the water content that would be kept constant throughout the study. To determine the soil water holding capacity, in duplicate, 100 g of air-dried soil was put into a disposable cup with 12 small holes at the bottom. Enough water was then added to fully submerge the soil, and was allowed to drain out for 2 days in order to reach 100% water holding capacity. Based on weight differences of the cup, it was possible to calculate the amount of water needed to keep the jars at 70% water holding capacity.

Across six wide mouth mason jars with 100 g soil each, two treatments were set up in triplicate to determine the degradation of TMX in soil at field conditions. The two soil treatments consisted of blank soil and TMX concentration of 2.3 µg per gram air dried soil. The soils were spiked with TMX at the target levels, and then stirred thoroughly to incorporate the TMX with the rest of the soil in each jar. The appropriate amount of deionized water was

added to each jar in order to reach a water content at its 70% water holding capacity. This water content was maintained during the entire incubation time by periodically weighing each jar and adding water accordingly. The jars were kept at 23°C and covered with Parafilm to keep aerobic conditions.¹³

Sampling occurred on days 0, 3, 7, and 28. A micro spoon was used to collect about 1 g of moist soil from 3 different places in each jar and composited. The composite samples from each jar went into a test tube to be freeze-dried overnight and 1 g each was to be extracted for the target analytes at a later date.

TMX and CLO extraction, cleanup, and analysis for sediment and soil samples

Freeze-dried and sieved sediment/soil were measured out using an analytical balance to 2 g (for sediment detection) or 1g (for incubation studies) and put into 35 mL round-bottom vials. A vial containing no sediment/soil was also put through the clean-up procedure for comparison. Samples containing a specific amount of added TMX or CLO were spiked at this time (usually 100 µL of 100 ppb compound). Ten milliliters of acetonitrile was added to each of the vials, which were covered with foil and lids. The samples were vortexed for 10 seconds each on 6.5 speed. To each vial, 2 g MgSO₄ (anhydrous) and 0.5 g NaCl per gram of sediment/soil were added. The samples were vortex mixed for 2 minutes on 6-7 speed then centrifuged in swinging-bucket adapters at these parameters (used for the entire duration of the extraction): 3500 rpm, 23°C, 6/ max accel/decel, and 10 minutes. The supernatant from these vials was transferred to another set of 35 mL round-bottom vials containing 0.5 g MgSO₄ (anhydrous) and 0.1 PSA sorbent per gram of sediment/soil that had been in the other sample vial. Five milliliters of acetonitrile was added to the sediment/soil vials, which were then vortexed for 1.5 minutes on 7-8 speed and centrifuged. The supernatant from these vials was transferred to the supernatant vials. These vials were then vortexed for 2 minutes on 6 speed and centrifuged. Ten milliliters of the supernatant was transferred using a 10 mL pipet to 25 mL test tubes to be dried down in the RapidVap at these general parameters: Round 1) 60 minutes, 130 mbar, 60% spin, 35°C; Round 2) 20 minutes, 140 mbar, 60% spin, 40°C. The dried down samples were then redissolved in 1 mL of 9:1 H₂O/MeOH with 5 mM NH₄Ac. Each final extract was diluted appropriately to fit the upper and lower standard range. Then, using a 1 mL syringe, the samples were fil-

tered through a 0.2 µm PTFE filter into a 2 mL HPLC vial for the UPLC/MS/MS analysis.

The Agilent 6490 Triple Quad LC/MS with the ZORBAX Extend C-18 analytical guard column 4.6x12.5mm, 5 micron was used to conduct all relevant experiments. The temperature of the column was maintained at 40°C. The mobile phase used was (A) 5mM NH₄Ac in water and (B) 5mM NH₄Ac in methanol. The following gradient of mobile phase was used: increase 10% to 95% (B) from 0 to 5 mins., held at 95% (B) for 2 mins., and then decrease to 10% (B) for 1 min. The flow rate used was 0.5 mL/min, with post time of 3 mins., and injection volume of 5.00 µL.

RESULTS AND DISCUSSION

Calibration of UPLC/MS/MS for TMX and CLO detection

All samples were analyzed on a triple quadrupole ultra performance liquid chromatography-tandem mass spectrometer (UPLC/MS/MS). As shown in Figures 2 and 3, the retention times of TMX and CLO in samples were 3.15 min. and 3.65 min., respectively, and the ratios between the quantifier and qualifier daughter ions of TMX and CLO in samples were around 40 and 100, respectively.

Levels of TMX and CLO in the sediment from Stroubles Creek

The highest mean concentration of TMX was 0.788 ppb (Figure 4), found in the sediment samples collected from Stroubles Creek at the second bridge (designated as B2). Sediment samples from all other locations along Stroubles

Creek had concentrations that were at most 0.16 ppb (Figure 4). The concentrations in those sediment samples were either lower or very close to the detection limit of 0.1 ppb. The sediment samples had concentrations of CLO that were all below the detection limit of 0.1 ppb.

The concentration of TMX in Stroubles Creek was found to be the highest at B2, the location directly below the cornfield (Figure 1), leading to the conclusion that TMX may mobilize readily from the soil in the cornfield to the sediment in the creek. Additionally, the presence of the cornfield itself influences the accumulation of TMX found in Stroubles Creek at that location. CLO is present in various locations along Stroubles Creek, though it is unclear what specific events along the stream would cause an accumulation of the compound. The concentrations of CLO in Stroubles creek do not correlate to any particular contaminator in the way that TMX concentrations reflect the location of the cornfield.

TMX and CLO Transformation Rate in Sediment

The half-life of TMX in sediment in this study was 8 days and the half-life of CLO in the sediment used in this study was 9 days. Over the course of 10 days, no concentrations of CLO were detected in the samples where TMX was transforming. It is important to note that the CLO concentration for Day 3 was found to be higher than the concentration of Day 0. This may be due to uneven distribution of the compound in the jars, either just within the sediment or between the water and sediment portions. The afore-

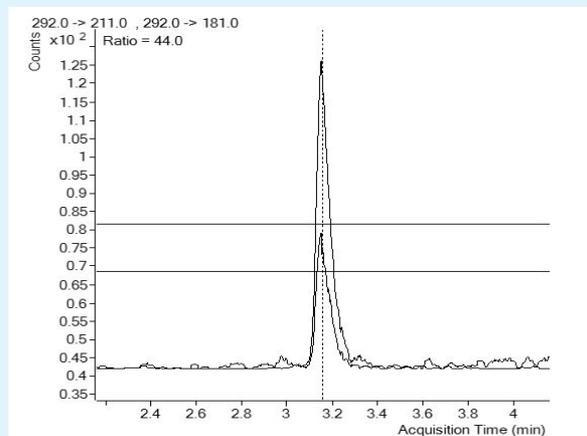


FIGURE 2. CHROMATOGRAM OF TMX STANDARD (0.58 PPB) SHOWING PEAK RETENTION TIME AND RATIO OF QUANTIFIER AND QUALIFIER DAUGHTER IONS

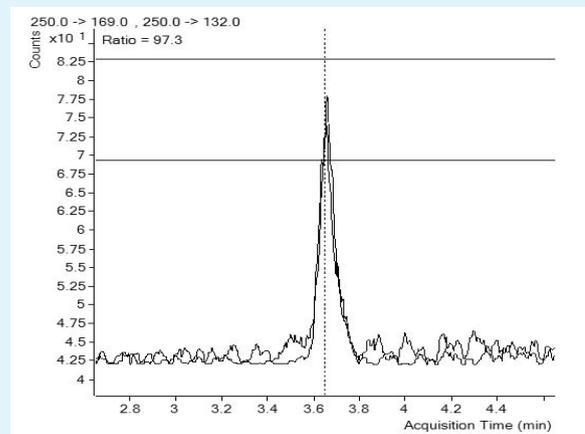


FIGURE 3. CHROMATOGRAM OF CLO STANDARD (0.53 PPB) SHOWING PEAK RETENTION TIME AND RATIO OF QUANTIFIER AND QUALIFIER DAUGHTER IONS

“TMX’s ability to stabilize at about 75% of its original concentration for 30 days shows the ability for the compound to accumulate in soils surrounding a field where TMX is used.”

mentioned error can also account for one jar’s sediment sample’s immense increase in concentration from 0.3 ppb to 26.7 ppb from Day 0 to 3.

TMX Transformation Rate in Soil

The TMX concentration in this study decreased by 25% over the first 7 days (Fig. 6). For the next 3 weeks, the concentration of TMX in the soil was relatively stable. Day 28, the concentration of CLO contained in the soil was also analyzed. Of the 25% of transformed TMX, only 0.8% of that concentration transformed into CLO (not shown). TMX’s ability to stabilize at about 75% of its original concentration for 30 days shows the ability for the compound to accumulate in soils surrounding a field where TMX is used.

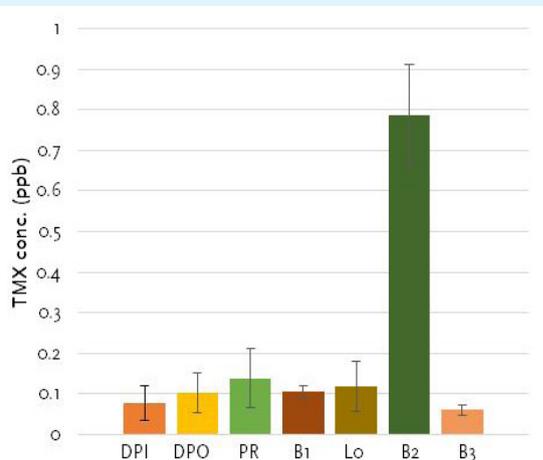


FIGURE 4. TMX CONCENTRATION (PPB) AT DESIGNATED LOCATIONS. THE LOCATIONS SHOWN HERE CORRELATE WITH THE LOCATIONS ON THE SAMPLE MAP (FIGURE 1). SEDIMENT AT LOCATIONS DPI AND B3 WERE BELOW DETECTION LIMIT, WHILE LOCATIONS DPO, PR, B1, AND LO WERE BETWEEN 0.1 PPB AND 0.16 PPB. SEDIMENT AT B2, ADJACENT TO THE CORNFIELD, WAS 0.788 PPB.

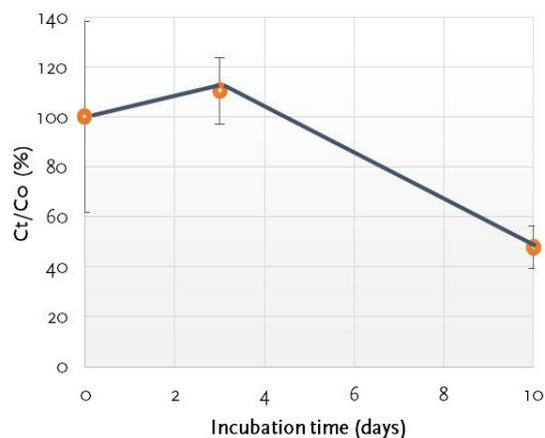
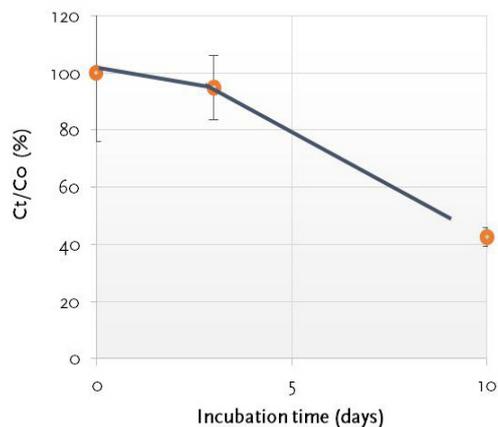
CONCLUSIONS

The highest concentration of TMX was found in the sampling location adjacent to the cornfield, with at least five times the concentration of TMX compared to sediment concentration to other locations. Based on this data, it can be stated that TMX has the ability to mobilize from the cornfield to the creek. Since the concentration of TMX was below the detection limit at the next downstream location, it is assumed that TMX does not mobilize much through the creek itself. The transformation rates of TMX in sediment from Stroubles Creek were comparable to those found in previous aerobic water studies,¹⁴ while the transformation rate of CLO, which has limited literature, was similar to that of TMX. The transformation rate of TMX in soil was also comparable to that of previous studies,¹⁵ as the half-life of TMX in soil was at least double that of TMX in sediment. The lack of high concentration of CLO found on Day 28 soil samples was unexpected and this possibly contradicts a previous study, which had stated CLO as a main transformation product of TMX.¹⁶ The analysis for CLO in the soil transformation study was not performed on previous study days for comparison. Therefore, the low concentration could be due to other reasons such as CLO degradation. The analysis of CLO concentrations in comparison to decreasing TMX concentrations is a possible topic for further study. Overall, the stability of TMX in soil suggests the ease with which the compound can accumulate to levels that would be dangerous to honey bees and other anthropods.

ACKNOWLEDGEMENTS

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FIGURES 5A AND 5B. GRAPH SHOWING THE TRANSFORMATION RATE OF TMX (TOP) AND CLO (BOTTOM) IN SEDIMENT COLLECTED FROM STROUBLES CREEK. THE HALF-LIFE OF TMX IN THIS SEDIMENT WAS FOUND TO BE ABOUT 8 DAYS. THE HALF-LIFE OF CLO IN THIS SEDIMENT WAS FOUND TO BE ABOUT 9 DAYS.

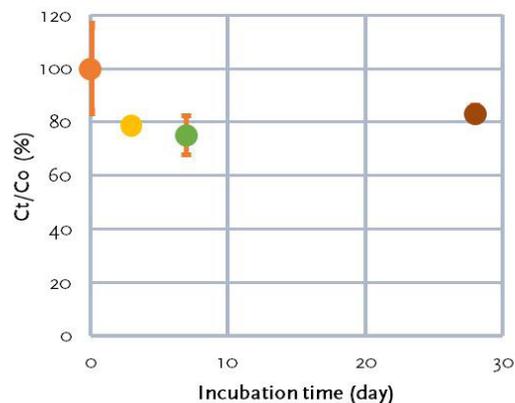


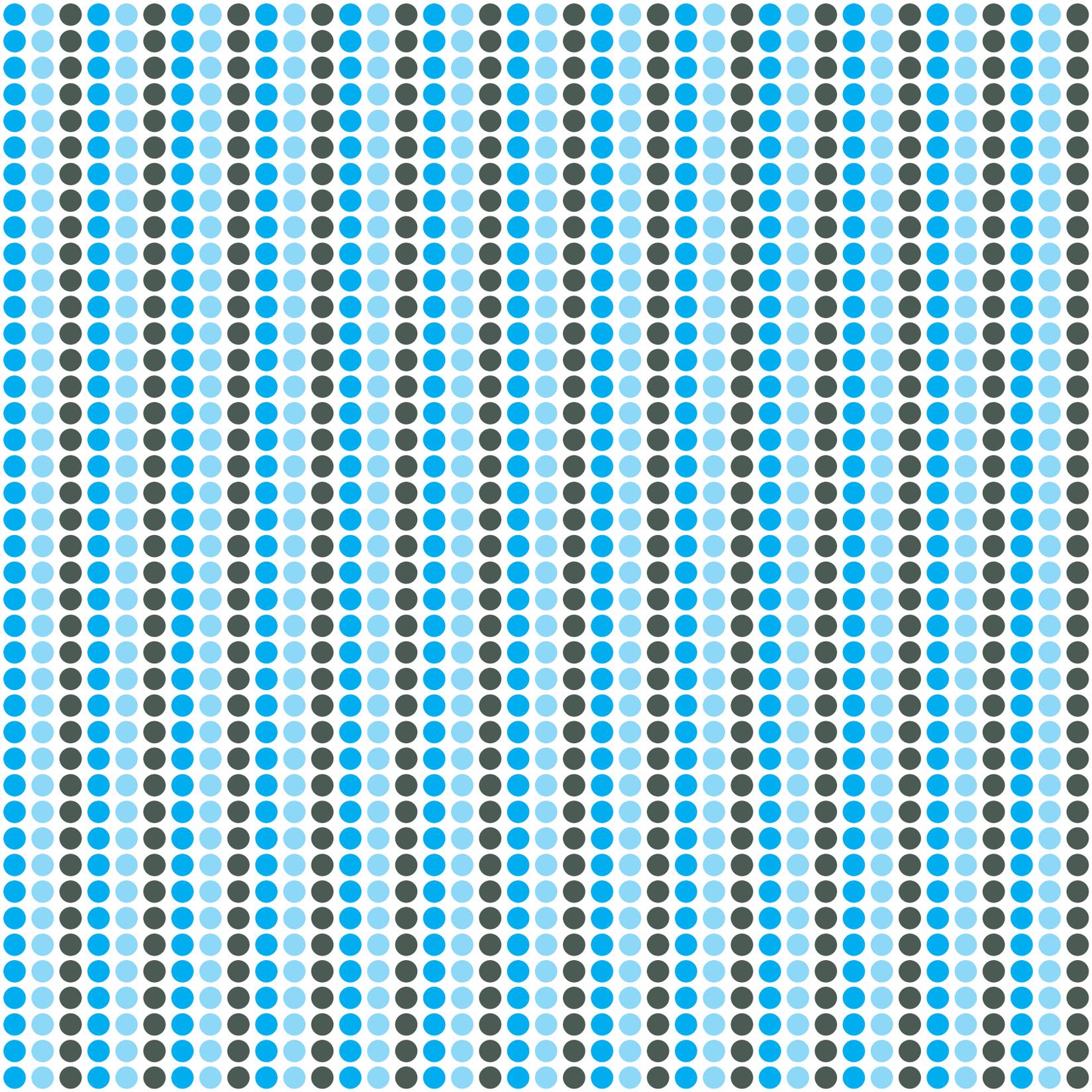
FIGURE 6. GRAPH SHOWING THE TRANSFORMATION OF TMX IN SOIL COLLECTED FROM THE VT AG. EXP. STATION. THE CONCENTRATION OF TMX IN THE SOIL DECREASED 25% OVER THE FIRST 7 DAYS OF INCUBATION.

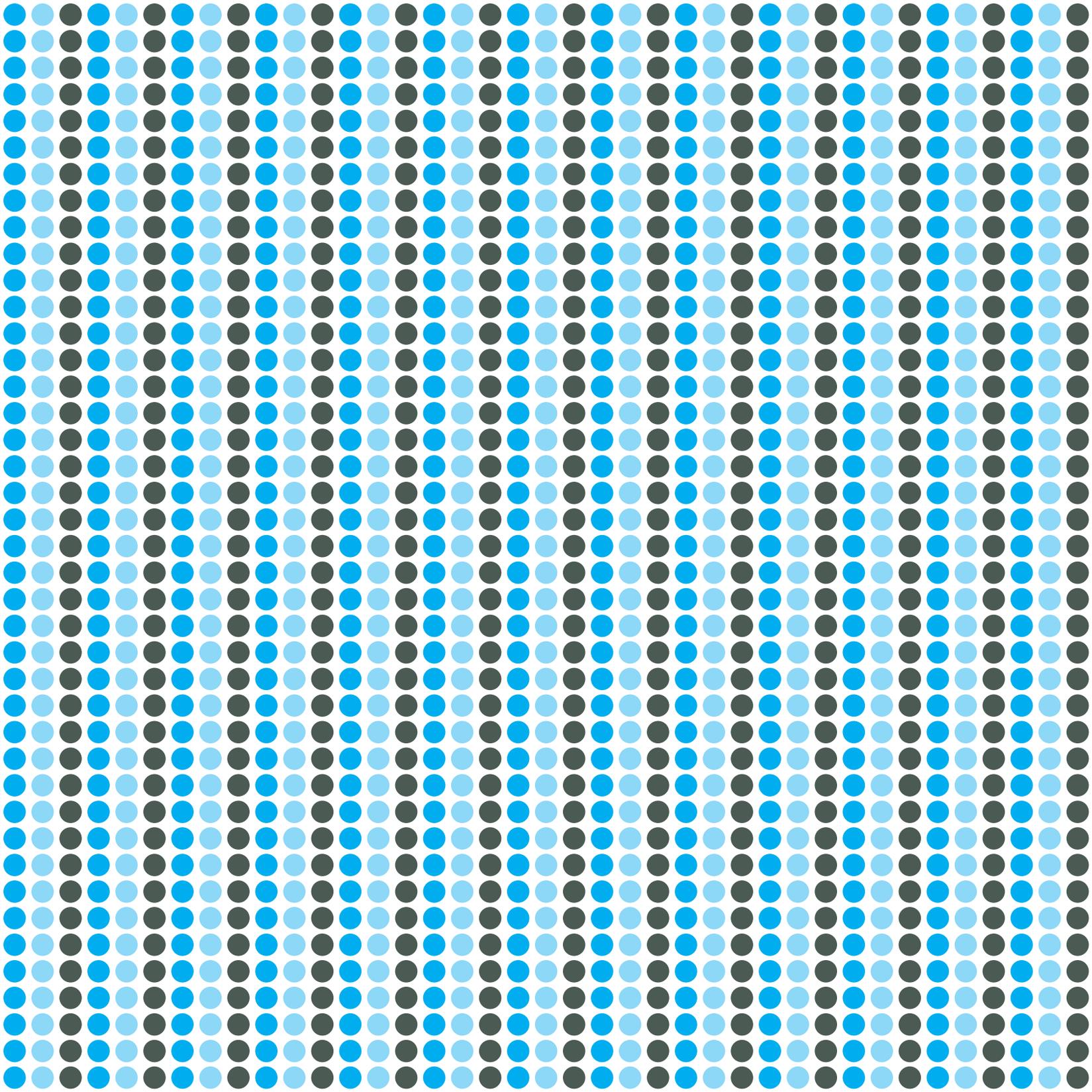
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“WHO WOULD HIRE A BLIND POET?”

Blindness in the Eyes of Stephen Kuusisto

CHRISTOPHER KABACINSKI

THE TROPE OF BLINDNESS HAS PERSISTED SINCE ANTIQUITY IN FIGURES LIKE OEDIPUS, TIRESIAS, AND THE HYPOTHETICAL BLIND MAN. FURTHERMORE, COLLOQUIAL USES OF BLINDNESS SHORE UP PROBLEMATIC AND REDUCTIVE NARRATIVES AND EXPECTATIONS ABOUT BLIND INDIVIDUALS. REPRESENTING THE DISABLED MAN THUS POSES A DISTINCT CHALLENGE AS IT WORKS AGAINST HEGEMONIC NOTIONS OF MASCULINITY AND ABILITY. DISABILITY—AS IT IS REDUCTIVELY ASSOCIATED WITH DEPENDENCY, INFIRMITY, AND WEAKNESS—CONTRADICTS THE STRENGTH, AUTONOMY, AND BODILY INTEGRITY OF STEREOTYPICAL MASCULINITY. THROUGH CLOSE READINGS OF THE POETRY AND MEMOIR OF STEPHEN KUUSISTO, A PARTIALLY BLIND AMERICAN POET, THE AUTHOR IDENTIFIES THE DOUBLE GESTURE OF DEFAMILIARIZATION AND REFAMILIARIZATION IN KUUSISTO’S REPRESENTATIONS OF BLINDNESS AND MASCULINITY. KUUSISTO CARVES OUT A SPACE FOR THE BLIND MAN IN EVERYDAY LIFE BY DEPLOYING, REWORKING, AND REJECTING THE PROBLEMATIC CONSTRUCTIONS OF BLINDNESS AND MASCULINITY.

"At times the blind see light,

And that moment is the Sistine ceiling ..."

—Stephen Kuusisto, "Only Bread, Only Light"

Disability theorist Tom Shakespeare observes that the disabled man "is largely absent as the subject of research."¹ Shakespeare is careful to cite the social model of disability to convey precisely where disability inheres: not in the body itself, but in the culture in which the body is located. What this allows then is an alliance with other critical discourses, such as the similar goals and methods of feminism and disability rights. If interrogating how the body is represented is crucial to critical feminist theory, the two discourses converge precisely at the body. What most concerns Shakespeare is the absence of narratives concerning men with disabilities and the ways in which differences in disability—between men and women, most specifically—are elided. In ableist and patriarchal cultures, disability and masculinity are opposites; if stereotypical disability suggests infirmity or weakness, stereotypical masculinity connotes "strength, potency, and physical activity."² Disabled masculinity, as a seemingly contradictory and incoherent subject position, resists expected or stereotypical narration and representation precisely because it unsettles the body and the language in which it is figured.

The blind man, however, has been a cultural mainstay for millennia, from the dramas and mythologies of ancient Greece to the films and novels of the contemporary United States. What is most troubling is that the blind man is still



TIRESIAS, A GREEK MYTHOLOGICAL PROPHET, IS TURNED INTO A WOMAN AFTER STRIKING SNAKES. (COURTESY OF WIKIMEDIA COMMONS)

largely "in Oedipus' shadow."³ Representations of blindness, reiterated over time, all carry the traces of the infamous blind figures of antiquity: Oedipus and Tiresias.^{4,5} This inability to break with the past has constrained, to an extent, the contemporary blind man. For Sigmund Freud, the tragedy of Oedipus has "left ineradicable traces in the history of humanity" precisely because he exemplifies the universality of his desires, crimes, and guilt of Oedipus.⁶ Blindness is the punishment Oedipus inflicts upon himself for his wretched deeds, charging blindness with enormous moral significance. Although the connection between blindness and sin may predate the legend, the representation of Oedipus renders "the sin distressingly and memorably specific."⁷ This single blind figure's tendency to haunt the blind, man and woman alike, is evidence of the persistence and prominence of Greek drama. Where in Ancient Greece, performance and recitation of Oedipus converged "religion, morals, society, and art" in the narrative of Oedipus, its retelling and appropriation throughout history has fixed Oedipus as a prominent cultural figure of blindness.⁸

The other "renowned story about blindness" arises from Greek tragedy, too, in the figure of Tiresias.⁹ The body of Tiresias is transgressive: he has been both man and woman. What further mars his body is the blindness with which Hera punishes him. Here Oedipus and Tiresias align in the association of blindness and punishment. What elides this physical blindness, however, is his mystical foresight. Zeus bestows upon Tiresias the "power of prophecy," and any perceived lack is diminished by "the magic of his gift."¹⁰ If one regards Tiresias in the shadow of Oedipus, what is most remarkable is the "ecstasy, grace, astonishment, instinct, hallucination, the soul" with which blindness is identified.¹¹ Moreover, throughout the history of philosophy, another visually impaired figure emerges: "the Hypothetical Blind Man."¹² Although philosophers ventriloquize their "Hypothetical Blind Men," narrating their non-visual worlds and the wisdom to which they have access, the philosophers often deploy them only to emphasize "the importance of sight and to elicit a frisson of awe and pity."¹³ The Hypothetical Blind Man's own body is deployed against itself; his body is always subordinated to the abled man.

Two opposed connotations of blindness emerge then from history: blindness as punishment and blindness as blessing. Oedipus and Tiresias are perhaps the first—and thus the most recognizable—characters with blindness in the Western tradition. What the recurring deployment of vi-

“Disability life-writing is able to re-create language precisely because its subject ... uses ordinary language to challenge conventions, stereotypes, and misrepresentations of disability.”

sual impairment in various discourses—literary, cultural, social—facilitates is the making of blindness into metaphor, allegory, or narrative device. In fact, the literary and cultural narratives in which blind characters figure prominently often depend on visual impairment as “narrative prosthesis.”¹⁴ Disability becomes narrative prosthesis precisely when it is figured as “a destabilizing sign of cultural prescriptions about the body and a deterministic vehicle for the characterization for characters constructed as disabled.”¹⁵ Characters marked as “disabled” become the very impetus for the narratives themselves; in this way, the disabled bodies of Oedipus and Tiresias become “key compo-

nents of the plot” of their myths as they are positioned in contrast to the nondisabled characters.¹⁶ Both Oedipus and Tiresias “[oscillate] between micro and macro levels of metaphorical meaning supplied by disability;” their bodies are simultaneously private and public, fraught with personal and sociocultural significance.¹⁷ What is so problematic about these narratives is the use of blindness chiefly as a plot device, rather than an instance of bodily difference or individual, lived experience.

Strangely, it is this movement between registers of meaning that restricts the blind man in literature and culture. His visual impairment is repeatedly deployed time and again for social and moral purposes; his blindness is allegorized as either punishment or blessing. The blind man’s body both spoken for and written for is constrained within “a limited array of symbolic meanings.”¹⁸ Although blindness mars the man as deviant, narrative prosthesis renders his body docile through its compliance to and reiteration of stereotypes of disability. Representing blindness recalls the characters of the blind men of the Western cultural tradition and the contradictory and reductive characterizations and connotations of blindness throughout history. The blind man’s story is perceived as always already written or vocalized; on his body the cultural narrative of blindness is always already inscribed.¹⁹

To move from the shadows of Oedipus, Tiresias, and the Hypothetical Blind Men, the blind man must represent himself. In order for bodily impairment to be recognized not as deviance, but as difference, it is crucial for self-representation to address the “everyday phenomenon” of lived disability.²⁰ Writing with blindness and about blindness, while both employing and transgressing conventions of disability, will propose “blindness as something besides the absence of sight.”²¹ Self-representation of disability is both a response to and a reaction against “the traditional misrepresentation of disability in Western culture.”²² Disability—in this case, blindness—typically irrupts into the narrative as a mark of otherness, of deviance. To alleviate



TIRESIAS APPEARING TO THE HERO ULYSSES (COURTESY OF WIKIMEDIA COMMONS)

the anxiety of otherness and deviance, both the narrative and the reader prompt the blind man to explain away his blindness. These narratives anticipate the blind man's "[conformity] to, and thus [confirmation of], a cultural script" of blindness.²³ This implicit subordination of the disabled body to the abled body is precisely what disability life-writing contests.

Language is precisely what enables the progressive and positive possibilities of disability life-writing. This claim, in part, is predicated upon the iterability of signs posited by Jacques Derrida: each sign, he asserts, is repeatable, "communicable, transmittable, decipherable."²⁴ Insofar as each sign is invested with meaning by its writer, its speaker, the sign carries with it "a force that breaks with its context."²⁵ Each sign is not restricted to a single, conventional meaning; there is, instead, a limitless possibility for meaning in each sign. In disability life-writing, then, that progress is only possible through the transgression of expected meaning. The disabled body is able to sign against the ableist culture and the hegemony of the abled; in this way, the body's transgressive potential can be realized. Disability life-writing is able to re-create language precisely because its subject—the disabled body and its experience—uses ordinary language to challenge conventions, stereotypes, and misrepresentations of disability.



ANTIGONE LEADING HER BLIND FATHER OEDIPUS
(COURTESY OF WIKIMEDIA COMMONS)

In disability culture, poetry holds the greatest potential for realizing the "infinite possibilities embedded within ordinary language."²⁶ While "ordinary language" follows a certain grammar and utilizes expected denotations and connotations, poetic language departs from these conventions.

Poets break open syntax and grammar to generate new meanings; the movement of poetry follows an associative rather than a grammatical logic. "Ordinary language" makes meaning in time, in the sequential order of the words, whereas poetry relies on spatial, associative links between the words and images of the poem. In a sense, poetry "breaks the inertia of language-habits."²⁷ When the subject of poetry is disability, the content of the poem breaks convention as much as the form itself. The poetics of disability, it seems, would emphasize the transgressive and generative possibilities of language and the body. While ableist societies typically isolate people with disabilities through cultural practices, traditions, and institutions, the reclamation of "ordinary language" by disability culture poetry relocates people with disabilities "in the normal ... in the everyday."²⁸

Thus, what is crucial to the poetry of disability culture is this re-presentation and representation of the disabled subject, such as the aforementioned blind man, who has inhabited literary and cultural narratives now for millennia. To bring himself into the light from the shadow of Oedipus, he must represent himself. In an ableist society, the disabled male is an entirely incoherent subject position. Hegemonic standards of masculinity—among them, "initiative, competitiveness, self-control, assertiveness, and independence"—invalidate disabled masculinity, relegating the disabled male to a powerless position.²⁹ For the patriarchal and ableist traditions and institutions to strip power from the body and the voice of the disabled male, his body's signs of deviancy must be erased. What always remains, however, are the marks of difference and impairment in which the power of the disabled subject position resides. The disabled body never ceases to sign against the ableist culture that subdues it.

In this sense, the poetry of the blind man has the potential to reshape reductive and widespread standards of masculinity and to create space for the disabled male in the live world. For Stephen Kuusisto, a partially blind poet himself, to write is to eclipse a tradition of shadows. Kuusisto was born in March 1955 with "retinopathy of prematurity," and has been considered "legally blind" since childhood.³⁰ Moving from the myth-worlds of Oedipus and Tiresias, from the powerless place of the disabled man, Kuusisto positions himself "in the normal ... in the everyday."³¹ Understanding disability as a "generative experience" in the production of poetry recognizes language's enormous power to "[rewrite] conventional standards of poetic beauty, form, and value."³²

“For Stephen Kuusisto, a partially blind poet himself, to write is to eclipse a tradition of shadows.”

Crucial to understanding disability as an aesthetic or literary practice is acknowledging its political potential. If aesthetics is concerned with “[tracking] the sensations that some bodies feel in the presence of other bodies,” the aesthetics of disability culture poetry can, in fact, produce change in the corporeal world.³³ Kuusisto’s memoir and poetry collections figure blindness as an everyday experience, rather than an extraordinary, mythical experience. Here, Kuusisto begins to move himself from the shadow of Oedipus.

To produce its aesthetic effects, poetry dislocates language from its expected meaning. Disability culture poetry, however, is charged with the additional task of dissolving the entrenched cultural representations of disability that limit and reduce the true representation of disability. To create his world with words, Kuusisto must first depart from a culture and a language that disavow blindness. Kuusisto accomplishes this in the first line of his memoir, *Planet of the Blind*: “Blindness is often perceived by the sighted as an either/or condition: one sees or one does not.”³⁴ What follows his explanation of his vision as “[staring] at the world through smeared and broken windowpanes,” is a mythic description of his impaired eyesight.³⁵ In the colors and shapes of his visual field, he sees “sails of Tristan’s ship,” “the great dead Greek’s in Homer’s descriptions of the underworld.”³⁶ Although this description positions him squarely in the mythic world of Oedipus and Tiresias, his introduction does not suggest the opposite connotations of these blind Greek men. He is neither sinner nor seer; rather, he seems entirely ordinary. Although the mythic past, populated with the traditional and hypothetical blind men, colors his vision, it does not dominate it. In fact, Kuusisto’s vision seems to meld the legendary with the ordinary: for example, who he perceives as one of “the great dead Greek ... crossing Charon’s river” is only “a middle-aged man in a London Fog raincoat.”³⁷

This oscillation between the mythic or traditional past and the everyday present is emblematic of Kuusisto’s memoir and corpus of poetry. In fact, the first group of poems, “Blind Days in Early Youth,” in his collection *Only Bread, Only Light* is reminiscent of the first page of his memoir. This first group, which speaks to his early fascination with

vision and blindness, is divided into three separate poems: “No Name for It,” “Terra Incognita,” and “Awake All Night.”³⁸ Where in *Planet of the Blind*, Kuusisto conjures up the myths of ancient Greece, in the first collection of *Only Bread, Only Light*, he invokes the Scandinavian culture in which he was raised.

Although Kuusisto was born in Exeter, New Hampshire, his family moved to Finland for his father’s job.³⁹ In his earliest memories looms the imposing figure of “a severe old woman who speaks to [his] father in Finland’s brand of Swedish.”⁴⁰ She reappears in the first poem of the subsection, “No Name for It,” as “the Swedish matron” who chides the speaker, the young Kuusisto.⁴¹ The poem’s title immediately calls attention to language’s limitations: there is “no name” for an unidentified “it.” In a childlike manner, the young Kuusisto rattles off a few words—“something Swedish:” “rus-blind,” “blinda-fläcken,” “blind-pipa,” “barna-blind.”⁴² Although he demonstrates a certain level of mastery of language by translating each of these idioms, there is something tentative and uncomfortable in his tone. The way in which these phrases are made by affixing “blind” unsettles Kuusisto precisely because the idioms have negative connotations—“blind drunk” and “nonentity,” for instance.⁴³

What most troubles Kuusisto, however, is the “piety and reproof” of the Swedish matron’s words: “En blind höna hittar också ett korn.”⁴⁴ The translation of this line—“The fool’s arrow sometimes hits the mark”—arrives only after a line break.⁴⁵ The translation for the other idioms immediately follows the Swedish phrase, but the translation of the matron’s derisive remark occurs in an entirely different couplet. This break conveys the dissonance of the speaker, trying to make sense of his own blindness and these blind-idioms. Her words reverberate in his mind, but her other call—“barna-blind; ‘blind child’”—[“echoes] on the stairs.”⁴⁶ While the translations are univocal and direct at the beginning of “No Name for It,” the translations are opened to different interpretations. In fact, Kuusisto reiterates “barna-blind” only to alter his original translation as “blind from birth.”⁴⁷

At the poem’s conclusion, Kuusisto retranslates the Swedish matron’s words: “En blind höna hittar... / The blind

child's arrow..."⁴⁸ Finally he takes control—albeit tentatively—of language; “blind” comes to signify not “fool,” but only “blind” itself. Although this translation seems tautological, it gives Kuusisto incredible power to rend blindness from its idiomatic usages. He makes sense of blindness by experience, rather than the idioms inscribed in language that is not even his own. If “the fool’s arrow sometimes hits the mark,” here “the blind child’s arrow” has hit the mark, however tentatively or elliptically. The poem becomes an “exploration of the possibilities of language” insofar as the young Kuusisto eschews the conventions of language, of meaning; idioms are evidence of the “inertia of language-habits” which poetry must overcome.⁴⁹ Poetry is precisely the force that sets language into motion again, that moves the blind-man from the shadow of Oedipus, this blind-child from the shadow of idioms.

Furthermore, “No Name for It” departs from poetry’s traditional reliance on the visual to accomplish its aesthetic effects. Instead, the poem employs auditory language more often—and, arguably, more forcefully—than does visual imagery. In fact, the visual is often overwhelmed by the auditory effects of language. It is not the image of the Swedish matron “[pointing] with a cane,” for instance, that controls the poem; in fact, Kuusisto describes her appearance only vaguely.⁵⁰ Rather, her voice is what Kuusisto remembers most clearly; he recalls with acuity her “tone mixed with piety and reproof.”⁵¹ As her voice “echoed on the stairs” all those years ago, so now does it reverberate in the Swedish idioms throughout “No Name for It.”⁵²



A SEEING-EYE DOG (COURTESY OF WIKIMEDIA COMMONS)

This reliance on the auditory, however, must not be construed as a domination of the auditory over the other senses. His poetry does not merely reverse the pervasive “belief that human experience, both physical and mental, is essentially visual.”⁵³ As Michael L. Melancon notes in his critical study of *Only Bread, Only Light*, Kuusisto’s poetry often investigates “how sight, hearing, and touch can serve to facilitate expression and communication by both receiving information and transmitting information.”⁵⁴ In this way, Kuusisto does not exchange visual primacy for auditory or tactile primacy. What emerges in his poetry is a synergy of the senses in which perception and experience is not restricted to a single sense, a single meaning. If the first poem in “Blind Days in Early Youth” seems to suggest auditory primacy, the two poems collected with “No Name for It” deny this interpretation in favor of this syncing of the senses.

In fact, the auditory is what is absent from “Terra Incognita.” The poem is remarkably visual and tactile: Kuusisto “[makes his way] among patches of dew – / Those constellations on the darkened grass.”⁵⁵ Walking on the dampened yard, he fathoms the dewdrops into constellations; here the “darkened grass” is illuminated by the stellar qualities of dew.⁵⁶ Just as the cosmic and the terrestrial are united here, so too are the visual and the tactile. The perceived movement of Kuusisto across the grass and the vision of the dewdrops are inseparable. The play of light and dark emerges again in the final stanza: “I pictured a shirt – / How I’d pull it over my head / And vanish in the sudden light.”⁵⁷ The stanza is initially coherent, describing the tacticity of putting on a shirt; the body moves in a familiar, expected manner. What is so peculiar, however, is the way in which he imagines “[vanishing] in sudden light.”⁵⁸ If light connotes knowledge or presence, disappearing “in sudden light” seems utterly incoherent.⁵⁹ The final stanza describes a liminal moment, between the shirt being both on and off Kuusisto’s body. Light and sight alone cannot confirm his body’s corporeality; rather it is the position and motion of his body that remain as he “[pulls the shirt] over [his] head.”⁶⁰ Vision and tactility are represented here in tandem, as the body cannot separate the two senses.

The synergy of the visual, the tactile, and the auditory emerges in the third poem of the first collection, “Awake All Night.” In the first three couplets, Kuusisto establishes the presence of all three senses: “The cabinet radio glowed / With its lighted dial / As I pressed my face to the glass.”⁶¹ Enamored by the light and the sound the radio produces, he draws it near, touching his face to the cabinet. Describ-

ing his own glasses as “kaleidoscopes of light,” he identifies his vision as both beautiful and impaired.⁶² This impairment, however, does not deny the possibility of enjoying “the brilliant city of tubes / Just visible through a crevice.”⁶³ What he does, instead, is “lean close” to the radio cabinet; the intimacy of the young Kuusisto and the radio illustrates the inseparability of the senses. While blindness stereotypically connotes the impossibility of visual pleasure, “Awake All Night” establishes vision as a component of pleasure and everyday experience for the blind speaker.

In fact, the visual, the tactile, and the auditory all comprise pleasure and the everyday for Kuusisto, but the three senses are at once present and absent. Although he confesses that “[he] never heard the music” those nights, there in the radio is the promise, the remembrance of sound.⁶⁴ Moreover, “[his] spectacles, thick as dishes,” attempt to correct his partial blindness only to refract the light.⁶⁵ The failure of his eyeglasses prompts him to “lean close,” but he can only “[press his] face to the glass.”⁶⁶ What Kuusisto suggests in “Awake All Night” is the limitations of single-sense perception; his experience is not a matter of compensating for the senses. Rather, the poem makes evident the coordination of the senses. Pressed to the glass of the glowing radio cabinet, Kuusisto “looks down out of habit / at the vivid world.”⁶⁷ Living in the world, perceiving the world is a matter of the whole body, not a single sense. The synergy of vision, hearing, and touch anchors the body in the world, and it is this anchorage that allows Kuusisto to establish his everyday and to re-create in his poetry.

Kuusisto’s poetry amounts to an attack on what David Bolt terms “the metanarrative of blindness,” which is “the story in relation to which those ... who have visual impairments often find [themselves] defined.”⁶⁸ Crucial to understanding this narrative is acknowledging that it is inflected by “ocularcentrism,” which “denotes a perspective—and by extension, a subject position—that is dominated by vision.”⁶⁹ This perspective is problematic precisely because it employs reductive, stereotypical representations of blindness to comprehend and convey the experience of blindness. What is more troubling is the exclusion of people with visual impairments from the weaving of this story; here the voice of the visually impaired is absent. In this way, the metanarrative misrepresents blind experience precisely by reproducing tropes of the Hypothetical Blind Men and the blind beggars by conjuring up the figures of

Oedipus and Tiresias.⁷⁰ The traditions and narratives inscribed in an ableist and certainly, an ocularcentric culture perpetuate “ocularnormativism,” which establishes vision as “the supreme means of perception.”⁷¹

Although ocularcentrism textures the metanarrative of blindness with diverse and disdainful representations of visual impairment, I am concerned primarily with the thread of blindness and psychoanalysis. Freud revives Oedipus for his own thesis of man’s natural ambivalence between love and aggression in Totem and Taboo, but blindness and the eyes also figure prominently, in his studies on the significance of dreams.⁷² In fact, Freud’s *The Interpretation of Dreams* demonstrates the intense “interest in eye symbolism of psychoanalysis.”⁷³ Recurring in psychoanalytic works are the associations of “testicular, ocular, and penile images,” which establishes a link between masculinity, sexuality, and vision.⁷⁴ Bolt describes this fixation as “ophthalmocentric,” which privileges “the instrument of vision, as in notions of eyes.”⁷⁵ Ophthalmocentrism is predicated upon ocularcentrism, linking inextricably vision and the eyes, and thus the association phallic imagery and eyesight implicitly genders the ability to gaze as masculine.

Building on the “implicit blindness-castration synonymy” of psychoanalytic theory, Rosemarie Garland-Thomson asserts “the social role of men is to be starrers.”^{76,77} This proposition reflects “the gendered asymmetries of the patriarchy,” which position males and females at opposite sides of the seer-seen dyad.⁷⁸ Although the gendered implications of the vision only arise in “lived gendered relations,” there is no doubt that “looking masculinizes... and being looked at feminizes.”⁷⁹ This is precisely the precondition for the construction of the “male gaze,” which, with a mere glance, subordinates the object of the stare.⁸⁰ In this way, the eyes are constructed as a synecdoche for the male body; thus the blind man, unable to exercise the male gaze, is emasculated.

This interrogation of ocularcentrism and ophthalmocentrism again conveys the primacy assigned to vision, but what is at stake in the “blindness-castration synonymy” is sexuality itself.⁸¹ If the male gaze—and, by association, male sexuality—is predicated upon dominance, power, and inequality, the blind male gaze disassembles the hegemonic expectations and diffuses power.⁸² Visual impairment may render the blind man incapable of executing “normative masculine performances,” but this does not necessarily emasculate him.⁸³ Disabled men do not dis-

“It is not simply visual pleasure that Kuusisto achieves, but a wholly corporeal, holistic pleasure.”

avow masculinity and sexuality altogether; instead, the lived experience of disability and masculinity requires the blind man to renegotiate sexuality and gender. This revision of expected gender performances can, in turn, level the inequality of the masculine-feminine binary undergirding both patriarchal and ableist traditions.

Stephen Kuusisto’s account of his first sexual experience in his memoir, *Planet of the Blind*, instantiates this negotiation of disability and masculinity. Although he had been “raised to know [he] was blind but taught to disavow it,” Kuusisto stops masking his visual impairment in college.⁸⁴ His professors accommodate his limitations, and one “benevolent Shakespeare professor” even finds someone to read to him.⁸⁵ Gradually “his habitual shyness around women” diminishes as Kuusisto connects with his peers.⁸⁶ This newfound confidence undergirds Kuusisto’s relationship with Bettina, an “altogether irreverent young woman, ... an Irish country girl with long, thrilling, unkempt hair”⁸⁷ If hegemonic masculinity asserts the male’s prerogative and female’s submission, Bettina’s initiation of Kuusisto’s first sexual encounter reverses that binary. With “a potent kiss” she pulls Kuusisto to the floor and guides him.⁸⁸

In this moment, Bettina’s agency astounds Kuusisto— “[he] can’t believe how quickly she does it.”⁸⁹ In fact, Bettina initiates and controls the encounter, “pulling down [his] pants,” “loosening [her] own buttons.”⁹⁰ Although her initiative may be perceived as a moment of feminine domination, the tenderness of the moment suggests something entirely different. If vision and sexuality are conflated in ocularcentric conceptions of masculinity, this scene separates them. It is not simply visual pleasure that Kuusisto achieves, but a wholly corporeal, holistic pleasure. Kuusisto figures this experience as entirely natural, beautiful: “a birch tree at midsummer, the sunlight seeming to be above and inside her.”⁹¹ Although the visual certainly constitutes part of pleasure for both Kuusisto and Bettina, it is the heightened tactility of the experience for Kuusisto that anchors this first sexual encounter. To resist locating pleasure solely in either sex, the scene alternates between descriptions of his body and her body. What’s more, while their two bodies are entangled, Kuusisto is “looped in the loops of her hair.”⁹² Their bodies remain separate although intertwined, and the ambiguity of who touches who dis-

mantles any domination or control implicit in the sexual encounter. This claim is informed, in part, by Merleau-Ponty’s assertion of “crisscrossing ... of the touching and the tangible” during a sexual encounter.⁹³ This is perhaps a reduction of Merleau-Ponty’s argument, but there seems to be something in his conception of the tactility that mitigates the perceived hostility, dominance of the touch.⁹⁴

Kuusisto’s lived experience demonstrates the insufficiency of ideals of embodied masculinity. Where patriarchal and ableist norms, echoing the metanarrative of blindness, locate masculinity largely in the visual, Kuusisto’s disabled masculinity posits a corporeality, a masculinity of the body whole, of all the senses. If traditional masculinity is predicated on “initiative, competitiveness, self-control, assertiveness, and independence,” disabled masculinity renegotiates these standards in accordance with the lived experience of bodily impairment.⁹⁵ Furthermore, disabled masculinity denaturalizes the “naturalized relation between masculinity and power.”⁹⁶ In her critical study of alternative masculinities, “Female Masculinity,” Judith Halberstam carves out a space for disabled masculinity in the repertoire of male subject-positions. Her critique of action films centers on the use of prosthetic extensions of the body “to extend masculinity.”⁹⁷ Prosthetics—gadgets, guns, automobiles, for example—implicitly “undermine the [idealized] heterosexuality” of the male star of the action film, effectively creating a gap between the hegemonic ideals of standards of masculinity and its embodiment in the world.⁹⁸ These prostheses, too, seem to subvert the idealized independence of hegemonic masculinity.

Prostheses are essential to Kuusisto’s day-to-day lived experience, and his reserve of prostheses comprises more than merely eyeglasses. Corky, Kuusisto’s guide dog, functions like a prosthetic, as she increases his mobility and capabilities in everyday life. However, Corky complicates is the traditional notion of prosthetic masculinity. The heroic male, star of the action flick, can function without his gadgets and weapons; the prostheses only supplement the hero’s masculinity.⁹⁹ Kuusisto’s guide-dog, Corky, is essential to his everyday life; here, man quite literally depends on man’s best friend. In fact, Corky becomes integral to Kuusisto’s lived experience as a disabled man. Whereas the gadgets of the action flick star seem unnatural and re-

sist incorporation into the body, Corky and Kuusisto “move as one, [although they] are more than that.”¹⁰⁰

Nowhere is this dependency, this between Kuusisto and his guide-dog more evident than in “Guiding Eyes,” a poem written for Corky in *Only Bread, Only Light*. His admiration is apparent from the stanza:

It’s been five years
Since I was paired with this dog
Who, in fact, is more than a dog –
She watches for me.¹⁰¹

What follows is a description of “[their] twin minds [going] walking” in New York City.¹⁰² Kuusisto and Corky navigate the city’s well-travelled paths and its landmarks in an unexpected and mythical manner. The tension between their separate bodies and their singular functioning prompts Kuusisto to call him and his guide-dog “a kind of centaur – / or maybe two owls / Riding the shoulders of Minerva.”¹⁰³ The mythic association here depicts the pair not as impaired or lacking, but rather as legendary, as wise. When he “[supposes] they’re scarcely whole,” he seems to recognize the myth of wholeness inscribed in the body.¹⁰⁴ This realization is hardly dismal, and Kuusisto’s subtle joy is palpable when he observes:

The centaur gathers
What passes from our flesh
Into the heart
Of animal faith.¹⁰⁵

Kuusisto’s impairment here does not signify a lack, but rather signifies a recognition of bodily difference. Kuusisto and Corky come to signify wholeness of their separate, distinct bodies, and the unity of guide-dog and the guided. If the everyday is about routine, about establishing a home in one’s own space, Corky is integral to Kuusisto’s everyday precisely because “she leads [him] home.”¹⁰⁶

In a way, “Guiding Eyes” returns us to the mythical world, inhabited not only by the centaurs invoked by Kuusisto, but also by the oldest blind men of the Western cultural tradition. Kuusisto’s poetry and memoir oscillate between the mythical and the everyday. If ableist and patriarchal cultures operate by othering the disabled male, this alienation immediately locates him outside the norm, outside

conventional, everyday experience.

What is so remarkable about Kuusisto’s quotidian representations of blindness is its ability to establish an “everyday life, [that is] the quintessential quality of taken-for-grantedness.”¹⁰⁷ Writing the everyday—that which goes without notice—is essential precisely because it relocates him, a disabled male, in the everyday consciousness: he is not an Oedipus, a Tiresias, or a Hypothetical Blind Man.¹⁰⁸ The disabled man, then, becomes present, familiar. He identifies himself as blind only to jettison the metanarrative of blindness, and only then is he able to familiarize, for the abled reader, his everyday life. This is precisely what disability life-writing aims to do: to familiarize and legitimize the everyday experience of disability by shedding the mask of the metanarrative. In this way, everyday disability resembles, represents, and coincides with everyday life. As Kuusisto “[walks] / both bodily and ghostly,” he and Corky retread the paths of New York City to establish their own everyday existences; they move with, not against, the city.¹⁰⁹

What Kuusisto’s life-writing amounts to is re-presentation of everyday life as a disabled man. Embodied, lived life depends on more than the visual for Kuusisto—and arguably for all humans. What Kuusisto rejects by familiarizing and legitimatizing the experience of blindness are the hegemonic standards of ableist masculinity. In this way, the oscillation between the mythic, the everyday, and the synergy of the senses in Kuusisto’s poetry and prose represents “disability and masculinity as lyric processes” that actively resist the “controlling narratives” of patriarchal and ableist culture.¹¹⁰ Representing disability and masculinity introduces an “unanticipated similarity between all things,” thus establishing the everyday life and the embodied experience as “a holistic texture” of identities and sensory experience.¹¹¹ Only now does Kuusisto move out of the shadows of Oedipus and illuminate his own everyday life as a blind male.

ENDNOTES

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2. Shakespeare, "The Sexual Politics of Disabled Masculinity," 1999, 54.
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4. Kleege, *Sight Unseen*, 1999, 66-69.
5. Kuusisto, *Planet of the Blind*, 1998, 187.
6. Freud, *Totem and Taboo*, 1989, 192.
7. Kleege, *Sight Unseen*, 1999, 69.
8. Kleege, *Sight Unseen*, 1999, 194.
9. Kuusisto, *Planet of the Blind*, 1998, 187.
10. Ibid.
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12. Kleege, "Blindness and Visual Culture: An Eyewitness Account," 2013, 447.
13. Kleege, "Blindness and Visual Culture: An Eyewitness Account," 2013, 448.
14. Mitchell and Snyder, "Narrative Prosthesis," 2013, 222.
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17. Ibid.
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19. Couser, "Disability, Life Narrative, and Representation," 2013, 458.
20. Couser, "Disability, Life Narrative, and Representation," 2013, 457.
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23. Couser, "Disability, Life Narrative, and Representation," 2013, 458.
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26. Bayliss, "Against Interpretosis: Deleuze, Disability, and Difference," 2009, 289.
27. Ibid.
28. Bayliss, "Against Interpretosis: Deleuze, Disability, and Difference," 2009, 292.
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30. Kuusisto, *Planet of the Blind*, 1998, 6.
31. Bayliss, "Against Interpretosis: Deleuze, Disability, and Difference," 2009, 292.
32. Mintz, "Lyric Bodies: Poets on Disability and Masculinity," 2012, 248.
33. Siebers, *Disability Aesthetics*, 2010, 1.
34. Kuusisto, *Planet of the Blind*, 1998, 5.
35. Ibid.
36. Ibid.
37. Ibid.
38. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 5-7.
39. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 5-7.
40. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 10.
41. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 7.
42. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 1-3, 9.
43. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 2-3.
44. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 4, 10.
45. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 5.
46. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 9, 11.
47. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 12.
48. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 12-13.
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50. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 8.
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52. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 11.
53. Kleege, *Sight Unseen*, 1999, 30.
54. Melancon, "A River that No One Can See," 2009, 184.
55. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 4.
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57. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 11-13.
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63. Kuusisto, *Only Bread, Only Light: Poems*, 2000, 8-9.
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DIVISIONS DISSECTED

A Deconstruction of Boston College's "Asian Bubble"

DANIEL PARK & YOON-SHIN (CLARA) LEE

ASIAN AMERICAN DISCRIMINATION IS OFTEN ASSOCIATED WITH THE CONCEPT OF THE "ASIAN BUBBLE." THIS DISCRIMINATION IS NO DIFFERENT IN THE BOSTON COLLEGE (BC) COMMUNITY THAN IN MUCH OF SOCIETY AT LARGE. A SERIOUS CONSIDERATION OF THE ASIAN BUBBLE AND THE IMPACT OF THIS LABEL ON THE ASIAN COMMUNITY IS NECESSARY TO OBTAIN A FULL UNDERSTANDING OF THIS COMPLEX ISSUE AND FACILITATE THE SEARCH FOR A PERMANENT SOLUTION. THIS RESEARCH PROJECT IS BASED UPON A SURVEY OF 236 BC STUDENTS THAT WAS CONDUCTED TO GAUGE RESPONDENT PERCEPTIONS OF THE ASIAN COMMUNITY, INVOLVEMENTS ON CAMPUS, AND CONNECTIONS WITH ASIAN AMERICAN IDENTITY. RESULTS OF THE STUDY REVEAL THAT STUDENTS AGREE ABOUT THE EXISTENCE OF NEGATIVE PERCEPTIONS OF THE ASIAN COMMUNITY. NEVERTHELESS, THE STUDY ALSO SHOWS THAT THE ASIAN COMMUNITY IS NOT AS EXCLUSIVE AS MANY PERCEIVE IT TO BE, WHICH OFFERS HOPE FOR FURTHER RESEARCH AND ACTION IN THE FUTURE.

INTRODUCTION

This paper studies the complex idea of Asian American identity within the context of the Boston College (BC) community. Through this research, we explore various aspects of identity in relation to the Asian American community that exists here at BC. Similar to other AHANA (African, Hispanic, Asian, Native American) students at BC, Asian Americans experience prejudices and stereotyping, but Asian American discrimination is often observed in association with the concept of the “Asian Bubble.” It is a phenomenon where Asian students on campus unite and form a unique community, a sub-culture that can seem rather exclusive to students on the outside.

The Asian Bubble is a phenomenon that occurs not only at BC, but also at other schools across the nation. Moreover, this tendency of forming a sub-culture occurs in other ethnicities on campus from other AHANA ethnicities to white students. According to an article written by Timothy Egan published in the *New York Times*, UC Berkeley student Jonathan Hu described the separation in ethnic groups as a form of “selective self-segregation,” where students of differing ethnicities often do not interact with each other on a regular basis. However, it is interesting that this Asian Bubble is especially stigmatized in comparison to “bubbles” of other ethnicities, given that it is actually white students that form the least diverse racial group. Research conducted by Princeton sociologists Thomas Espenshade and Alexandria Walton Radford shows that white students have the most homogenous friendship groups.¹ A recent poll conducted by Reuters corroborates that information by concluding that 40% of white Americans and 25% of non-whites have friends only of the same race.² The negative connotations of the Asian Bubble and the resulting bias against the Asian community on campus only heighten the marginalization of Asian American students. This, in turn, can have a negative impact on individual self-expression and sense of identity because Asian heritage is not perceived as positively as it should be on campus, despite the reality that it constitutes an integral portion of identity for Asian Americans.

“Similar to other AHANA students at BC, Asian Americans experience prejudices and stereotyping, but Asian American discrimination is often observed in association with the concept of the ‘Asian Bubble.’”

SIGNIFICANCE AND PURPOSE

At BC, a very distinct culture exists, one that students often refer to as the “BC experience.” It sets very distinctive expectations of what a BC student should and should not do. Within this larger experience, however, there are also many other sub-cultures that impact individual growth over the course of four years. These sub-cultures are often determined by demographics, such as racial or gender similarities, or extracurricular activities.

Within the Asian community, a large portion of the population is a part of an intercultural organization, whether as a registered member or simply by association. Although past research, performed by Asian Caucus Directors of Policy and Political Initiatives Grace Son and Benjamin Miyamoto,³ has shown that Asian American students also participate in other activities and clubs across campus, there is an assumption that they are most, if not solely, involved in these intercultural organizations. This only exacerbates the belief in the community’s exclusivity. These negative perceptions not only change the way that students interact with each other, but also influence students’ self-perceptions.

On a greater scale, there are also many social norms and stereotypes that revolve around certain racial minorities. These beliefs become dangerous as they are often overgeneralized to the larger population. Even in the university setting, it is noticeable that certain stereotypes are imposed on certain groups. Having these as major identifiers can lead to misrepresentation and marginalization, affecting not only the greater community, but also the individual. Many famous psychologists, such as Eric Erikson, mark college as a crucial time for identity development. Popular beliefs can strongly influence the way students perceive the world around them and their overall satisfaction at the school.

In the wake of recent events at the University of Missouri, Yale, Ithaca, and many more universities across the United

“Students who come from cultures incongruent with the existing culture at a PWI often detach themselves from their culture of origin and adopt the values, norms, and assumptions of the existing dominant culture in order to find success.”

States, many AHANA students have called for policy reform at BC, but before that is done, it is important to understand how institutionalized racism can affect the individual and the larger community, in this case, the Asian American community. This study undertakes a deeper look at more individual and personal differences that may exist within the community. By assessing inter/intra group differences, a better understanding of this particular group, as a whole, can be ascertained. Overall, the research should be able to provide important insights and identify issues specifically pertinent for the Asian American community, such as formation of identity within the context of a predominantly white institution (PWI).

LITERATURE REVIEW

A review of the existing literature has revealed several interesting insights into Asian American identity and community. The insights and relevant information can be grouped into several categories: the Role of Ethnic Organizations, the Significance and the Effects of Diversity, and the Effect of Predispositions on Asian American Students.

In general, first year AHANA students at PWIs have been shown to experience a significantly weaker sense of belonging than first year white students.⁴ Students who come from cultures incongruent with the existing culture at a PWI often detach themselves from their culture of origin and adopt the values, norms, and assumptions of the existing dominant culture in order to find success.⁵ This is especially significant for Asian American and Black students, as they report the most negative assessments of the environment at PWIs, according to data from the National Survey of Student Engagement.⁶ Research shows that such a result is likely due to some of the stereotypes surrounding both ethnic groups, with Asian American students experiencing pressures that they are academically superior and Black students experiencing the assumption that they are academically inferior.⁷

Ethnic organizations have been shown to aid in the transition to college, providing AHANA students with an essential component of cultural validation and familiarity, while also serving as a means to advocacy and cultural expression.⁸ The ethnic organizations on campus can also help such students break down the overwhelming unfamiliarity of the university into smaller sub-cultures, making the transition to a PWI much easier.⁹ This compartmentalization of the university is especially significant for students who have “[traversed] a long cultural distance” to come to the university, because integration into a sub-culture on campus has been shown to increase the probability of a student’s successful immersion in and adjustment to college.¹⁰ Finally, research conducted on Black students by Harper and Quaye also shows that participation in these ethnic organizations improves cross-cultural communication skills, advocacy for marginalized populations, expression of identity, and the pursuit of social justice.¹¹ While this information refers specifically to Black students, it maintains relevance for Asian Americans because research has indicated that AHANA students do often share common struggles.¹²

Literature on the importance of diversity sheds light on the struggle faced by Asian Americans at PWIs. The marginalization of AHANA students at PWIs is well documented and discussed, with success at college being strongly linked to the sense of belonging a student feels on campus.¹³ White students have consistently reported more faculty and resource availability, alongside the highest overall satisfaction with the campus racial climate.¹⁴ Moreover, out of 574 first and third year students surveyed at a large mid-Atlantic university, white students reported only limited discrimination, together with an apparent ignorance of the prejudice faced by other minority groups.¹⁵ Diversity on campus is a crucial part of ensuring all parties are equally included, and perhaps more importantly, fostering positive race relations. Many students, especially at schools such as BC, come from racially homogenous

backgrounds that do not adequately prepare them to deal with the diversity they have never previously experienced.¹⁶ Thus, fostering positive race relations is often difficult for many students to do because of their predispositions that steer them towards certain behaviors and paths in college, an element that will be discussed further in the following paragraph.¹⁷ Moreover, alongside individual commitment to diversity, research has shown strong benefits associated with an institutional commitment to diversity.¹⁸ An institutional commitment to diversity will significantly improve race relations on campus and overcoming barriers, but it must be done in the right way. Research shows that institutional commitment must manifest itself through provision of educational information on interracial friendships and through support of diverse student interaction.¹⁹ The diversity on campus needs to operate through the development of interracial friendship in a close, interpersonal environment in order to explicitly support marginalized students.²⁰

Predispositions are attitudes and mindsets ingrained within individuals that influence them in certain directions. In the case of Asian American identity, predispositions affect the individual actions of groups of students, which in turn can affect the overall culture of an institution.²¹ The culture of an institution may then impact the identity of Asian American students, who arrive with certain predispositions. Literature indicates the importance of accentuation theory, which theorizes that students' predispositions entering college are reinforced as students select certain activities and peer groups.²² Thus, those who have experience with diversity and recognize its importance will likely accentuate that value by selecting "courses, peers, and activities that will strengthen their initial inclinations."²³ This theory is especially important to consider at a PWI such as BC that has many students, faculties, and administrative staffs from homogenous backgrounds.²⁴ These predispositions also impact the racial tension on campus through a fear-induced anxiety of interacting with diverse groups which prevents students from interacting confidently and meaningfully.²⁵ A reduction of said anxiety is therefore integral to increasing inter-ethnic interaction, and by consequence all essential feelings of belonging students feel at school.

The literature offers interesting implications for the Asian American community in relation to the larger population, whether in private institutions or more casual settings.

These implications establish an interesting frame of reference with which to study the BC community. Through the study of Asian American identity and community within the context of a specific institution, this study seeks to integrate academic credibility into future conversations about the Asian community, the various perceptions and connotations of the term Asian Bubble, and the idea of Asian American identity within the context of BC. These findings and information will initiate the change in perceptions of the Asian American community at BC, open up opportunities for further research, advocacy, and even inspiration for Asian American communities outside of the context of BC.

METHODS

For our research, a survey was distributed to and completed by 236 BC students, both those on campus and those abroad during the Fall 2015 semester, almost all of whom identified as Asian or Asian American, or had one parent of Asian descent. Of the participant pool, 36% identified as Chinese, 32% as Korean, 5% as Taiwanese, 5% as Indian/South Asian, 4% as Filipino, and 9% were of mixed ethnic descent. 56.9% were from the Morrisey School of Arts and Sciences, 24.6% from the Carroll School of Management, 10.6% from the Connell School of Nursing, and the remaining 7.7% studied in the Lynch School of Education. Aside from basic demographic questions such as race and graduation year, the survey contained a diverse array of questions to help us collect as much data as possible, including multiple choice, free response, and Likert scale. The questions were intended to gather information on three topics: 1) Perception of the Asian community; 2) In-



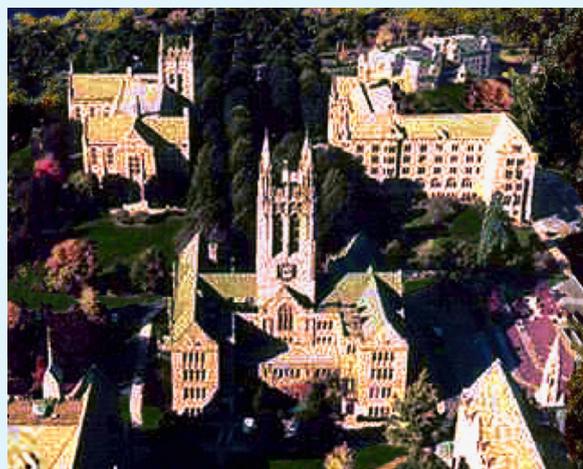
ASIAN COLLEGE STUDENTS RELAXING ON CAMPUS
(COURTESY OF WIKIMEDIA COMMONS)

volvement on campus; 3) Perception of “Asian” identity. Also, several non-Asian students filled out the survey. Their responses were noted, as they could provide useful opinions; however, they were not included in the overall analysis of the survey.

The survey was split into two portions: identity and community. The identity section mainly consisted of involvement in high school and college activities for freshmen, sophomores, juniors, and seniors, respectively. They were also asked questions on how strongly they identified with their ethnicity, using a Likert scale. The question, “If you were on the phone with someone you never met, how would you describe yourself in one sentence?” has answers coded into 8 different categories: physical, personality traits, characteristic values, activities, interests, labels/roles, cultural/ethnic, and miscellaneous. The last of the 8 was coded as a 0. The second part consisted of varying questions and statements about beliefs regarding the Asian Bubble and perceptions of the community, which were also all measured by a Likert scale. A question on the perception of the Asian American community was also asked. The survey questioned respondents: “In your own words, how do you define the Asian Bubble?” If a response had a negative perception, it was coded as -1, if neutral or mixed, it was coded as 0, if it had a positive perception, it was coded as 1.

Moreover, depending on whether the participants indicated whether they were freshmen or not, a separate Freshman Survey, slightly different from the Sophomore-Senior survey, was provided. Freshmen may have a different perspective on the campus community, and their experiences or lack thereof can prevent them from providing reliable answers to some of the questions tailored for the upperclassmen, such as: “How has the Asian community impacted your personal development?” Therefore, they were asked questions about their past involvement in high school, and questions about their perception of the existing Asian community at BC. Questions about identity and beliefs about the Asian Bubble remained the same. Like the previous survey, this survey mainly utilized a Likert scale for a majority of its questions, such as “Do you believe that the Asian Bubble will impact your experience at BC over the course of your four years?” Depending on the question, strength of agreement or negative/positive attitude was measured.

The survey was distributed to the BC community utilizing several mediums. Under the campus club Asian



AN AERIAL VIEW OF BOSTON COLLEGE (COURTESY OF WIKIMEDIA COMMONS)

Caucus, the Asian Caucus Facebook page, e-mail list, and events could be used to continually advertise the survey and the associated raffle prizes to a wider audience. Moreover, the Thea Bowman AHANA Intercultural Center (BAIC) staff assisted with the distribution of the survey. The BAIC staff has access to an e-mail group that includes all the Asian students on campus, and the email that BAIC staff members sent to the group on our behalf directly resulted in many more responses. The last form of advertisement, but by no means the least, was simple word of mouth. The survey was released to the public in late September, and upon closing of the survey on November 15, a comprehensive analysis of the data received was conducted.

RESULTS

In the survey, a section of the questions, for both freshmen and upperclassmen, was measured by a Likert Scale. Depending on the question, the scale measured the degree of agreement or the degree of a positive/negative attitude, shown in Figure 1 and 2. Freshmen were asked different questions in a similar manner as explained above.

The freshman mode ranged between 3 and 4. With a standard deviation of 1.339, the question regarding involvement in the Asian community in high school had the highest standard deviation. There was also a negative correlation of -0.127 between the belief in the existence of the Asian Bubble and integration into the Asian community during

Most of my friends here at BC are of same or similar ethnic descent as me.

1 2 3 4 5

Strongly Disagree Strongly Agree

=

The Asian community here at BC offers me a sense of belonging and comfort.

1 2 3 4 5

Strongly Disagree Strongly Agree

I act differently with Asians than I do with non-Asians.

1 2 3 4 5

Strongly Disagree Strongly Agree

There seems to be a negative perception of the Asian community amongst non-Asian students at Boston College.

1 2 3 4 5

Strongly Disagree Strongly Agree

The Asian community provides me with an environment to be my true self.

1 2 3 4 5

Strongly Disagree Strongly Agree

Overall, how has the Asian community personally impacted you?

1 2 3 4 5

Very Negatively Very Positively

FIGURE 1 SOPHOMORES TO SENIORS WERE ASKED TO RATE THEIR LEVEL OF AGREEMENT ON VARYING STATEMENTS ABOUT THEIR COMMUNITY. A HIGHER NUMBER INDICATED HOW MUCH ONE AGREED AND PERSONALLY IDENTIFIED WITH A CERTAIN BELIEF OR STEREOTYPE ABOUT THE ASIAN COMMUNITY. THE LAST QUESTION FOCUSED ON UNDERSTANDING THE INFLUENCE THE COMMUNITY HAS HAD ON THEIR PERSONAL DEVELOPMENT THUS FAR. DUE TO THE DIFFERENCES IN QUESTIONS, THE SCALE WAS CHOSEN BASED ON WHAT WAS TRYING TO BE MEASURED.

high school. The correlation between the expected impact of the Asian Bubble on one's experience and expectations of the Asian community had a correlation of 0.247.

For sophomores and seniors, the statement, "Most of my friends here at BC are of same or similar ethnic descent as me," had the largest, standard deviation of 1.355, whereas the question of "Overall, how has the Asian community personally impacted you?" had the lowest standard deviation

of 0.824. This question also had the lowest range of 3, as no one answered 1 for this particular question. The statement, "There seems to be a negative perception of the Asian community amongst the non-Asian students at BC," had a median of 4, while other statements and questions all had a median of 3.

Correlation between the impact of the Asian community on their "BC experience," and the definition of the Asian Bubble was 0.236. When the statistic of the definition of the Asian Bubble is replaced with that of the perception of the Asian Bubble, the correlation rises to .438. The correlation between how much an individual identified with the Asian community at BC and their perception of the Asian Bubble was 0.426.

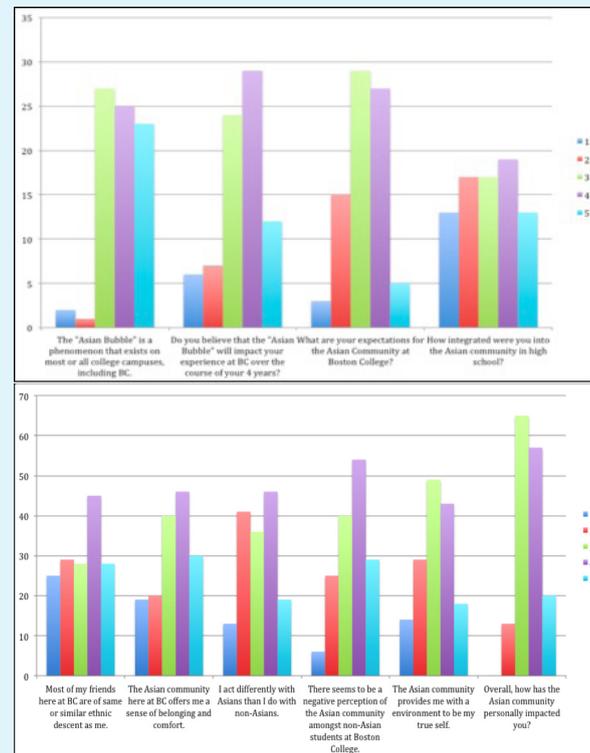


FIGURE 2 DISTRIBUTION OF ANSWERS FOR FRESHMEN (TOP) AND SOPHOMORES AND SENIORS (BOTTOM). ALL OF THE QUESTIONS WERE MEASURED BASED ON WHAT WAS CONSIDERED THE MOST APPROPRIATE MEASURE/SCALE. FOR THE FRESHMEN, THE QUESTION "WHAT ARE YOUR EXPECTATIONS OF THE BOSTON COLLEGE COMMUNITY?" WAS MEASURED ON A LIKERT SCALE OF 'VERY EXCLUSIVE' TO 'VERY INCLUSIVE.'

Between identity and how strongly one identified with his or her Asian heritage, the correlations were -0.106 and 0.100 , for freshmen and sophomores, juniors, and seniors, respectively. It was also shown that freshmen had a greater tendency to give a negative definition for the Asian Bubble, at a mean of -0.244 , compared to their sophomore, junior, and senior counterparts, at -0.188 .

DISCUSSION

Based on the results, three important findings about the intersection of identity and community were identified.

First of all, our research showed that the Asian American community is not as exclusive as the perception of the Asian Bubble would suggest. Freshmen entering BC showed much variation in past involvement in the Asian community, and sophomores, juniors, and seniors indicated that many have friends of different ethnic descent, with the largest variation. For involvement, freshmen were shown to be more involved in service, athletics, and academics during high school. As for sophomores, juniors and seniors, the top three involvements were cultural, service, and academics, which were all close in number. Unlike what was predicted, identity and ethnic heritage were shown to have a very low correlation. Individuals were more likely to identify themselves with personal traits than anything else, regardless of their graduation year. It disproves the idea that Asian Americans exclusively involve themselves with those who are ethnically similar to them. Out-group differences and visible characteristics are therefore more likely to be emphasized and shared. Although individually, participants were more likely to use personal characteristics, their general view of the Asian Bubble was still negative.

One statistic that was particularly interesting was how many students agreed that there was a negative perception of the Asian community at BC. It had the highest mean of 3.48 and mode of 4 , in comparison to other statements and questions. Within the group, beliefs and characteristics are more determined by expectations of the greater community rather than individual contributions. Expectations, even in larger society, play a huge role in determining the ways that individuals think, both about the community and about themselves. This may also contribute to the exclusivity that is perceived. These negative perceptions may discourage individuals from interacting with those outside of their community.

Curiously, there was not a strong correlation between several categories hypothesized to show a strong significance. For example, the correlation between an individual's perception of the Asian Bubble and how much an individual identifies with the Asian community was 0.426 , which was lower than expected going into the initial analysis of the dataset. This surprisingly weak relationship also continues into the analysis of correlation between other factors such as the impact of the Asian community on one's "BC experience" and one's definition of the Asian Bubble. Initially, it was expected that if one believed the Asian community impacted their "BC experience" in a positive manner, they would also have a more positive definition of the Asian Bubble. However, that correlation only came out to be 0.236 . A possible cause for this is that there are students who filled out the survey and indicated a positive perception of the Asian Bubble, are not actively involved in the community, thus lowering the correlations. If true, then it could show that the negative perceptions of the Asian community are not as pronounced as many within the community believe.

Lastly, an interesting difference between the freshman perception and the upperclassman perception of the Asian community was noticed. When analyzing the results of the question "In your own words, how do you define the Asian Bubble?" it was notable that the freshmen had a more negative perception than the upperclassmen. Using the perception code of negative: -1 , neutral: 0 , and positive: 1 , freshmen had an average perception of -0.244 , while the upperclassmen had an average of -0.188 . This may be due to one of two reasons: 1) Groupthink affects upperclassmen who are a part of the Asian community to respond



ASIAN STUDENTS IN CLASS (SOURCE: PUBLICDOMAINPICTURES)

“The hope is to foster a community of people who support the growth and development of each individual, while also igniting the flame for Asian American advocacy.”

positively, or 2) Directly experiencing the Asian community contradicts the negative perceptions surrounding the community, leading upperclassmen to have more positive perceptions.

These results can all be linked to the concept of Asian American Identity. The Asian community as a whole is an agglomeration of unique individuals that are all seeking to find a sense of identity and belonging on campus. In coming to BC, Asian Americans will likely feel naturally marginalized, given the lack of diversity present in many areas of the school. Moreover, the presence of a tightly knit Asian community offers a familiarity that is key for a student’s sense of belonging and ultimate sense of identity as individuals. Thus, despite most of the information and findings relating to the Asian community as a whole, it is still pertinent for our main concern of the Asian American student on an individual level. The hope is to foster a community of people who support the growth and development of each individual while also igniting the flame for Asian American advocacy. In attempting to study the community through an objective lens, we desire to integrate academic credibility into conversations about the Asian community, the various perceptions and connotations of the Asian Bubble, and the idea of Asian American identity within the context of BC.

LIMITATIONS

There were many limitations in both data collection and data analysis. As the survey was conducted on campus with a limited amount of time, our sample was a self-selected, convenience sample. Although around 25% of the Asian population at BC participated in the study, that quarter may have been representative of only a few specific characteristics of the larger population, therefore cannot be generalized to all Asian BC students. With the collection method that was used, the survey was more likely to reach a certain group of individuals within the greater population. Students more involved in the Thea Bowman AHANA Intercultural Center, more likely to check email, or those who are members of Asian intercultural clubs had

a higher probability of being exposed to the survey at one point during the two months time span.

As with most surveys, there are also threats of self-report and response bias. It is difficult to truly surmise whether the responses received were honest or whether individuals interpreted our questions in different manners. Due to individual differences, answers to certain questions may have been different, leading to a different analysis of our data. Although a disclaimer to the survey was included, in electronic form, people may have been more hesitant about being completely candid with their responses. Also, being an Asian American study, it may have changed answers or elicited varying responses to certain questions. Individuals may have been more inclined to use personal characteristics or other descriptors, rather than ethnic or racial ones in their answers, knowing that all participants were of the same race.

For the freshmen data that was collected, there was also an issue of time. Based on the time at which freshmen completed the survey, answers may have differed. If filled out closer to the end of the two months, freshmen may have been exposed to the Asian community quite a bit by that time, thus altering their perceptions about the community. Providing this survey to incoming freshmen at orientation or when they were accepted to BC would have been a more ideal situation to rid any confounding variables.

Lastly, with the topic chosen and the consequent research done, it is difficult to make concrete conclusions about this topic. More research would need to be done on each specific subtopic in order to get a clearer understanding of the actual results. This survey would need to be repeated longitudinally to see the actual long-term effects of the Asian community on an individual.

FUTURE RESEARCH

It is important for this study to be continued in the future in order to assess the true long-term impact of one’s perception of the community on one’s identity.

Longitudinally, this study would be more valuable in understanding how perceptions and behaviors develop over time. However, within this study, there are many other ideas that can be more deeply analyzed. Being an explorative study, there are also many subtopics that may have not been looked at in detail. The interactions within the community and whether or not they are reflective of what was found within this research could be further explored. Also, conducting the research on other schools' campuses can potentially shed light on how these sub-cultures may differ at universities.

In the future, it is also important to consider both out-group and in-group differences in the research, both of which play key roles in how certain beliefs are developed concerning our own community. This does not only ring true for societal ideas and norms, but also for subtle beliefs amidst the community. By looking at ways in which others perceive other communities, it is also possible to look at how the Asian community is perceived. Especially in a time and age that is changing so rapidly, it is crucial to evaluate how in-group differences are changing. Studying how certain beliefs may affect actual behavior may provide insightful conclusions as well.

Perceptions of others can also largely impact one's beliefs. Understanding how fellow members view not only the community but also those on the outside can provide a new perspective on existing ideas. Although the topics studied mostly pertain to Asian American students, it would also be helpful to assess students of other races. Conducting studies on the sense of identity for other AHANA ethnicities would be especially useful. Not only can such research provide useful insight for students of other races, but it may also identify where common struggles exist for all AHANA students, thus providing a stronger foundation for social unity and advocacy efforts on campus. Furthermore, it would help recognize and differentiate various ethnicities and the issues they are facing. This will prevent the oversimplification of all AHANA issues as one single question.

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THE PSYCHOLOGICAL PUZZLE

Contributing Factors to the Top-Down Politicization of Intelligence

REBECCA MORETTI

POLICY AND INTELLIGENCE ARE INTIMATELY INTERTWINED. POLICYMAKERS NEED INTELLIGENCE TO MAKE DECISIONS, WHILE THE INTELLIGENCE COMMUNITY DERIVES SIGNIFICANCE FROM ITS ABILITY TO PROVIDE POLICY MAKERS WITH RELIABLE INFORMATION. IN THIS SYMBIOTIC RELATIONSHIP, IT IS HEALTHY FOR INTELLIGENCE CONSUMERS TO AT TIMES CHECK AND DIRECT THE WORK OF INTELLIGENCE PRODUCERS. HOWEVER, IF UNDERTAKEN MALICIOUSLY, THIS CHECKING MECHANISM MANIFESTS AS TOP-DOWN POLITICIZATION. HERE, LEADERS USE INTELLIGENCE POST FACTO TO LEGITIMIZE THEIR POLICIES INSTEAD OF USING IT TO GUIDE THEM, REVERSING THE RATIONAL DECISION-MAKING PROCESS. CERTAIN FACTORS MAY COMPEL LEADERS TO MANIPULATE INTELLIGENCE TO REFLECT THEIR POLICY PREFERENCES. THIS ESSAY DEMONSTRATES HOW THREE DISTINCT PROCESSES OF TOP-DOWN POLITICIZATION CAN ARISE FROM AMBIGUOUS EVIDENCE, THE PSYCHOLOGY OF INTELLIGENCE CONSUMERS, AND THE NATURE OF THE LEADERS' POLITICAL POSITIONS AND RESPONSIBILITIES. IT THEN PROCEEDS TO ARGUE THAT POLITICAL LEADERS' PSYCHOLOGY IS THE MOST POTENT SOURCE OF TOP-DOWN POLITICIZATION.

AMBIGUOUS EVIDENCE AND INDIRECT MANIPULATION OF INTELLIGENCE

Ambiguous evidence can subtly shape and manipulate intelligence. Policymakers can exert this form of top-down politicization either consciously or unconsciously. For example, when ambiguous evidence is a factor, intelligence consumers may pose repeated questions to producers or request more specific information. If the policymaker truly does not understand the intelligence or wants the analyst to produce more relevant information, this process remains relatively benign. However, policymakers will often use this tactic as a subtle form of pressure, designed to direct analysts—who sometimes comply out of self-interest or resignation—to produce policy-friendly intelligence. Policymakers often prefer a snappy and decisive analysis over a careful and complex one, since they are under time constraints that incline them to act quickly and confidently, while analysts are more concerned with depth and accuracy.¹ Uncertainties and ambiguities—characteristics inherent to intelligence—are discomfoting to policymakers, who try to refine intelligence to make it support their policies or otherwise exploit ambiguity by manipulating intelligence to their liking.² When intelligence is vague, choices regarding critical decisions are likely to be political. The tendency of intelligence officers to qualify their intelligence and render it more ambiguous leads policymakers to reward and encourage those who produce more concise—and often more hasty—intelligence products.³



A POLITICAL CARTOON FROM *HARPER'S WEEKLY* DEPICTING AN EXCHANGE BETWEEN CARL SCHURZ AND UNCLE SAM (COURTESY OF WIKIMEDIA COMMONS)

“Analysts who simplify and advocate get more attention from time-pressed policymakers than analysts who complicate or equivocate,” writes Richard Betts.⁴ Policymakers may ignore ambiguous evidence or force analysts to continually re-evaluate and re-focus their analyses. When intelligence is too ambiguous, policymakers may also try to bypass analysts by examining the raw data themselves, which invariably leads to an imposition of their own biases. Ambiguous evidence makes it hard to create the consensus of support policymakers need to justify their decisions, and increases the likelihood that leaders will prod the intelligence community to produce more decisive analyses. Mark Lowenthal explains, “The policy maker wants to be able to show that a policy or decision is correct or well handled and wants intelligence that is supportive or that does not call into question the policy or decision.”⁵ Thus, ambiguous evidence is at times shunned by policymakers, who will search for a more suitable analysis or indirectly manipulate intelligence to their benefit.

LEADERS’ PSYCHOLOGY AND SELECTIVE PROCESSING OF INTELLIGENCE

From leaders’ psychology can emerge the process of “cherry-picking” congenial intelligence, ignoring and disregarding information that refutes certain policies. Due to cognitive biases, policymakers are likely to focus on information that supports their opinions while ignoring opposing information, discouraging analysts from revealing contradictory evidence.⁶ According to Richard Betts, “What [political zealots] seek from intelligence is ammunition, not truth.”⁷ Leaders are accustomed to risk, and experience has taught them to be confident in their judgments, which is why it is psychologically feasible for them to ignore contrary evidence and seek ammunition to confirm their biases. “The psychology of decision-making also explains why leaders ignore intelligence,” writes Joshua Rovner. “Individuals’ expectations have a powerful effect on their ability to accurately perceive information,” writes Rovner.⁸ For this reason, policymakers have a hard time absorbing data that is inconsistent with their preconceptions. Rather than seeking out intelligence to shape policy, they seek intelligence to support their preformed political and ideological notions.⁹ Because bottom-up politicization exists simultaneous to “cherry-picking,” policymakers inherently fear subversion by intelligence producers and focus on analyses that fall in line with their own policies. Not only do they disregard unpleasant information, but they may also scorn the analyst or organization that provided it.¹⁰ Furthermore, this selectivity of information can advertent-

“The psychological pain of confronting failure is intense in any situation, but is especially magnified on the global stage in the policymakers’ world.”

ly or inadvertently apply pressure on analysts, who may tailor their reports to the policymakers’ preference. There are heavy psychological costs to be incurred with the realization that a chosen and long-propounded policy is failing and must be reversed; therefore, policymakers “cherry-pick” not only to publicly support their policies, but also to privately soothe their psychological qualms about their own decisions. In dealing with the war in Iraq, former President George W. Bush “was aware that a degree of self-manipulation if not self-deception was involved.”¹¹ Bush focused on intelligence that supported his policy in Iraq because he knew that if his resolve weakened, his whole team’s confidence in its abilities would weaken as well. The psychological pain of confronting failure is intense in any situation, but is especially magnified on the global stage in the policymakers’ world. Policies are difficult to reverse once they have gained momentum, so even if related information surfaces against the policy it will likely be ignored.¹² Additionally, once people have invested a lot of time and effort into something, the psychological costs of starting from scratch are too painful to bear. As a result, officials will ignore unwelcome news and fixate on information that is supportive of their endeavors.

LEADERS’ POLITICAL POSITION AND DIRECT MANIPULATION OF INTELLIGENCE

Sometimes even direct manipulation of intelligence may arise from officials’ political positions and policy concerns. Direct manipulation is risky since it is the most blatant kind of politicization and is therefore used in only dire situations when a leader’s political position or an important policy is at stake. Although examples of this arm-twisting are rare, it appears to be an effective solution when a leader’s reputation is in danger.¹³ “Politicization is more likely when policymakers have committed themselves to highly controversial issues,” writes Rovner. “Public commitments make policymakers vulnerable to political costs if their plans appear misguided or doomed to fail, giving them strong incentives to pressure intelligence to deliver supporting estimates.”¹⁴ Direct politicization occurs when policymakers pressure intelligence agencies to deliver

products that support their policies and, more subtly, appoint analysts who are likely to produce the preferred outcome, resulting in manipulation by appointment. Direct manipulation can emerge out of leaders’ genuine belief that their policy is the best long-term solution for their constituents, regardless of contrary intelligence. Furthermore, since renegeing a political position or admitting failure can have severe political consequences, leaders are likely to do everything in their power to defend their actions. They know that criticism of their policies will be very costly, so they try to create an image of consensus and legitimacy by pressuring intelligence—which tends to be seen as politically unbiased—to support their decisions.¹⁵ “To change their basic objectives will be to incur very high costs, including, in some cases, losing their offices if not their lives,” writes Robert Jervis.¹⁶ Policymakers seek reelection, career advancement, and other benefits from the policies they pursue, giving them a strong personal incentive to gain approval for their initiatives.¹⁷ Since the stakes are high in such cases, leaders in these situations are more likely to employ direct manipulation. If desperate, policy-



A POLITICAL CARTOON FROM *THE WORLD* DEPICTING NATIONALIST SYMBOLS OF GREAT BRITAIN UPSET OVER AMERICAN NEUTRALITY DURING EARLY WORLD WAR I (COURTESY OF WIKIMEDIA COMMONS)

makers may even resort to the willful distortion of analysis. Usually this occurs when policymakers genuinely believe their policy will eventually be beneficial, and are willing to manipulate the truth to get it to succeed.

LEADERS' PSYCHOLOGY AS THE MOST POTENT SOURCE OF POLITICIZATION

At first glance, leaders' political position appears to be the most potent source of politicization. However, although this is a powerful source, it is neither the most prevalent nor the most corrupting. While the nature of leaders' political positions and responsibilities is subject to change, their cognitive behaviors remain the same, which is why leaders' psychology is actually the most potent and widespread source of politicization. If officials were unfettered by their psychological influences, they would realize that it is more rational and beneficial to adapt policy to intelligence whenever possible. In practice, by accepting important evidence—even if it contradicts policy—leaders could ameliorate their political positions and better fulfill their responsibilities to the public in the long run. Although they may suffer short-term consequences for modifying their policies, leaders could validate these shifts with relevant intelligence. In reality, however, the leader will often choose to continue the policy even when it is unpopular. This phenomenon can only be explained by the policy maker's psychology, since rational consideration would favor more flexible decision-making. As Betts says, the main challenge to high-level operators is "recognizing when a proper understanding of reality confirms the feasibility of their aims, or compels them to change course."¹⁹ What compels leaders to politicize intelligence is not their current political positions, but rather the psychological tendencies that prevent them from constructively accepting opposition. Leaders' psychology and their political position are intrinsically tied. The leaders' psychological attachment to predispositions and first-choice policies is what prevents them from looking at their policies and responsibilities objectively. Even if leaders receive intelligence that their policy is failing, they will fixate on supporting evidence and continue their policy out of a psychological aversion to backing out of large commitments. For this reason, it is difficult for leaders to see when their policies are inadequate and to use intelligence in an unbiased way that could help improve policy. What allows policymakers to exploit ambiguous intelligence is not primarily the intelligence itself, regardless of its ambiguity, but rather the psychological predilections that prevent them from accurately appraising the information.

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TWO SEPARATE PERSONS

Ethnicity and Identity in Trollope's Phineas Finn

JENNIFER HEINE

THIS ESSAY EXPLORES ANTHONY TROLLOPE'S DECISION TO IDENTIFY PHINEAS FINN, OF HIS VARIOUS "PALLISER NOVELS," AS IRISH. MANY VICTORIAN READERS QUESTIONED PHINEAS'S ETHNICITY AND LACK OF STEREOTYPICALLY IRISH CHARACTERISTICS, AND TROLLOPE HIMSELF RENOUNCED THIS DECISION IN HIS AUTOBIOGRAPHY. THE CHARACTER'S IRISHNESS, HOWEVER, SEEMS TO BE MORE THAN A GIMMICK TO DIFFERENTIATE THE NOVEL FROM SIMILAR TALES OF ASPIRING MEMBERS OF PARLIAMENT; IN PHINEAS FINN, THE AUTHOR USES ETHNICITY TO INVERT THE NATIONAL MARRIAGE TROPE. TROLLOPE EMPLOYS GENDERED ETHNIC STEREOTYPES, CASTING HIS TITLE CHARACTER AS FEMININE IN HIS ROMANTIC ENTANGLEMENTS AND EVEN HIS POLITICAL BEHAVIOR, WHILE THE ENGLISH LADIES HE MEETS ARE DESCRIBED AS MASCULINE. BUT THE CHARACTER OF PHINEAS EMERGES AS MORE COMPLICATED THAN A FEMININE OR EMASCULATED ONE; IN HIS TENUOUS LOYALTY TO HIS DOCILE IRISH SWEETHEART, PHINEAS BECOMES A CONVENTIONAL MALE LEAD. HIS IRISHNESS, THEN, LENDS A DUALITY TO HIS CHARACTER THAT ENCOMPASSES MORE THAN MERELY TWO NATIONAL IDENTITIES; IT EMBODIES TWO ENTIRELY DIFFERENT KINDS OF MEN: ONE MASCULINE AND THE OTHER FEMININE, ONE A PHILANDERER AND THE OTHER LOYAL, ONE ENGLISH AND THE OTHER IRISH.

Phineas Finn is widely regarded as one of Anthony Trollope's most popular works. Published serially in *St Paul's Magazine* between 1867 and 1868, the novel satirizes the British parliamentary system through the adventures of its title character, an Irish picaresque, who experiences a number of ups and downs over the course of a tumultuous political career. While the novel, unlike several of Trollope's others, takes place in England, it is frequently remembered as one of his Irish novels, given the ethnicity of the protagonist. However, the nature of that ethnicity, particularly what Trollope intended to accomplish by writing his hero as Irish, remains controversial; while some regard Phineas's Irishness as inherent to his character and to the plot of the novel, others consider it secondary, even accidental. In order to analyze the significance of Phineas Finn's ethnicity, one must consider what aspects of Irish culture the character embodies, as well as what he might symbolize in the context of Trollope's work.

According to Trollope's autobiography, Phineas Finn ought not to have been written this way at all. As he explains:

It was certainly a blunder to take him from Ireland – into which I was led by the circumstance that I created the scheme of the book during a visit to Ireland. There was nothing to be gained by the peculiarity, and there was an added difficulty in obtaining sympathy and affection for a politician belonging to a nationality whose politics are not respected in England. But in spite of this, Phineas succeeded.¹



A SKETCH OF LONDON AS THE CITY WOULD APPEAR IN *PHINEAS FINN* IN THE 1860S (COURTESY OF WIKIMEDIA COMMONS)

Whether Trollope intended to suggest that the entire novel ought to have been set in Ireland, or that his aspiring member of Parliament ought to have been English, remains unclear. It is also possible that he mentions this opinion to spark interest in an earlier novel towards the end of his career.

This acknowledgement has led Phineas's nation of origin to be hotly contested among readers and critics. For some, Trollope's comment has enabled them to largely ignore Phineas's Irish identity and instead focus on other aspects of his character. According to Patrick Lonergan's "The Representation Of Phineas Finn: Anthony Trollope's Palliser Series And Victorian Ireland," "Phineas's nationality has been ignored because of Trollope's statement that he believed it was a 'blunder' to make his hero an Irishman... it is disappointing that Phineas's nationality has been ignored or dismissed by literary critics."² Jane Elizabeth Dougherty contrasts this in "An Angel In The House: The Act Of Union And Anthony Trollope's Irish Hero," claiming that the opposite effect can be discerned:

Because Trollope himself called attention to the "blunder"... many of these critics have examined the importance of Phineas's ethnicity to the story... Clearly, critics have not yet reached a consensus on the tricky subject of the ethnicity of Phineas Finn, and its effects on the characterizations, composition, trajectory, and reception of Trollope's... novel.³

One can conclude, though, that Phineas's Irish heritage was originally intended to improve upon the novel's hero. According to Trollope's *An Autobiography*,

In writing *Phineas Finn*... I was conscious that I could not make a tale pleasing chiefly, or perhaps in any part, by politics. If I write politics for my own sake, I must put in love and intrigue, social incidents, with perhaps a dash of sport, for the benefit of me readers. In this way I think I make my political hero interesting.⁴

That is to say, the author felt that he could not write a wholly political novel for fear of alienating his readers, who chiefly sought amusement from his works. Rather, the *Phineas Finn* that emerged is more of a satire of political novels than a standard political novel. Writing the title character as an Irishman helps to set it apart from similar tales of ambitious men with Parliamentary aspirations.

“...he can be read, not as a representative of his culture, but rather as an individualistic, particular representation of an Irish person.”

The problem with Phineas’s Irishness, to many readers, is that it does not seem particularly Irish. Unlike many other stereotypical Irish characters of the time, “he is neither lazy, nor improvident, nor dishonest, nor a drunkard, nor anything more than a nominal Roman Catholic, nor, in particular, violent. He doesn’t even have a brogue”.⁵ Thus, it would be possible for English readers to consider him Irish in name only, without any of the difficulties that typically accompany an Irish character.

Critics, however, have called attention to the character’s resemblance to a number of historical Irish politicians of the time. As Lonergan argues,

Phineas closely resembles at least six real Irish politicians, and is comparable to numerous others. This proves one thing conclusively: Phineas is similar to a large number of Irish people who actually existed during Trollope’s time. It is therefore obviously incorrect to describe him as insufficiently “Hibernian.”⁶

In his “‘Two Nations on One Soil’: Land, Fenians, and Politics in Fiction,” James Murphy adds, “Several individuals have been proffered as candidates for the real-life Phineas. The most likely seems to be Sir John Pope Hennessy (1834–1891), a Catholic who sat as a Conservative member of parliament.”⁷ Regardless of who served as the model for Trollope’s character, one must conclude that, given critical speculation of Phineas’s similarity to various historical Irishmen, his portrayal is somewhat realistic. One could conclude that readers and critics who call Phineas insufficiently Irish have failed to distinguish between the stereotype of an Irish character and the reality of one.

Dougherty expresses this conflict well when she explains:

There is little about Phineas that is obviously Irish, and yet it does favor him, at least in Phineas Finn. Phineas is a successful and sympathetic character... Phineas’s Irishness is and is not evident in the text, it is both crucial and incidental to Phineas’s characterization; the narrative trajectory of the Phineas novels is at once enabled and disabled by the ethnicity of their eponymous hero.⁸

Because Phineas represents a unique Irishman, one who supports the union between Ireland and Great Britain and feels welcome in English society, he can be read, not as a representative of his culture, but rather as an individualistic, particular representation of an Irish person.

In fact, the Liberal Party seems to seek exactly that individuality in their recruitment of Phineas Finn:

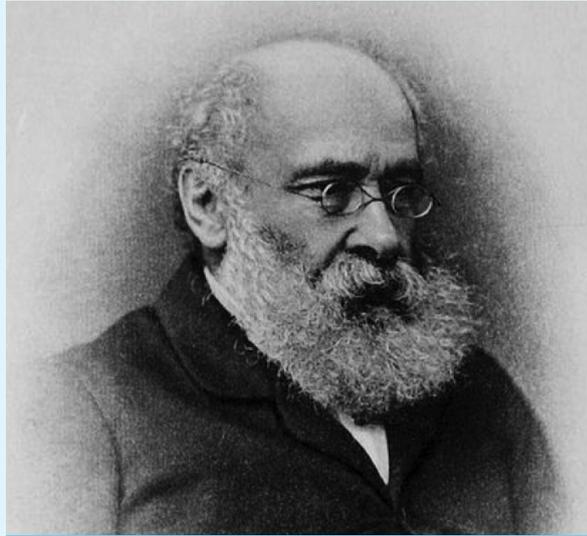
Then ‘the party,’ – by which Barrington Erle probably meant the great man in whose service he himself had become a politician, – required that the candidate should be a safe man, one who would support ‘the party,’ – not a cankerous, red-hot, semi-Fenian, running about to meetings at the Rotunda, and such-like, with views of his own about tenant-right and the Irish Church. ‘But I have views of my own,’ said Phineas, blushing again. ‘Of course you have, my dear boy,’ said Barrington, clapping him on the back. ‘I shouldn’t come to you unless you had views. But your views and ours are the same, and you’re just the lad for Galway.’⁹

Though Barrington’s requirements come across as incredibly specific, they reflect a particular kind of representation of Irishness by Trollope: one that acknowledges a diversity of Irish individuals. Though the stereotypical Irishman is described here in a potentially offensive manner, both Barrington and the author recognize that not all Irish people can be categorized that way. Rather, the Irish populace may have “views of [their] own,” whether in support of or against the Act of Union.

Murphy expresses a similar sentiment:

Though [Phineas is] an Irish Catholic he is not a formal nationalist per se and is a participant in the internal machinations of the British political party system. This reflects the politics of the 1850s and 1860s before the rise of the new Irish parliamentary party in the 1870s.¹⁰

Given the political upheaval of the era, following the Act of Union, which bound Ireland to the United Kingdom after a spate of rebellious activities in the late eighteenth



A PHOTOGRAPH OF THE AUTHOR, ANTHONY TROLLOPE, IN THE 1870s, (COURTESY OF WIKIMEDIA COMMONS)

century, the character's loyalty is particularly notable. An outsider himself, Phineas nonetheless expresses great respect for his new position and in particular for the government he serves: "Phineas had many serious, almost solemn thoughts on his journey towards London... he was minded to be very earnest. He would go to his work honestly and conscientiously, determined to do his duty as best he might."¹¹

Like the author, then, the protagonist partakes in no rebellious actions throughout *Phineas Finn*, and even supports British rule, unlike many of his historical counterparts. According to Dougherty, "the text takes pains to absolve Phineas of any Fenian tendencies, and unlike the Fenians, Phineas has no interest in dismantling the union; instead he hopes to make the Union work for him, as it did for his creator Trollope."¹² This individualism helped the text "succeed," as Trollope noted in his aforementioned autobiography, despite his heritage.¹³

Alternately, many critics have come to interpret Phineas as a symbolic character, one who represents a version of the national marriage trope in the context of the Act of Union.

The Act of Union legally assimilated Ireland into the United Kingdom. From the moment it was proposed – as a means of subduing Ireland, which had in 1798 exploded into violent rebellion – it was seen in the popular imagination as a marriage

between Great Britain and Ireland, with Britain as the groom and Ireland as the bride.¹⁴

This trope, commonly known as the national marriage, had already been well-established by the time Trollope adopted it. According to "Love's Labour's Lost: Romantic Allegory in Trollope's "Castle Richmond" by Bridget Matthews-Kane,

The popularity of other allegorical romances such as Lady Morgan's *The Wild Irish Girl* (1806), Charles Maturin's *The Milesian Chief* (1812), and the Banim Brothers' *The Boyne Water* (1826) does make it likely that Trollope read them and was familiar with the conventions of the form."¹⁵

In most of these novels, a female personification of Ireland and a male personification of Great Britain are cast in a romance that leads ultimately to a happy marriage: one that is meant to represent the union of the two nations.

Most of the novel seems to make reference to that pattern, even as it perverts it. As Matthews-Kane continues,

One of the three main hallmarks of the national tale is a relationship between a British traveler and a Celtic guide that leads to a marriage symbolically uniting the two cultures. Trollope, who was well read in Irish literature, modifies this common plot device to make his own argument about the political situation in Ireland.¹⁶

Here, it is not the traveller who represents Great Britain, but the native London ladies, including Lady Laura Standish, Violet Effingham, and Madame Max Goesler, while Ireland, usually personified by a woman, is instead represented by Phineas himself.

This gender reversal leads to some fascinating characterizations in *Phineas Finn*, including the duality of its protagonist. Despite Phineas's seemingly Don Juan-esque tendencies, juggling the affections of four different women over the course of the story, he nevertheless seems emasculated by his national characterization. Far from a playboy, Murphy argues that Trollope presents Phineas as particularly feminine, in the way that Will Ladislaw of *Middlemarch* is feminized through his relationships with women: "Ironically, though, this results in the feminization of his own position... Phineas... is in some ways reduced to being a passive object of women's admiration."¹⁷ This emasculation is underlined by Phineas's being the

recipient of two different marriage proposals; he is thereby cast as the female role in his relationships with women.

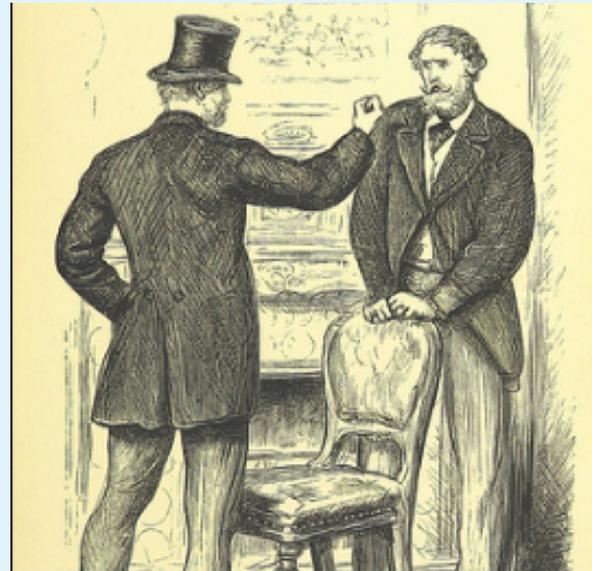
Trollope's descriptions of these characters further supports this unusual gendering. When Lady Laura Standish is introduced, for instance, the narrator utilized vocabulary conventionally used to describe men:

Lady Laura was six feet high... her figure was straggling, and... her hands and feet were quite large... There was something of nobility in her gait, and she seemed thus to be taller... Her hair was in truth red, – a deep thorough redness. Her brother's hair was the same; and so had been that of her father, before it had become sandy with age. Her sister's had been of a soft auburn hue, and hers had been said to be the prettiest head of hair in Europe at the time of her marriage... Her face was very fair, though it lacked that softness which we all love in women.¹⁸

Beyond the use of traditionally masculine terms, Trollope explicitly compares Lady Laura Standish to men, rather than to women. Thus, one can conclude that Lady Laura is meant to be read as a personification of Great Britain, in the same way that the *Wild Irish Girl* is intended to represent Ireland.

Similarly, Phineas's eventual wife, Mary Flood Jones, comes across as excessively feminine. She remains docile and does not question Phineas throughout the novel, though he strongly considers breaking off their engagement and residing in London. According to the text, Mary is "one of those girls, so common in Ireland, whom men, with tastes, that way given, feel inclined to take up and devour on spur the moment; and when she liked her lion, she had a look about her which seemed to ask to be devoured."¹⁹ Thus, not only is Mary depicted as a stereotypically feminine character, but the narrator suggests that her character is a common one in Ireland, even that the stereotypical Irish girl is as lamb-like as Mary.

It follows, then, that Phineas Finn is feminized by his association with his home country. If the author wrote him as the representative Irish character and the women he meets as representative English characters, then Phineas necessarily plays the more feminine role. Indeed, many of the stereotypically Irish traits he displays, such as passion and emotionality, are also conventionally feminine, while Lady Laura's interest in politics can be read as more masculine.



A SCENE FROM THE ORIGINAL MANUSCRIPT OF *PHINEAS FINN* (SOURCE: FLICKR)

Nonetheless, Phineas clearly identifies as a man and in various scenes he demonstrates a conventional kind of masculinity, as when he duels Chiltern for the opportunity to court Violet Effingham or when he rescues Robert Kennedy from thieves. As a result, his characterization becomes more complicated than mere emasculation: Phineas's Irishness lends a duality to his person. Patrick Fessenbecker explores this concept at length in his essay "Anthony Trollope on Akrasia, self-deception, and ethical confusion," which argues that several of Trollope's characters have undergone this experience of developing a double self.

In the case of *Phineas Finn*, Fessenbecker contends, this duality can account for the protagonist's seemingly illogical movement between women. He writes,

Anthony Trollope tended to reuse a particular version of the marriage plot... a version of the romantic triangle in which protagonists, usually male, commit to marrying one character but then find themselves drawn to a second... This... leads to a recurring consideration of a particular issue in philosophical psychology: moral philosophers have long been interested in situations where moral agents know what they ought to do, but do not do it.²⁰

“Not only do Ireland and Great Britain represent different genders, but also different kinds of relationships available to Phineas.”

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Throughout the novel, Phineas cannot seem to choose between the variety of women who have demonstrated their affection for him, despite such obstacles as Lady Laura's marriage and Phineas's promise to return to Mary.

His response, then, is to mentally split himself into more than one entity. Just as Phineas can be read as both masculine and feminine, he can also be read as faithful to two different sets of women, living in two different places. Trollope's novel supports this reading in several places, as when Phineas muses:

He felt that he had two identities, – that he was, as it were, two separate persons, – and that he could, without any real faithlessness, be very much in love with Violet Effingham in his position of man of fashion and member of Parliament in England, and also warmly attached to dear little Mary Flood Jones as an Irishman of Killaloe. He was aware, however, that there was a prejudice against such fullness of heart, and, therefore, resolved sternly that it was his duty to be constant to Miss Effingham.²¹

This sense of dual identity, then, permits him to carry on dalliances with multiple women. Not only do Ireland and Great Britain represent different genders, but also different kinds of relationships available to Phineas. One must note that his love for two different women does not just mean that Phineas Finn is attracted to both Violet and Mary. Instead, he exhibits two entirely distinct, fully realized personas, one Irish and one English, that lead two very different lives and are attracted to very different women.

Fessenbecker attributes the development of this double self to Phineas's sexual drive, declaring that “the primary cause of Phineas's self-deception is his desire: he convinces himself of the possibility of a dual life because this allows him to achieve the multiple sexual relationships for which he yearns.”²² However, one can also explain his behavior in terms of *Akrasia*, meaning that he is able to distinguish between right and wrong but cannot act on it. Trollope's speaker shifts the blame away from his protagonist and onto fate or circumstance when he comments that “Phineas was a traitor, of course, but he was almost forced

to be a traitor, by the simple fact that Lady Laura Standish was in London, and Mary Flood Jones in Killaloe.”²³ His Irishness, then, is interpreted as a weakness here, that draws him back to Mary when he yearns for a union with Lady Laura or Violet. Simply by travelling to London, he has put himself in moral danger, as he cannot control his romantic or sexual urges.

While Fessenbecker and others insist that Phineas is not an inherently bad person, but rather one affected by his surroundings – “he is not consciously duplicitous; the text makes it clear he does not intend to hurt Mary. But he does in fact behave badly toward her, and does so by convincing himself it is possible for part of him to act without all of him acting” – Phineas's behavior suggests otherwise.²⁴ That he thinks of Mary with great frequency over the course of the text demonstrates that he does remember her, and does acknowledge his feelings for and promises to her. Yet, he cannot bring himself to abandon his English admirers, and indeed seems devastated when they do not want to marry him. For instance, although he fears “despair and utter banishment” upon Lady Laura's rejection,²⁵ he nevertheless assures Mary of his loyalty just pages later with, “If you knew, Mary, how often I think about you.”²⁶

In short, Phineas Finn seems too complicated a character to be defined by ethnic background alone. However, this controversial background does help describe his duality of character: both masculine and feminine, both philanderer and loyal long-distance lover, both English and Irish. That Trollope would continue to develop the character in a sequel speaks to the fascination inherent in Phineas, and suggests that, despite the author's later claims to the contrary, his Irishness plays a vital and intriguing part in how he is characterized. As merely an English member of Parliament, this protagonist would become much easier to interpret, and therefore significantly less interesting to read. Thus, far from a stereotype or a rash authorial decision, Phineas's ethnicity seems a calculated decision to better comment on duality of character, the difficulty of making moral decisions, and the relative femininity and masculinity of characters and traits.

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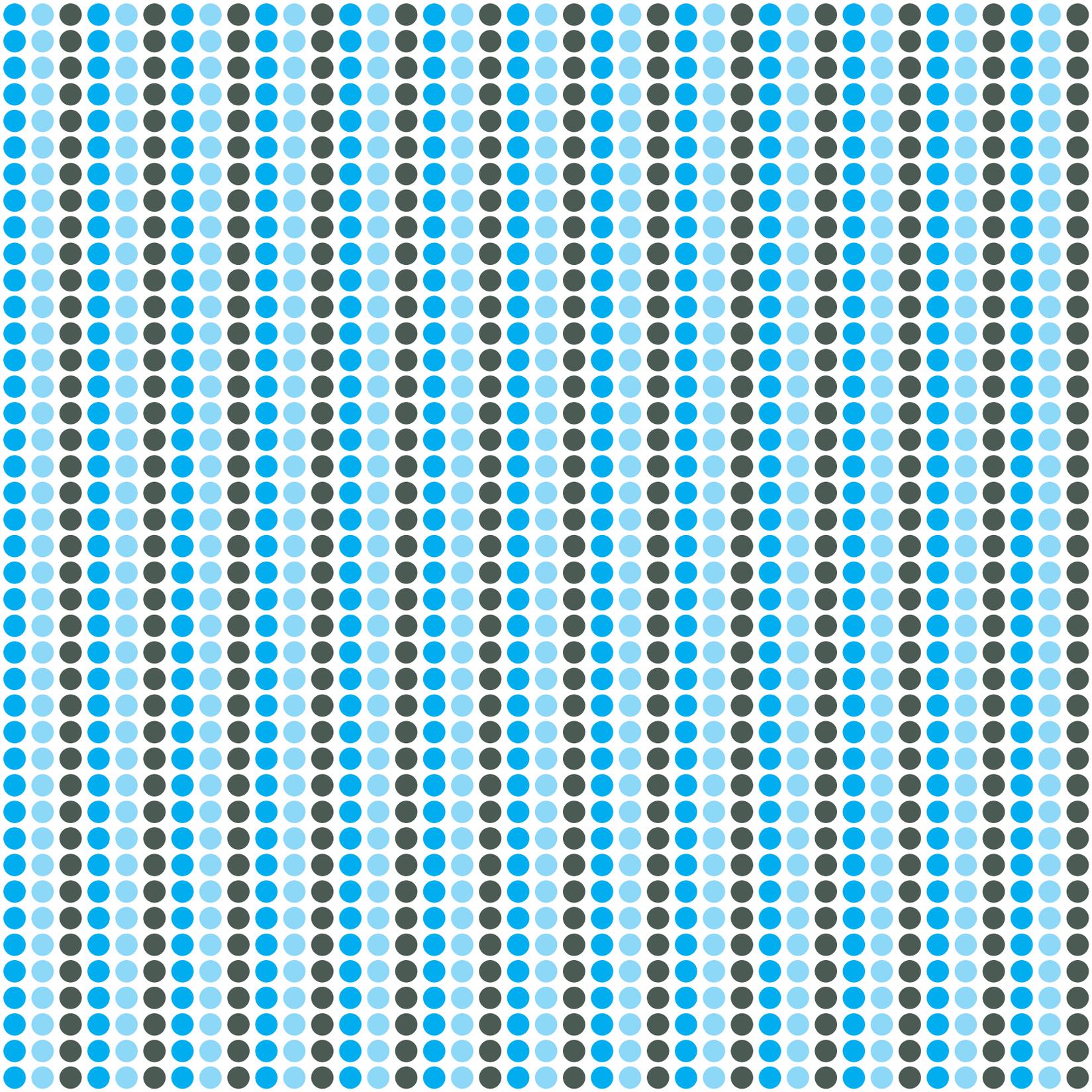
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TITAN OF TERROR

A Personification of the Destroyer of Worlds

ALESSANDRA LUEDEKING

IN 1954, JAPAN WAS BARELY RECOVERING FROM A DEVASTATING DEFEAT IN WORLD WAR II AND A HUMILIATING SEVEN-YEAR AMERICAN OCCUPATION WHEN THE UNITED STATES DROPPED TWO ATOMIC BOMBS OVER HIROSHIMA AND NAGASAKI. PLUNGED INTO THE ATOMIC AGE, JAPAN PRODUCED A FILM, *GOJIRA* (GODZILLA), THAT REFLECTED THE PSYCHOLOGICAL TRAUMA OF A PEOPLE TRYING TO SALVAGE THEIR CITIES, THEIR CULTURE, AND THEIR LIVES. IN THE FILM, THE MONSTER IS THE PHYSICAL EMBODIMENT OF THE DESTRUCTIVE FORCES OF NUCLEAR POWER. ITS POIGNANCY IS DERIVED FROM ITS HISTORICAL ALLUSIONS TO REAL EVENTS, INCLUDING THE *LUCKY DRAGON 5* INCIDENT IN WHICH A JAPANESE TUNA TRAWLER WAS COVERED IN RADIOACTIVE ASH FROM THE DETONATION OF AN UNDERWATER AMERICAN ATOM BOMB. MOREOVER, THE FILM CAPTURES THE CONFLICT BETWEEN CENSORSHIP OF THE EXPOSITION OF TRUTH, FOCUSING ON THE BURDEN OF SCIENTIFIC RESPONSIBILITY. FINALLY, THE FILM CONCLUDES BY UNDERSCORING THE ULTIMATE VICTIMIZATION OF HUMANITY UNDER THE TYRANNY OF MASSIVE DESTRUCTION AND WARNS AGAINST THE PERILS OF NUCLEAR PROLIFERATION.

The attack on the United States at Pearl Harbor by the Japanese Imperial Navy “provoked a rage bordering on the genocidal among Americans.” It prompted “exterminationist rhetoric” that reflected deep-seated anti-Oriental sentiment, including Admiral William Halsey’s motivational slogan, “Kill Japs, kill Japs, kill more Japs” and the popular wartime phrase, “the only good Jap is a dead Jap.”¹ The Japanese were pejoratively referred to as “Japs” and “Nips” in the media and official government memoranda.² These racial epithets were also frequently heard in wartime songs such as “We’re Gonna Have to Slap the Dirty Little Jap” and “Good-bye Mama, I’m Off to Yokohama.”³ Anti-Japanese sentiment was further characterized by its “nonhuman or subhuman representation”.⁴ The Japanese were perceived as animals, reptiles, and insects, which translated to their dehumanization and humiliating treatment in American internment camps during the Second World War. Specifically, the Japanese were associated with “simian imagery,” or the monkey and ape.⁵ The reduction to “stupid, bestial, even pestilential subhuman caricatures on the enemy” made it easier to tolerate the prospect of mass killing other human beings.⁶ Indeed, in his private diary, President Harry Truman, in reference to the planned use of atomic bombs on Hiroshima and Nagasaki commented:

Even if the Japs are savages, ruthless, merciless and fanatic, we as the leader of the world for the common welfare cannot drop this terrible bomb on the old capital or the new” [in reference to Kyoto and Tokyo]...I know that Japan is a terribly cruel and uncivilized nation in warfare...because they are beasts...⁷

The superiority complex espoused by the United States extended to its occupation of Japan from 1945-1952. The stated purpose was to democratize the country and to establish peace within the nation. General MacArthur, Supreme Commander of the Allied forces, claimed, “We could not simply encourage the growth of democracy. We had to make sure that it grew.” Following the detonation of the atomic bombs, Japanese resistance remained “muted”.⁸ The United States enacted a stringent censorship policy that banned all newspapers, magazines, and other print media from publishing anything that “might invite mistrust or resentment” of the occupation forces due to fear of the publication of such material would “tarnish the reputation of the United States both in Japan and in other nations.”⁹ The censorship extended to school textbooks, which omitted any mention of atomic bombings or scientific research on the bombing casualties. As a result, the

Japanese were denied the ability to reflect on the meaning of nuclear weapons and their impact on the nation.

That is, until *Gojira* appeared. The film, directed by Ishira Honda, provided the psychological outlet to externalize the fears of nuclear annihilation and the attempts of a people to rebuild their cities, their culture, and their lives, threatened by radioactive fallout. The monster is the physical embodiment of the destructive forces of nuclear power. The texture of Godzilla’s skin is made to simulate radiation scarring, his roar to resemble air-raid sirens, and his footsteps to reverberate like exploding bombs.¹⁰ The film’s poignancy derives from its historical allusions to the tragedies wrought by the atom bombs. The most significant of these include the *Lucky Dragon 5* incident, hypostatizing the pervasive tension between censorship and truth, the burden of scientific responsibility, and the film’s humanitarian ending.



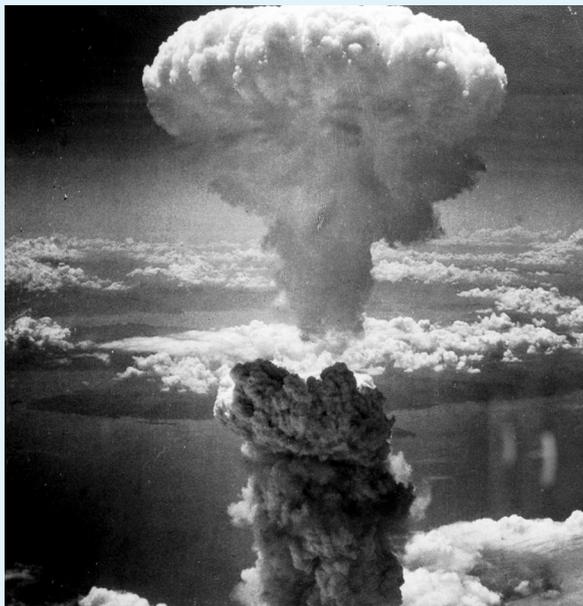
JAPANESE MOVIE POSTER FOR GODZILLA, 1954 (COURTESY OF WIKIMEDIA COMMONS)

“The Japanese were perceived as animals, reptiles and insects which translated to their dehumanization and humiliating treatment in American internment camps during the Second World War.”

The *Lucky Dragon 5* incident refers to a Japanese tuna trawler, *Daigo Fukuryū Maru* (*Lucky Dragon 5*) which, in mid-March 1954, found itself covered in radioactive fallout from the thermonuclear tests the United States was conducting on Bikini Atoll. The hydrogen bombs far exceeded their predicted effectiveness, causing the damage from the nuclear fallout to extend far past the designated danger zones. A member of the boat's crew remembered, “The sky in the west suddenly lit up and the sea became brighter than day.”¹¹ The 23 crewmembers were all hospitalized for more than a year, while the *Lucky Dragon's* radio operator died seven months later. *Gojira's* opening scene depicts the very incident just described. A fishing boat is peacefully floating on the ocean when a sudden burst of light, accompanied by a thunderous explosion, blinds the fishermen on board. The film emphasizes the radio operator, who is

seen frantically transmitting the distress signal, and whose death keenly mirrors the reality that had befallen *Daigo Fukuryū Maru* months earlier. Furthermore, the blinding light illuminates a white, round raft revealing a “No. 5” painted upon it in black letters, blatantly establishing the historical connection. The significance of this allusion is primarily political. Japan inculpates the United States for the devastation and destruction of its cities through fire and radiation. The burden of responsibility falls on the Americans. In fact, Dr. Yamane attributes *Gojira's* menacing presence to the “recent experimental nuclear detonations...that may have removed it from its surroundings.”¹²

The insinuations against the United States are momentous for their audacity, given the times. The tension between compliance with secrecy and the exposition of truth is realized in the parliamentary committee to which Dr. Yamane addresses the dangers of *Gojira*. Half of the committee asserts that “Professor Yamane's report is of such extreme importance it must not be made public” to which three vociferous women dissent by exclaiming, “What are you saying? Because it is so important, it should be made public!”¹³ These opposite viewpoints were emblematic of Japan's competing cultures following the occupation. Half of the Japanese population was disillusioned by Japan's militarism and embraced the cause of peace. They sought to cultivate peaceful diplomatic relations with the United States and further democratize values within the country. The other half resented American encroachment and was staunchly against US nuclear experimentation. In the film, the newspapers on the following morning divulge the panic-inducing information on *Gojira*: truth had prevailed. In this scene, a new meta-dimension is spawned, wherein the film proffers a criticism against censorship policies instated by the United States. The film errs on the side of truth, allowing Japan to unite in opposition against the nuclear threat embodied in *Gojira*, and consequently, American nuclear proliferation. The scenes that portray these critical points of discussion also ground the film in realism, depicting the events as though they were occurring in real



AERIAL VIEW OF THE BOMBING OF NAGASAKI (COURTESY OF WIKIMEDIA COMMONS)



CREW MEMBER OF DAIGO FUKURYU MARU RECEIVING TREATMENT (COURTESY OF WIKIMEDIA COMMONS)

time. This characteristic differentiates the film from fantasy and places it within the science fiction genre.

The moral quandary of the film is embodied in the scientist, Serizawa, and the scientific responsibility with which he is charged. Serizawa recognizes the dangerous, dual nature of his “oxygen destroyer” in harnessing its power for the benefit of mankind, and his profound fear that, in other hands, it could instead be used as a weapon, perhaps more grievous than the atom bomb itself.¹⁴ Serizawa’s concerns stem deeper, as he is concerned that not only will his work be put to destructive and violent purposes, but also that he will be the primary instigator of its realization—that he will be responsible for allowing his discovery to be used against humanity. Serizawa argues, “Even if I burn my notes, the secret will still be in my head. Until I die, how can I be sure I won’t be forced by someone to make the device again?”¹⁵ Again, the film accesses the meta-dimension when Ogata and Serizawa engage in a physical

struggle, representing the two poles of the debate. Serizawa knocks Ogata down and injures him; the violence he has inflicted causes the scientist to stop in his tracks. The realization prompts Serizawa to burn his notes, and undertake the ultimate sacrifice to ensure the oxygen destroyer would only ever be used once. This moral predicament parallels similar concerns among the physicists working on the atomic bomb in the United States. Robert Oppenheimer, the leading physicist in charge of the Manhattan Project (the organization which manufactured the first atom bomb), knowing the full capacity of the bomb’s destructive powers, advised against using it on Japanese civilians. Instead, he counseled releasing it on benign territory so that “the first atomic bombings would be an act of rhetoric, aimed less at the enemy’s cities than at his mind.”¹⁶ Upon watching a test bomb explode, Oppenheimer was reminded of a passage from Hebrew scripture: “I am become Death, the destroyer of worlds.”¹⁷ *Gojira* recoils from the bomb’s magnitude of power. This is made poignantly clear in the film’s ending.

Gojira’s humanitarian ideology is encapsulated in the victimization of *Godzilla* and Serizawa in the closing scene of the film. Throughout the entire movie, *Godzilla*’s catastrophic potency has underscored the cataclysmic effect of the atomic bomb on Japan. Yet, the ending scene introduces a paradigm shift in which compassion reaches out to embrace even the destructive power at the center of its story—*Godzilla*. Underwater, the audience glimpses the beast in a peaceful state, so that they are reminded of the external stimulus, namely, nuclear force, which has violently wrenched *Godzilla* from his natural habitat. As humanity responds by unleashing a force greater even than *Godzilla* himself, the film’s underlying narrative reveals *Godzilla*’s victimization. Yet, humanity is not victorious, for both man and monster perish as victims of massive devastation. While the film’s conclusion is the culmination of the atomic tragedy that ravaged Japan during World War II, the entire film maintains a gravitas and sincerity in its effort to convey this historical misfortune. *Godzilla*’s destructive acts are never gratuitous; the audience is never invited to admire and derive enjoyment from *Godzilla*’s

“If we keep on conducting nuclear tests, it’s possible that another *Godzilla* might appear somewhere in the world, again.”

tremendous feats of destructive might. This again distinguishes the film as a science fiction portrayal of an emotional reality. The film's historical inspiration retains a cogent presence, which eludes the fantasy film genre. Indeed, the film's parting words allude to the real fears of a nuclearized world, which Dr. Yamane articulates by stating, "I can't believe that Godzilla was the only surviving member of its species. But if we keep on conducting nuclear tests, it's possible that another Godzilla might appear somewhere in the world, again."¹⁸

Gojira is a Japanese science fiction film incorporating a monster as symbolic of the destructive and terrifying effects of atomic warfare. Japanese-American relations had been strained prior to World War II, underscored by deep-seated racism that endowed the United States with a superiority complex. The occupation that ensued established a rigid censorship policy that curtailed freedom of speech and expression. As a result, Japan was denied the ability to grieve and reflect over its ravaged nation. *Gojira* was finally produced two years after the occupation had ended, resulting in Japan's first emotional response to the events of the war. Representative of this, the film presents various historical allusions, including the *Lucky Dragon 5* incident, the debate between censorship and truth, and the moral tension ensuing from the bomb's unprecedented power. *Gojira* employs the science fiction genre to present a historical reality with a humanitarian emphasis that was once believed to be the stuff of fantasy. The film serves as a warning to the world about the perils of nuclear warfare and the fate that might arise if more "Godzillas" are awakened.

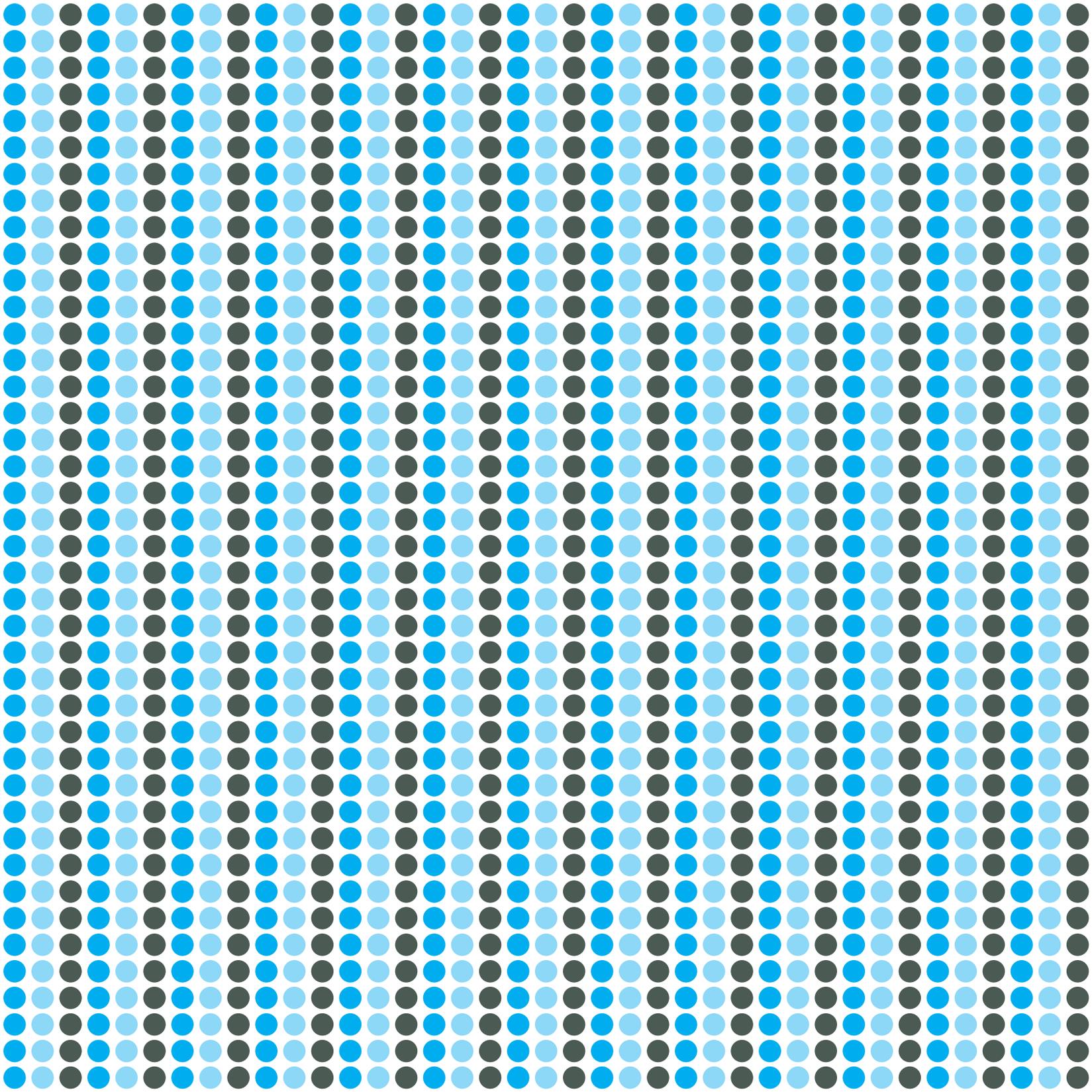
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DREIBENS MODULO 7

A New Formula for Primality Testing

ARTHUR DIEP-NGUYEN

IN THIS PAPER, WE DISCUSS STRINGS OF 3'S AND 7'S, HEREBY DUBBED "DREIBENS." AS A FIRST STEP TOWARDS DETERMINING WHETHER THE SET OF PRIME DREIBENS IS INFINITE, WE EXAMINE THE PROPERTIES OF DREIBENS WHEN DIVIDED BY 7. BY DETERMINING THE DIVISIBILITY OF A DREIBEN BY 7, WE CAN RULE OUT SOME COMPOSITE DREIBENS IN THE SEARCH FOR PRIME DREIBENS. WE ARE CONCERNED WITH THE NUMBER OF DREIBENS OF LENGTH N THAT LEAVE A REMAINDER 1 WHEN DIVIDED BY 7. BY USING NUMBER THEORY, LINEAR ALGEBRA, AND ABSTRACT ALGEBRA, WE ARRIVE AT A FORMULA THAT TELLS US HOW MANY DREIBENS OF LENGTH N ARE DIVISIBLE BY 7. WE ALSO FIND A WAY TO DETERMINE THE NUMBER OF DREIBENS OF LENGTH N THAT LEAVE A REMAINDER 1 WHEN DIVIDED BY 7. FURTHER INVESTIGATION FROM A COMBINATORIAL PERSPECTIVE PROVIDES ADDITIONAL INSIGHT INTO THE PROPERTIES OF DREIBENS WHEN DIVIDED BY 7. OVERALL, THIS PAPER HELPS CHARACTERIZE DREIBENS, OPENS UP MORE PATHS OF INQUIRY INTO THE NATURE OF DREIBENS, AND RULES OUT SOME COMPOSITE DREIBENS FROM A PRIME DREIBEN SEARCH.

INTRODUCTION TO DREIBENS AND THE SEARCH FOR INFINITELY MANY PRIME DREIBENS

The existence of infinitely many prime numbers is an elementary fact of number theory. However, mathematicians continue to ponder over whether there are infinitely many primes of a certain kind. For instance, it is not yet known whether or not the set of Mersenne primes is finite or infinite. Evidently, questions about primes remain at the forefront of number theory.

Our current research focuses on a type of number that we dubbed *dreibens*. Dreibens are merely strings of 3s and 7s (e.g. 333, 777, 3377373737, etc.), yet these simple strings provide a foundation for a multitude of questions. Our ultimate goal is to prove whether or not infinitely many prime dreibens exist. While that question is beyond the scope of this paper, this paper contributes to that goal by ruling out some composite dreibens. In fact, this paper concerns itself with dreibens divisible by 7; by understanding dreibens modulo 7, we can rule out some dreibens that are certainly *not* prime.

This paper uses a variety of approaches to learn about dreibens modulo 7, including techniques from number theory, abstract algebra, linear algebra, and combinatorics. With time, we hope dreibens to one day become a very well characterized type of number.

LEARNING ABOUT DREIBENS MODULO 7 BY EXPLORING $A_7^i(n)$

We would best approach dreibens by attempting to find the number of dreibens divisible by some number. For this paper, we interest ourselves in the number of dreibens divisible by 7. Let us define $A_j^i(n)$ as the number of dreibens of length n that leave a remainder i when divided by j . In this paper, we will concern ourselves with $A_7^i(n)$.

How do we find $A_7^i(n+1)$? We can find formulas for $A_7^i(n+1)$ by considering the first n digits of a dreiben of length $n+1$, then seeing what the last digit must be such that the dreiben leaves a remainder i when divided by 7. Let us consider a dreiben D_{n+1} of length $n+1$, which could leave a remainder of 0, 1, 2, 3, 4, 5, or 6 when divided by 7. The first n digits of D_{n+1} form another dreiben D_n that could leave a remainder of 0, 1, 2, 3, 4, 5, or 6 when divided by 7. Hence, we have seven cases, each with seven sub-cases, which we must consider. We will write the first three cases below.

Case 1: D_{n+1} leaves a remainder of 0 when divided by 7, i.e. D_{n+1} is counted in $A_7^0(n+1)$.

- (a) If D_n is 0 (mod 7), i.e. D_n is counted in $A_7^0(n)$, then the last digit of D_{n+1} must be 7.
- (b) If D_n is 1 (mod 7), i.e. D_n is counted in $A_7^1(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is divisible by 7.
- (c) If D_n is 2 (mod 7), i.e. D_n is counted in $A_7^2(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is divisible by 7.
- (d) If D_n is 3 (mod 7), i.e. D_n is counted in $A_7^3(n)$, there is no digit that can be appended to D_n such that D_{n+1} is divisible by 7.
- (e) If D_n is 4 (mod 7), i.e. D_n is counted in $A_7^4(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is divisible by 7.
- (f) If D_n is 5 (mod 7), i.e. D_n is counted in $A_7^5(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is divisible by 7.
- (g) If D_n is 6 (mod 7), i.e. D_n is counted in $A_7^6(n)$, then the last digit of D_{n+1} must be 3.

Case 2: D_{n+1} leaves a remainder of 1 when divided by 7, i.e. D_{n+1} is counted in $A_7^1(n+1)$.

- (a) If D_n is 0 (mod 7), i.e. D_n is counted in $A_7^0(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 1 (mod 7).
- (b) If D_n is 1 (mod 7), i.e. D_n is counted in $A_7^1(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 1 (mod 7).
- (c) If D_n is 2 (mod 7), i.e. D_n is counted in $A_7^2(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 1 (mod 7).
- (d) If D_n is 3 (mod 7), i.e. D_n is counted in $A_7^3(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 1 (mod 7).
- (e) If D_n is 4 (mod 7), i.e. D_n is counted in $A_7^4(n)$, then the last digit of D_{n+1} must be 3.
- (f) If D_n is 5 (mod 7), i.e. D_n is counted in $A_7^5(n)$, then the last digit of D_{n+1} must be 7.
- (g) If D_n is 6 (mod 7), i.e. D_n is counted in $A_7^6(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 1 (mod 7).

Case 3: D_{n+1} leaves a remainder of 2 when divided by 7, i.e. D_{n+1} is counted in $A_7^2(n+1)$.

- (a) If D_n is 0 (mod 7), i.e. D_n is counted in $A_7^0(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 2 (mod 7).
- (b) If D_n is 1 (mod 7), i.e. D_n is counted in $A_7^1(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 2 (mod 7).
- (c) If D_n is 2 (mod 7), i.e. D_n is counted in $A_7^2(n)$, then the last digit of D_{n+1} must be 3.
- (d) If D_n is 3 (mod 7), i.e. D_n is counted in $A_7^3(n)$, then the last digit of D_{n+1} must be 7.
- (e) If D_n is 4 (mod 7), i.e. D_n is counted in $A_7^4(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 2 (mod 7).
- (f) If D_n is 5 (mod 7), i.e. D_n is counted in $A_7^5(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 2 (mod 7).
- (g) If D_n is 6 (mod 7), i.e. D_n is counted in $A_7^6(n)$, then there is no digit that can be appended to D_n such that D_{n+1} is 2 (mod 7).

"We can find formulas for $A_7^i(n+1)$ by considering the first n digits of a dreiben of length $n+1$, then seeing what the last digit must be such that the dreiben leaves a remainder i when divided by 7."

Notice that in Case 1, D_{n+1} covers all possible dreibens of length $n+1$ divisible by 7. Likewise, Case 2 covers all possible dreibens of length $n+1$ that are $1 \pmod{7}$, Case 3 covers all possible dreibens of length $n+1$ that are $2 \pmod{7}$, and so forth. Similarly, each subcase (a) covers all possible dreibens of length n divisible by 7, each subcase (b) covers all possible dreibens of length n that are $1 \pmod{7}$, and so forth. Hence, each case represents $A_7^i(n+1)$ for some i and each sub-case represents $A_7^i(n)$ for some i . From these cases, we get the following formulas for $A_7^i(n+1)$

$$\begin{aligned} A_7^0(n+1) &= 1 \cdot A_7^0(n) + 0 \cdot A_7^1(n) + 0 \cdot A_7^2(n) + 0 \cdot A_7^3(n) + 0 \cdot A_7^4(n) + 0 \cdot A_7^5(n) + 1 \cdot A_7^6(n) \\ A_7^1(n+1) &= 0 \cdot A_7^0(n) + 0 \cdot A_7^1(n) + 0 \cdot A_7^2(n) + 0 \cdot A_7^3(n) + 1 \cdot A_7^4(n) + 1 \cdot A_7^5(n) + 0 \cdot A_7^6(n) \\ A_7^2(n+1) &= 0 \cdot A_7^0(n) + 0 \cdot A_7^1(n) + 1 \cdot A_7^2(n) + 1 \cdot A_7^3(n) + 0 \cdot A_7^4(n) + 0 \cdot A_7^5(n) + 0 \cdot A_7^6(n) \\ A_7^3(n+1) &= 1 \cdot A_7^0(n) + 1 \cdot A_7^1(n) + 0 \cdot A_7^2(n) + 0 \cdot A_7^3(n) + 0 \cdot A_7^4(n) + 0 \cdot A_7^5(n) + 0 \cdot A_7^6(n) \\ A_7^4(n+1) &= 0 \cdot A_7^0(n) + 0 \cdot A_7^1(n) + 0 \cdot A_7^2(n) + 0 \cdot A_7^3(n) + 0 \cdot A_7^4(n) + 1 \cdot A_7^5(n) + 1 \cdot A_7^6(n) \\ A_7^5(n+1) &= 0 \cdot A_7^0(n) + 0 \cdot A_7^1(n) + 0 \cdot A_7^2(n) + 1 \cdot A_7^3(n) + 1 \cdot A_7^4(n) + 0 \cdot A_7^5(n) + 0 \cdot A_7^6(n) \\ A_7^6(n+1) &= 0 \cdot A_7^0(n) + 1 \cdot A_7^1(n) + 1 \cdot A_7^2(n) + 0 \cdot A_7^3(n) + 0 \cdot A_7^4(n) + 0 \cdot A_7^5(n) + 0 \cdot A_7^6(n) \end{aligned}$$

1) in terms of $A_7^i(n)$:

We can rewrite this linear system in terms of matrices. Let

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}, \vec{v}_n = \begin{bmatrix} A_7^0(n) \\ A_7^1(n) \\ A_7^2(n) \\ A_7^3(n) \\ A_7^4(n) \\ A_7^5(n) \\ A_7^6(n) \end{bmatrix}$$

The aforementioned linear system is the same as

$$\vec{v}_{n+1} = \begin{bmatrix} A_7^0(n+1) \\ A_7^1(n+1) \\ A_7^2(n+1) \\ A_7^3(n+1) \\ A_7^4(n+1) \\ A_7^5(n+1) \\ A_7^6(n+1) \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} A_7^0(n) \\ A_7^1(n) \\ A_7^2(n) \\ A_7^3(n) \\ A_7^4(n) \\ A_7^5(n) \\ A_7^6(n) \end{bmatrix} = A\vec{v}_n$$

By induction, we find that

$$\vec{v}_{n+1} = A\vec{v}_n = A^n\vec{v}_1$$

This linear system allows us to quickly find the number of dreibens of length n that leave a remainder i when divided by 7. We need only calculate the following:

$$\vec{v}_n = A^{n-1}\vec{v}_1$$

Let us investigate A^n to see if we find anything interesting. Evidently:

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Let

$$B = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \end{bmatrix} \quad \text{and} \quad C = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

so $A = B + C$.

If we look at the powers of B and C , we find that

$$B^i = \begin{cases} \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 1 \pmod{6} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 2 \pmod{6} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 3 \pmod{6} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 4 \pmod{6} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 5 \pmod{6} \\ \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 0 \pmod{6} \end{cases} \quad \text{and} \quad C^i = \begin{cases} \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 1 \pmod{6} \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 2 \pmod{6} \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 3 \pmod{6} \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 4 \pmod{6} \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 5 \pmod{6} \\ \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} & \text{if } i \equiv 0 \pmod{6} \end{cases}$$

Notice how for $i \equiv 0 \pmod{6}$, both B^i and C^i are equal to the identity matrix I_7 . Both the powers of B and C are cyclic groups of order 6.

Before examining A^n , let us define the following:

$$\begin{aligned} a(n) &= \sum_{i=0}^{\infty} \binom{n}{6i} = \binom{n}{0} + \binom{n}{6} + \binom{n}{12} + \dots \\ b(n) &= \sum_{i=0}^{\infty} \binom{n}{6i+1} = \binom{n}{1} + \binom{n}{7} + \binom{n}{13} + \dots \\ c(n) &= \sum_{i=0}^{\infty} \binom{n}{6i+2} = \binom{n}{2} + \binom{n}{8} + \binom{n}{14} + \dots \\ d(n) &= \sum_{i=0}^{\infty} \binom{n}{6i+3} = \binom{n}{3} + \binom{n}{9} + \binom{n}{15} + \dots \\ e(n) &= \sum_{i=0}^{\infty} \binom{n}{6i+4} = \binom{n}{4} + \binom{n}{10} + \binom{n}{16} + \dots \\ f(n) &= \sum_{i=0}^{\infty} \binom{n}{6i+5} = \binom{n}{5} + \binom{n}{11} + \binom{n}{17} + \dots \end{aligned}$$

These formulas will be useful for condensing our notation.

Now we can finally begin examining A^n :

$$\begin{aligned} A &= B + C \\ A^n &= (B + C)^n \\ &= \binom{n}{0} B^n + \binom{n}{1} B^{n-1} C + \binom{n}{2} B^{n-2} C^2 + \dots + \binom{n}{n-2} B^2 C^{n-2} + \binom{n}{n-1} B C^{n-1} + \binom{n}{n} C^n \\ &= \left[\binom{n}{0} B^n + \binom{n}{6} B^{n-6} C^6 + \binom{n}{12} B^{n-12} C^{12} + \dots \right] + \left[\binom{n}{1} B^{n-1} C + \binom{n}{7} B^{n-7} C^7 + \binom{n}{13} B^{n-13} C^{13} + \dots \right] \\ &\quad + \left[\binom{n}{2} B^{n-2} C^2 + \binom{n}{8} B^{n-8} C^8 + \binom{n}{14} B^{n-14} C^{14} + \dots \right] + \left[\binom{n}{3} B^{n-3} C^3 + \binom{n}{9} B^{n-9} C^9 + \binom{n}{15} B^{n-15} C^{15} + \dots \right] \\ &\quad + \left[\binom{n}{4} B^{n-4} C^4 + \binom{n}{10} B^{n-10} C^{10} + \binom{n}{16} B^{n-16} C^{16} + \dots \right] + \left[\binom{n}{5} B^{n-5} C^5 + \binom{n}{11} B^{n-11} C^{11} + \binom{n}{17} B^{n-17} C^{17} + \dots \right] \\ &= \left[\binom{n}{0} B^n + \binom{n}{6} B^{n-6} C^6 + \binom{n}{12} B^{n-12} C^{12} + \dots \right] + \left[\binom{n}{1} B^{n-1} C + \binom{n}{7} B^{n-7} C^7 + \binom{n}{13} B^{n-13} C^{13} + \dots \right] \\ &\quad + \left[\binom{n}{2} B^{n-2} C^2 + \binom{n}{8} B^{n-8} C^8 + \binom{n}{14} B^{n-14} C^{14} + \dots \right] + \left[\binom{n}{3} B^{n-3} C^3 + \binom{n}{9} B^{n-9} C^9 + \binom{n}{15} B^{n-15} C^{15} + \dots \right] \\ &\quad + \left[\binom{n}{4} B^{n-4} C^4 + \binom{n}{10} B^{n-10} C^{10} + \binom{n}{16} B^{n-16} C^{16} + \dots \right] + \left[\binom{n}{5} B^{n-5} C^5 + \binom{n}{11} B^{n-11} C^{11} + \binom{n}{17} B^{n-17} C^{17} + \dots \right] \\ &= \left[\binom{n}{0} B^n + \binom{n}{6} B^{n-6} C^6 + \binom{n}{12} B^{n-12} C^{12} + \dots \right] + \left[\binom{n}{1} B^{n-1} C + \binom{n}{7} B^{n-7} C^7 + \binom{n}{13} B^{n-13} C^{13} + \dots \right] \\ &\quad + \left[\binom{n}{2} B^{n-2} C^2 + \binom{n}{8} B^{n-8} C^8 + \binom{n}{14} B^{n-14} C^{14} + \dots \right] + \left[\binom{n}{3} B^{n-3} C^3 + \binom{n}{9} B^{n-9} C^9 + \binom{n}{15} B^{n-15} C^{15} + \dots \right] \\ &\quad + \left[\binom{n}{4} B^{n-4} C^4 + \binom{n}{10} B^{n-10} C^{10} + \binom{n}{16} B^{n-16} C^{16} + \dots \right] + \left[\binom{n}{5} B^{n-5} C^5 + \binom{n}{11} B^{n-11} C^{11} + \binom{n}{17} B^{n-17} C^{17} + \dots \right] \\ &= \left[\binom{n}{0} B^n + \binom{n}{6} B^{n-6} C^6 + \binom{n}{12} B^{n-12} C^{12} + \dots \right] + \left[\binom{n}{1} B^{n-1} C + \binom{n}{7} B^{n-7} C^7 + \binom{n}{13} B^{n-13} C^{13} + \dots \right] \\ &\quad + \left[\binom{n}{2} B^{n-2} C^2 + \binom{n}{8} B^{n-8} C^8 + \binom{n}{14} B^{n-14} C^{14} + \dots \right] + \left[\binom{n}{3} B^{n-3} C^3 + \binom{n}{9} B^{n-9} C^9 + \binom{n}{15} B^{n-15} C^{15} + \dots \right] \\ &\quad + \left[\binom{n}{4} B^{n-4} C^4 + \binom{n}{10} B^{n-10} C^{10} + \binom{n}{16} B^{n-16} C^{16} + \dots \right] + \left[\binom{n}{5} B^{n-5} C^5 + \binom{n}{11} B^{n-11} C^{11} + \binom{n}{17} B^{n-17} C^{17} + \dots \right] \\ &= a(n) B^n + b(n) B^{n-1} C + c(n) B^{n-2} C^2 + d(n) B^{n-3} C^3 + e(n) B^{n-4} C^4 + f(n) B^{n-5} C^5 \end{aligned}$$

Now we have

$$A^n = a(n) B^n + b(n) B^{n-1} C + c(n) B^{n-2} C^2 + d(n) B^{n-3} C^3 + e(n) B^{n-4} C^4 + f(n) B^{n-5} C^5$$

The problem with the above equation is that we still have the powers of B in terms of n . However, we can easily solve this problem because the powers of B form a cyclic group. Since this cyclic group has order 6, we must consider six cases.

Case 1: $n \equiv 0 \pmod{6}$

$$\begin{aligned} A^n &= a(n) I + b(n) B^5 C + c(n) B^4 C^2 + d(n) B^3 C^3 + e(n) B^2 C^4 + f(n) B C^5 \\ &= \begin{pmatrix} a(n) & c(n) & 0 & f(n) & d(n) & e(n) & b(n) \\ b(n) & a(n) & c(n) & 0 & f(n) & d(n) & e(n) \\ e(n) & b(n) & a(n) & c(n) & 0 & f(n) & d(n) \\ d(n) & e(n) & b(n) & a(n) & c(n) & 0 & f(n) \\ f(n) & d(n) & e(n) & b(n) & a(n) & c(n) & 0 \\ 0 & f(n) & d(n) & e(n) & b(n) & a(n) & c(n) \\ c(n) & 0 & f(n) & d(n) & e(n) & b(n) & a(n) \end{pmatrix} \end{aligned}$$

Case 2: $n \equiv 1 \pmod{6}$

$$\begin{aligned} A^n &= a(n) B + b(n) C + c(n) B^5 C^2 + d(n) B^4 C^3 + e(n) B^3 C^4 + f(n) B^2 C^5 \\ &= \begin{pmatrix} a(n) & c(n) & 0 & f(n) & d(n) & e(n) & b(n) \\ 0 & f(n) & d(n) & e(n) & b(n) & a(n) & c(n) \\ d(n) & e(n) & b(n) & a(n) & c(n) & 0 & f(n) \\ b(n) & a(n) & c(n) & 0 & f(n) & d(n) & e(n) \\ c(n) & 0 & f(n) & d(n) & e(n) & b(n) & a(n) \\ f(n) & d(n) & e(n) & b(n) & a(n) & c(n) & 0 \\ e(n) & b(n) & a(n) & c(n) & 0 & f(n) & d(n) \end{pmatrix} \end{aligned}$$

Case 3: $n \equiv 2 \pmod{6}$

$$\begin{aligned} A^n &= a(n) B^2 + b(n) B C + c(n) C^2 + d(n) B^5 C^3 + e(n) B^4 C^4 + f(n) B^3 C^5 \\ &= \begin{pmatrix} a(n) & c(n) & 0 & f(n) & d(n) & e(n) & b(n) \\ f(n) & d(n) & e(n) & b(n) & a(n) & c(n) & 0 \\ b(n) & a(n) & c(n) & 0 & f(n) & d(n) & e(n) \\ 0 & f(n) & d(n) & e(n) & b(n) & a(n) & c(n) \\ e(n) & b(n) & a(n) & c(n) & 0 & f(n) & d(n) \\ c(n) & 0 & f(n) & d(n) & e(n) & b(n) & a(n) \\ d(n) & e(n) & b(n) & a(n) & c(n) & 0 & f(n) \end{pmatrix} \end{aligned}$$

Case 4: $n \equiv 3 \pmod{6}$

$$A^n = a(n)B^3 + b(n)B^2C + c(n)BC^2 + d(n)C^3 + e(n)B^5C^4 + f(n)B4C^5$$

$$= \begin{bmatrix} a(n) & c(n) & 0 & f(n) & d(n) & e(n) & b(n) \\ c(n) & 0 & f(n) & d(n) & e(n) & b(n) & a(n) \\ 0 & f(n) & d(n) & e(n) & b(n) & a(n) & c(n) \\ f(n) & d(n) & e(n) & b(n) & a(n) & c(n) & 0 \\ d(n) & e(n) & b(n) & a(n) & c(n) & 0 & f(n) \\ e(n) & b(n) & a(n) & c(n) & 0 & f(n) & d(n) \\ b(n) & a(n) & c(n) & 0 & f(n) & d(n) & e(n) \end{bmatrix}$$

Case 5: $n \equiv 4 \pmod{6}$

$$A^n = a(n)B^4 + b(n)B^3C + c(n)B^2C^2 + d(n)BC^3 + e(n)C^4 + f(n)B5C^5$$

$$= \begin{bmatrix} a(n) & c(n) & 0 & f(n) & d(n) & e(n) & b(n) \\ e(n) & b(n) & a(n) & c(n) & 0 & f(n) & d(n) \\ f(n) & d(n) & e(n) & b(n) & a(n) & c(n) & 0 \\ c(n) & 0 & f(n) & d(n) & e(n) & b(n) & a(n) \\ b(n) & a(n) & c(n) & 0 & f(n) & d(n) & e(n) \\ d(n) & e(n) & b(n) & a(n) & c(n) & 0 & f(n) \\ 0 & f(n) & d(n) & e(n) & b(n) & a(n) & c(n) \end{bmatrix}$$

Case 6: $n \equiv 5 \pmod{6}$

$$A^n = a(n)B^5 + b(n)B^4C + c(n)B^3C^2 + d(n)B^2C^3 + e(n)B^1C^4 + f(n)C^5$$

$$= \begin{bmatrix} a(n) & c(n) & 0 & f(n) & d(n) & e(n) & b(n) \\ d(n) & e(n) & b(n) & a(n) & c(n) & 0 & f(n) \\ c(n) & 0 & f(n) & d(n) & e(n) & b(n) & a(n) \\ e(n) & b(n) & a(n) & c(n) & 0 & f(n) & d(n) \\ 0 & f(n) & d(n) & e(n) & b(n) & a(n) & c(n) \\ b(n) & a(n) & c(n) & 0 & f(n) & d(n) & e(n) \\ f(n) & d(n) & e(n) & b(n) & a(n) & c(n) & 0 \end{bmatrix}$$

Evidently, no matter what n is, the first row of the matrix A^n is always

$$[a(n) \quad c(n) \quad 0 \quad f(n) \quad d(n) \quad e(n) \quad b(n)]$$

Recall that

$$\vec{v}_{n+1} = A^n \vec{v}_1$$

If we want to find $A_7^c(n+1)$, i.e. the first entry of \vec{v}_{n+1} , we need only consider the first row of A^n :

$$A_7^0(n+1) = a(n)A_7^0(1) + c(n)A_7^1(1) + 0A_7^2(1) + f(n)A_7^3(1) + d(n)A_7^4(1) + e(n)A_7^5(1) + b(n)A_7^6(1)$$

$$= a(n)(1) + c(n)(0) + 0(0) + f(n)(1) + d(n)(0) + e(n)(0) + b(n)(0)$$

$$= a(n) + f(n)$$

$$A_7^1(n) = a(n-1) + f(n-1)$$

$$= \left[\binom{n-1}{0} + \binom{n-1}{6} + \binom{n-1}{12} + \dots \right] + \left[\binom{n-1}{5} + \binom{n-1}{11} + \binom{n-1}{17} + \dots \right]$$

$$= \sum_{i=0}^{\infty} \binom{n-1}{6i} + \sum_{i=0}^{\infty} \binom{n-1}{6i+5}$$

Now we have a formula with which to find the number of dreibens of length n that are divisible by 7:

$$A_7^0(n) = a(n-1) + f(n-1)$$

What if we want to find any $A_7^i(n)$, $i = 0, 1, 2, 3, 4, 5, 6$? We know that these $A_7^i(n)$ are entries of \vec{v}_n . Recall that

$$\vec{v}_{n+1} = A^n \vec{v}_1$$

To solve for \vec{v}_{n+1} , we must first understand A^n . Recall that

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

As it turns out, A is a diagonalizable matrix, so A^n is also diagonalizable:

$$A^n = PD^nP^{-1}$$

$$P = \begin{bmatrix} 0 & -2 & 1 & \frac{1}{2}i(3i+\sqrt{3}) & \frac{1}{2}i(i+\sqrt{3}) & -\frac{1}{2}i(-3i+\sqrt{3}) & -\frac{1}{2}i(-i+\sqrt{3}) \\ 0 & 2 & 1 & \frac{-2i}{\sqrt{3}} & 0 & \frac{2i}{\sqrt{3}} & 0 \\ 0 & -2 & 1 & \frac{1}{2}i(3i+\sqrt{3}) & \frac{1}{2}(1-i\sqrt{3}) & \frac{-1}{6}i(-3i+\sqrt{3}) & \frac{1}{2}(1+i\sqrt{3}) \\ 0 & 0 & 1 & 1 & -1 & -1 & -1 \\ -1 & 1 & 1 & \frac{1}{2}i(3i+\sqrt{3}) & \frac{1}{2}(3+i\sqrt{3}) & -\frac{1}{2}(-3i+\sqrt{3}) & \frac{1}{2}(3-i\sqrt{3}) \\ 1 & 1 & 1 & \frac{1}{2}i(3i+\sqrt{3}) & -\frac{1}{2}i(-3i+\sqrt{3}) & -\frac{1}{2}(-3i+\sqrt{3}) & \frac{1}{2}(3i+\sqrt{3}) \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

$$D = \begin{bmatrix} -\frac{1}{2} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{1}{2}i(1-i\sqrt{3}) & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{2}(1-i\sqrt{3}) & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{2}i(i+\sqrt{3}) & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2}(1+i\sqrt{3}) \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$P^{-1} = \begin{bmatrix} \frac{1}{2} & 0 & 0 & -\frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \\ \frac{1}{2}i(3i+2\sqrt{3}) & \frac{1}{2}i(i+3\sqrt{3}) & \frac{1}{2}i(3i+2\sqrt{3}) & \frac{1}{2}(5-i\sqrt{3}) & -\frac{1}{2}i(-3i+5\sqrt{3}) & -\frac{1}{2}i(-3i+5\sqrt{3}) & \frac{1}{2}(5-i\sqrt{3}) \\ \frac{-2i}{\sqrt{3}} & 0 & \frac{-2i}{\sqrt{3}} & 0 & 0 & 0 & 0 \\ \frac{1}{2}i(-3i+2\sqrt{3}) & \frac{1}{2}(-1-3i\sqrt{3}) & \frac{1}{2}(-1-3i\sqrt{3}) & \frac{1}{2}(5+i\sqrt{3}) & \frac{1}{2}i(3i+5\sqrt{3}) & \frac{1}{2}i(3i+5\sqrt{3}) & \frac{1}{2}(5+i\sqrt{3}) \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{bmatrix}$$

Interestingly, some entries of D are 6th roots of unity. If we let ζ_i^j be the j th i th-root of unity, then

$$D = \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{2}i(-i+\sqrt{3}) & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{2}(1-i\sqrt{3}) & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{1}{2}i(i+\sqrt{3}) & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2}(1+i\sqrt{3}) \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{2} - i\frac{\sqrt{3}}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{1}{2} - i\frac{\sqrt{3}}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{1}{2} + i\frac{\sqrt{3}}{2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{2} + i\frac{\sqrt{3}}{2} \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & e^{\frac{4\pi i}{3}} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & e^{\frac{2\pi i}{3}} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & e^{\frac{2\pi i}{3}} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & e^{\frac{\pi i}{3}} \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \zeta_3^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \zeta_3^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \zeta_3^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \zeta_6^1 \end{bmatrix}$$

$$D^n = \begin{bmatrix} (-1)^n & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \zeta_6^{4n} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \zeta_6^{5n} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \zeta_6^{2n} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \zeta_6^n \end{bmatrix}$$

Recall that the n th roots of unity form a cyclic group of order n , as in Table 1 below:

$n \pmod{6}$	ζ_6^{0n}	ζ_6^n	ζ_6^{2n}	ζ_6^{3n}	ζ_6^{4n}	ζ_6^{5n}
0	1	1	1	1	1	1
1	1	ζ_6^1	ζ_6^2	-1	ζ_6^4	ζ_6^5
2	1	ζ_6^2	ζ_6^4	1	ζ_6^2	ζ_6^4
3	1	-1	1	-1	1	-1
4	1	ζ_6^4	ζ_6^2	1	ζ_6^4	ζ_6^2
5	1	ζ_6^5	ζ_6^4	-1	ζ_6^2	ζ_6^1

Based on the properties of the 6th roots of unity, we find that

$$D^n = \begin{cases} \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \zeta_6^4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \zeta_6^5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \zeta_6^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \zeta_6^1 \end{bmatrix} & \text{if } n \equiv 1 \pmod{6} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \zeta_6^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \zeta_6^4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \zeta_6^4 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \zeta_6^2 \end{bmatrix} & \text{if } n \equiv 2 \pmod{6} \\ \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -1 \end{bmatrix} & \text{if } n \equiv 3 \pmod{6} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \zeta_6^4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \zeta_6^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \zeta_6^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \zeta_6^4 \end{bmatrix} & \text{if } n \equiv 4 \pmod{6} \\ \begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \zeta_6^5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \zeta_6^1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \zeta_6^5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \zeta_6^1 \end{bmatrix} & \text{if } n \equiv 5 \pmod{6} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} & \text{if } n \equiv 0 \pmod{6} \end{cases}$$

Now that we understand D^n , we are much closer to characterizing A^n . All we need to do is to calculate PD^nP^{-1} for each case of D^n . Below, we will calculate the first case, i.e. where $n \equiv 0 \pmod{6}$.

If $n \equiv 0 \pmod{6}$,

$$\begin{aligned} & \text{If } n \equiv 0 \pmod{6}, \\ & D^n = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2^n & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \\ & PD^n = \begin{bmatrix} 0 & -2 & 2^n & -\frac{1}{2} + i\frac{\sqrt{3}}{6} & \zeta_6^2 & -\frac{1}{2} - i\frac{\sqrt{3}}{6} & \zeta_6^4 \\ 0 & 2 & 2^n & -i\frac{\sqrt{3}}{6} & 0 & i\frac{\sqrt{3}}{6} & 0 \\ 0 & -2 & 2^n & -\frac{1}{2} + i\frac{\sqrt{3}}{6} & \zeta_6^5 & -\frac{1}{2} - i\frac{\sqrt{3}}{6} & \zeta_6^4 \\ 0 & 0 & 2^n & 1 & -1 & 1 & -1 \\ -1 & 1 & 2^n & -\frac{1}{2} + i\frac{\sqrt{3}}{6} & \frac{1}{2} + i\frac{\sqrt{3}}{6} & -\frac{1}{2} - i\frac{\sqrt{3}}{6} & \frac{1}{2} - i\frac{\sqrt{3}}{6} \\ 1 & 1 & 2^n & -\frac{1}{2} + i\frac{\sqrt{3}}{6} & -\frac{1}{2} - i\frac{\sqrt{3}}{6} & -\frac{1}{2} - i\frac{\sqrt{3}}{6} & -\frac{1}{2} + i\frac{\sqrt{3}}{6} \\ 0 & 0 & 2^n & 1 & 1 & 1 & 1 \end{bmatrix} \\ & A^n = PD^nP^{-1} = \begin{bmatrix} \frac{1}{7}(2^n+6) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) \\ \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n+6) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) \\ \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n+6) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) \\ \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n+6) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) \\ \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n+6) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) \\ \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n+6) & \frac{1}{7}(2^n-1) \\ \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n-1) & \frac{1}{7}(2^n+6) \end{bmatrix} \end{aligned}$$

Where $n \equiv 0 \pmod{6}$, the entries of A^n are all either $1/7(2^n - 1)$ or $1/7(2^n + 6)$. Hence, A^n can be much more easily calculated; instead of performing lengthy matrix power operations, one can merely find $1/7(2^n - 1)$ and $1/7(2^n + 6)$ to determine A^n . Since $\vec{v}_n = A^{n-1}\vec{v}_1$, one can now easily determine any $A^n_i(n)$ where $n \equiv 0 \pmod{6}$. In other words, one can easily determine the number of dreibens of length $n \equiv 0 \pmod{6}$ that leave remainder i when divided by 7. By extension, one can determine the number of dreibens of length $n \equiv 0 \pmod{6}$ divisible by 7; all of these dreibens are necessarily composite, so they can be ruled out during our search for infinitely many prime dreibens.

We can perform similar calculations for A^n where $n \equiv 1, 2, 3, 4, 5 \pmod{6}$, thereby allowing us to quickly find A^n for any n . Hence, we can easily determine A^n for any n , allowing us to rule out many composite dreibens.

COMBINATORIAL APPROACH TO DREIBENS MODULO 7

Let us take a combinatorial approach to $A^n_i(n)$. For now, let us restrict ourselves to $A^n_7(n)$; in other words, we are looking for when a dreiben of length n is divisible by 7. These dreibens are obviously composite, so learning to identify them will help rule out composite dreibens in a prime dreiben search.

Here, we will use the divisibility rule for 7 to aid us. Recall the divisibility rule for 7:

$$10^x \equiv \begin{cases} 1 \pmod{7} & \text{if } x \equiv 0 \pmod{6} \\ 3 \pmod{7} & \text{if } x \equiv 1 \pmod{6} \\ 2 \pmod{7} & \text{if } x \equiv 2 \pmod{6} \\ 6 \pmod{7} & \text{if } x \equiv 3 \pmod{6} \\ 4 \pmod{7} & \text{if } x \equiv 4 \pmod{6} \\ 5 \pmod{7} & \text{if } x \equiv 5 \pmod{6} \end{cases}$$

Notice that the powers of $10 \pmod{7}$ forms a cyclic group of order 6.

Let us use the above divisibility rule to determine, as an example, $9487310294 \pmod{7}$:

$$\begin{aligned} 9487310294 &= 9(10^9) + 4(10^8) + 8(10^7) + 7(10^6) + 3(10^5) + 1(10^4) + 0(10^3) + 2(10^2) + (10)9 + 4 \\ &\equiv 9(10^3) + 4(10^2) + 8(10) + 7 + 3(10^5) + 1(10^4) + 0(10^3) + 2(10^2) + (10)9 + 4 \\ &\equiv 9(6) + 4(2) + 8(3) + 7 + 3(5) + 1(4) + 0(6) + 2(2) + (3)9 + 4 \\ &\equiv 54 + 8 + 24 + 0 + 15 + 4 + 0 + 4 + 27 + 4 \\ &\equiv 140 \equiv 0 \pmod{7} \end{aligned}$$

Dreibens consist of only 7's and 3's; hence, the divisibility of a dreiben by 7 depends on both the number and placement of 3's amongst its digits. (Neither the number nor placement of 7's in a dreiben affect its divisibility by 7, as we can tell from the divisibility rule for 7.) Let $D_3^n(i)$ be the number of dreibens of length n with i number of 3's in it, e.g. $D_3^n(2)$ is the number of dreibens of length n where 3 occupies exactly 2 digits of each dreiben. Since the divisibility of a dreiben by 7 depends on the number and placement of 3's amongst that dreiben's digits, we would stand to gain from investigating $D_3^n(i)$.

As you may have realized already,

$$A_7^n(n) = \sum_{k=0}^{\infty} D_3^n(k) = D_3^n(0) + D_3^n(1) + D_3^n(2) + D_3^n(3) + \dots$$

Evidently, by examining $D_3^n(i)$, we can approach the problem of determining the number of dreibens of length n divisible by 7. Our approach will involve investigating $D_3^n(i)$ with varying i to see if we can make any generalizations about $D_3^n(i)$.

First, let us examine $D_3^n(0)$. There is only one way to put exactly zero 3's in a dreiben; every digit of that dreiben must be 7. Obviously, if a number's digits are all 7's, then the number is divisible by 7. Since all of the digits of a dreiben with zero 3's is 7, and since there is only one way

to make a dreiben of length n with zero 3's, we can easily see that $D_3^n(0) = 1$.

Next, we can examine $D_3^n(1) = 0$. There are no dreibens with only one 3, since 3 times any digit place 10^x is never divisible by 7, so $D_3^n(1) = 0$.

So far, we have covered two very simple instances of $D_3^n(i)$. When $i = 0$, there is only a single way to make a dreiben divisible by 7. When $i = 1$, it is impossible to make a dreiben divisible by 7. However, as i increases, the problem of describing $D_3^n(i)$ becomes much more complicated. The next question in our investigation of $D_3^n(i)$ involves $i = 2$. In other words, how many ways are there to put exactly two 3's in a dreiben of length n ? Putting exactly two 3's in a dreiben of length n means we must choose two digit places 10^x and 10^y where $x \neq y$ and $0 \leq x, y \leq n - 1$. Putting our two 3's in these two digit places, we find that the dreiben is congruent to $3(10^x + 10^y) \pmod{7}$. Clearly, the dreiben is divisible by 7 if and only if $10^x + 10^y$ is divisible by 7, so we need only consider $10^x + 10^y \pmod{7}$.

What are the possible ways to make $10^x + 10^y \equiv 0 \pmod{7}$? The powers of 10 modulo 7 form a cyclic group of order 6; without loss of generality, the possible solutions are

- (a) $10^x \equiv 1 \pmod{7}, 10^y \equiv 6 \pmod{7}$
- (b) $10^x \equiv 2 \pmod{7}, 10^y \equiv 5 \pmod{7}$
- (c) $10^x \equiv 3 \pmod{7}, 10^y \equiv 4 \pmod{7}$

Another way to write the possible solutions is

- (a) $x \equiv 0 \pmod{6}, y \equiv 3 \pmod{6}$
- (b) $x \equiv 2 \pmod{6}, y \equiv 5 \pmod{6}$
- (c) $x \equiv 1 \pmod{6}, y \equiv 4 \pmod{6}$

For each solution, we choose one digit place each from two sets of digit places. Here, we introduce some notation that will make the later calculations more concise:

- α is the set of digit places $10^x \equiv 1 \pmod{7}$, i.e. $x \equiv 0 \pmod{6}$.
- β is the set of digit places $10^x \equiv 2 \pmod{7}$, i.e. $x \equiv 2 \pmod{6}$.
- γ is the set of digit places $10^x \equiv 3 \pmod{7}$, i.e. $x \equiv 1 \pmod{6}$.
- δ is the set of digit places $10^x \equiv 4 \pmod{7}$, i.e. $x \equiv 4 \pmod{6}$.
- ϵ is the set of digit places $10^x \equiv 5 \pmod{7}$, i.e. $x \equiv 5 \pmod{6}$.
- ζ is the set of digit places $10^x \equiv 6 \pmod{7}$, i.e. $x \equiv 3 \pmod{6}$.

As an example, one possible way to put two 3's into a dreiben is to choose one digit place from α and another digit place from ζ . The number of possible combinations of choosing two digit places, one from α and one from ζ , is $\binom{|\alpha|}{1}\binom{|\zeta|}{1} = |\alpha| \cdot |\zeta|$. Applying this to the other sets of digit places, we find that

$$D_3^n(2) = |\alpha| \cdot |\zeta| + |\beta| \cdot |\epsilon| + |\gamma| \cdot |\delta|$$

As you may have noticed, the cardinality of the six sets above depends on $n \pmod 6$. This can be seen in Table 2 below:

Table 2: Cardinality of the sets α through ζ

$n \pmod 6$	$ \alpha $	$ \beta $	$ \gamma $	$ \delta $	$ \epsilon $	$ \zeta $
0	$\frac{n}{6}$	$\frac{n}{6}$	$\frac{n}{6}$	$\frac{n}{6}$	$\frac{n}{6}$	$\frac{n}{6}$
1	$\frac{n+5}{6}$	$\frac{n-1}{6}$	$\frac{n-1}{6}$	$\frac{n-1}{6}$	$\frac{n-1}{6}$	$\frac{n-1}{6}$
2	$\frac{n+4}{6}$	$\frac{n-2}{6}$	$\frac{n+4}{6}$	$\frac{n-2}{6}$	$\frac{n-2}{6}$	$\frac{n-2}{6}$
3	$\frac{n+3}{6}$	$\frac{n+3}{6}$	$\frac{n+3}{6}$	$\frac{n-3}{6}$	$\frac{n-3}{6}$	$\frac{n-3}{6}$
4	$\frac{n+2}{6}$	$\frac{n+2}{6}$	$\frac{n+2}{6}$	$\frac{n-4}{6}$	$\frac{n-4}{6}$	$\frac{n+2}{6}$
5	$\frac{n+1}{6}$	$\frac{n+1}{6}$	$\frac{n+1}{6}$	$\frac{n-5}{6}$	$\frac{n-5}{6}$	$\frac{n+1}{6}$

Hence,

- If $n \equiv 0 \pmod 6$, then

$$D_3^n(2) = \frac{n}{6} \cdot \frac{n}{6} + \frac{n}{6} \cdot \frac{n}{6} + \frac{n}{6} \cdot \frac{n}{6} = \frac{3n^2}{36} = \frac{n^2}{12}$$

- If $n \equiv 1 \pmod 6$, then

$$D_3^n(2) = \frac{n+5}{6} \cdot \frac{n-1}{6} + \frac{n-1}{6} \cdot \frac{n-1}{6} + \frac{n-1}{6} \cdot \frac{n-1}{6} = \frac{(n+5)(n-1) + 2(n-1)^2}{36} = \frac{(n^2 + 4n - 5) + 2(n^2 - 2n + 1)}{36} = \frac{3n^2 - 3}{36} = \frac{n^2 - 1}{12}$$

- If $n \equiv 2 \pmod 6$, then

$$D_3^n(2) = \frac{n+4}{6} \cdot \frac{n-2}{6} + \frac{n-2}{6} \cdot \frac{n-2}{6} + \frac{n+4}{6} \cdot \frac{n-2}{6} = \frac{2(n+4)(n-2) + (n-2)^2}{36} = \frac{2(n^2 + 2n - 8) + (n^2 - 4n + 4)}{36} = \frac{3n^2 - 12}{36} = \frac{n^2 - 4}{12}$$

- If $n \equiv 3 \pmod 6$, then

$$D_3^n(2) = \frac{n+3}{36} \cdot \frac{n-3}{36} + \frac{n+3}{36} \cdot \frac{n-3}{36} + \frac{n+3}{36} \cdot \frac{n-3}{36} = \frac{3(n+3)(n-3)}{36} = \frac{3(n^2 - 9)}{36} = \frac{n^2 - 9}{12}$$

- If $n \equiv 4 \pmod 6$, then

$$D_3^n(2) = \frac{n+2}{36} \cdot \frac{n+2}{36} + \frac{n+2}{36} \cdot \frac{n-4}{36} + \frac{n+2}{36} \cdot \frac{n-4}{36} = \frac{(n^2 + 4n + 4) + 2(n^2 - 2n - 8)}{36} = \frac{3n^2 - 12}{36} = \frac{n^2 - 4}{12}$$

- If $n \equiv 5 \pmod 6$, then

$$D_3^n(2) = \frac{n+1}{36} \cdot \frac{n+1}{36} + \frac{n+1}{36} \cdot \frac{n+1}{36} + \frac{n+1}{36} \cdot \frac{n-5}{36} = \frac{2(n+1)^2 + (n+1)(n-5)}{36} = \frac{2(n^2 + 2n + 1) + (n^2 - 4n - 5)}{36} = \frac{3n^2 - 3}{36} = \frac{n^2 - 1}{12}$$

Evidently, $D_3^n(2) = \lfloor n^2/12 \rfloor$. Let us prove this.

Proof. If $n \equiv 0 \pmod 6$, i.e. $n = 6m$ where m is an integer, then

$$D_3^n(2) = \frac{n^2}{12} = \frac{(6m)^2}{12} = \frac{36m^2}{12} = 3m^2$$

$$\left\lfloor \frac{n^2}{12} \right\rfloor = \left\lfloor \frac{(6m)^2}{12} \right\rfloor = \lfloor 3m^2 \rfloor = 3m^2$$

$$D_3^n(2) = \left\lfloor \frac{n^2}{12} \right\rfloor$$

If $n \equiv 1 \pmod 6$, i.e. $n = 6m + 1$ where m is an integer, then

$$D_3^n(2) = \frac{n^2 - 1}{12} = \frac{(6m+1)^2 - 1}{12} = \frac{36m^2 + 12m + 1 - 1}{12} = 3m^2 + m$$

$$\left\lfloor \frac{n^2}{12} \right\rfloor = \left\lfloor \frac{(6m+1)^2}{12} \right\rfloor = \left\lfloor \frac{36m^2 + 12m + 1}{12} \right\rfloor = \left\lfloor 3m^2 + m + \frac{1}{12} \right\rfloor = 3m^2 + m$$

$$D_3^n(2) = \left\lfloor \frac{n^2}{12} \right\rfloor$$

If $n \equiv 2 \pmod 6$, i.e. $n = 6m + 2$ where m is an integer, then

$$D_3^n(2) = \frac{n^2 - 4}{12} = \frac{(6m+2)^2 - 4}{12} = \frac{36m^2 + 24m + 4 - 4}{12} = 3m^2 + 2m$$

$$\left\lfloor \frac{n^2}{12} \right\rfloor = \left\lfloor \frac{(6m+2)^2}{12} \right\rfloor = \left\lfloor \frac{36m^2 + 24m + 4}{12} \right\rfloor = \left\lfloor 3m^2 + 2m + \frac{1}{3} \right\rfloor = 3m^2 + 2m$$

$$D_3^n(2) = \left\lfloor \frac{n^2}{12} \right\rfloor$$

If $n \equiv 3 \pmod 6$, i.e. $n = 6m + 3$ where m is an integer, then

$$D_3^n(2) = \frac{n^2 - 9}{12} = \frac{(6m+3)^2 - 9}{12} = \frac{36m^2 + 36m + 9 - 9}{12} = 3m^2 + 3m$$

$$\left\lfloor \frac{n^2}{12} \right\rfloor = \left\lfloor \frac{(6m+3)^2}{12} \right\rfloor = \left\lfloor \frac{36m^2 + 36m + 9}{12} \right\rfloor = \left\lfloor 3m^2 + 3m + \frac{3}{4} \right\rfloor = 3m^2 + 3m$$

$$D_3^n(2) = \left\lfloor \frac{n^2}{12} \right\rfloor$$

If $n \equiv 4 \pmod{6}$, i.e. $n = 6m + 4$ where m is an integer, then

$$\begin{aligned} D_3^n(2) &= \frac{n^2 - 4}{12} = \frac{(6m+4)^2 - 4}{12} = \frac{36m^2 + 48m + 16 - 4}{12} = \frac{36m^2 + 48m + 12}{12} = 3m^2 + 4m + 1 \\ \left\lfloor \frac{n^2}{12} \right\rfloor &= \left\lfloor \frac{(6m+4)^2}{12} \right\rfloor = \left\lfloor \frac{36m^2 + 48m + 16}{12} \right\rfloor = \left\lfloor 3m^2 + 4m + 1 + \frac{1}{3} \right\rfloor = 3m^2 + 4m + 1 \\ D_3^n(2) &= \left\lfloor \frac{n^2}{12} \right\rfloor \end{aligned}$$

If $n \equiv 5 \pmod{6}$, i.e. $n = 6m + 5$ where m is an integer, then

$$\begin{aligned} D_3^n(2) &= \frac{n^2 - 1}{12} = \frac{(6m+5)^2 - 1}{12} = \frac{36m^2 + 60m + 25 - 1}{12} = \frac{36m^2 + 60m + 24}{12} = 3m^2 + 5m + 2 \\ \left\lfloor \frac{n^2}{12} \right\rfloor &= \left\lfloor \frac{(6m+5)^2}{12} \right\rfloor = \left\lfloor \frac{36m^2 + 60m + 25}{12} \right\rfloor = \left\lfloor 3m^2 + 5m + 2 + \frac{1}{12} \right\rfloor = 3m^2 + 5m + 2 \\ D_3^n(2) &= \left\lfloor \frac{n^2}{12} \right\rfloor \end{aligned}$$

Therefore, in general, $D_3^n(2) = \lfloor n^2/12 \rfloor$.

How many ways are there to put exactly three 3's in a dreiben of length n , i.e. what is $D_3^n(3)$? We must choose three digit places 10^x , 10^y , and 10^z where $x \neq y \neq z$ and $0 \leq x, y, z \leq n-1$. Now the question is, what are the possible ways to make $10^x + 10^y + 10^z \equiv 0 \pmod{7}$?

In fact, there are eight cases: without loss of generality, the possible solutions are

- (a) $10^x \equiv 1 \pmod{7}$, $10^y \equiv 1 \pmod{7}$, $10^z \equiv 5 \pmod{7}$
- (b) $10^x \equiv 1 \pmod{7}$, $10^y \equiv 2 \pmod{7}$, $10^z \equiv 4 \pmod{7}$
- (c) $10^x \equiv 1 \pmod{7}$, $10^y \equiv 3 \pmod{7}$, $10^z \equiv 3 \pmod{7}$
- (d) $10^x \equiv 2 \pmod{7}$, $10^y \equiv 2 \pmod{7}$, $10^z \equiv 3 \pmod{7}$
- (e) $10^x \equiv 2 \pmod{7}$, $10^y \equiv 6 \pmod{7}$, $10^z \equiv 6 \pmod{7}$
- (f) $10^x \equiv 3 \pmod{7}$, $10^y \equiv 5 \pmod{7}$, $10^z \equiv 5 \pmod{7}$
- (g) $10^x \equiv 4 \pmod{7}$, $10^y \equiv 4 \pmod{7}$, $10^z \equiv 6 \pmod{7}$
- (h) $10^x \equiv 4 \pmod{7}$, $10^y \equiv 5 \pmod{7}$, $10^z \equiv 5 \pmod{7}$

These cases can be split into two categories. Cases (b) and (f) entail choosing one digit place from each of three sets, whereas the remaining cases entail choosing two digit places from one set and one digit place from another. To describe these two categories, let us examine cases (b) and (c).

In case (b), we are choosing one digit place each from the sets α , β , and ζ . Hence, the number of possible combinations of three digit places chosen thusly is $\binom{|\alpha|}{1} \binom{|\beta|}{1} \binom{|\zeta|}{1} = |\alpha| \cdot |\beta| \cdot |\zeta|$.

In case (c), we are choosing one digit place from α and two digit places from γ . Hence, the number of possible combinations of three digit places chosen thusly is $\binom{|\alpha|}{1} \binom{|\gamma|}{2} = |\alpha| \cdot (|\gamma|)(|\gamma|-1)/2$. Describing the other cases similarly, we find that

$$\begin{aligned} D_3^n(3) &= \binom{|\alpha|}{2} \binom{|\epsilon|}{1} + \binom{|\alpha|}{1} \binom{|\beta|}{1} \binom{|\delta|}{1} + \binom{|\alpha|}{1} \binom{|\gamma|}{2} + \binom{|\beta|}{2} \binom{|\gamma|}{1} \\ &\quad + \binom{|\beta|}{1} \binom{|\zeta|}{2} + \binom{|\gamma|}{1} \binom{|\epsilon|}{1} \binom{\zeta}{1} + \binom{|\delta|}{2} \binom{|\zeta|}{1} + \binom{|\delta|}{1} \binom{|\epsilon|}{2} \end{aligned}$$

As before, since the cardinalities of the sets α through ζ are dependent on $n \pmod{6}$, we would be best served writing out each of the six possible cases to see if we notice a pattern:

- If $n \equiv 0 \pmod{6}$, then

$$\begin{aligned} D_3^n(3) &= \frac{\binom{n-6}{2} \binom{n}{6}}{2} \binom{n}{6} \cdot 6 + 2 \binom{n}{6}^3 = \binom{n}{6}^2 \binom{n-6}{2} + 2 \binom{n}{6}^3 \\ &= \frac{n^3 - 6n^2}{72} + \frac{n^3}{108} = \frac{5n^3 - 18n^2}{216} \end{aligned}$$

- If $n \equiv 1 \pmod{6}$, then

$$\begin{aligned} D_3^n(3) &= \frac{\binom{n-1}{2} \binom{n+5}{6}}{2} \binom{n-1}{6} + \binom{n+5}{6} \binom{n-1}{6}^2 + \binom{n+5}{6} \frac{\binom{n-7}{2} \binom{n-1}{6}}{2} \\ &\quad + 4 \frac{\binom{n-7}{6} \binom{n-1}{6}}{2} \binom{n-1}{6} + \binom{n-1}{6}^3 \\ &= \binom{n-1}{6}^2 \binom{n+5}{12} + \binom{n+5}{6} \binom{n-1}{6}^2 + \binom{n+5}{12} \binom{n-7}{6} \binom{n-1}{6} \\ &\quad + \binom{n-7}{3} \binom{n-1}{6}^2 + \binom{n-1}{6}^3 \\ &= \frac{1}{216} (n-1)(5n^2 - 13n - 10) = \frac{5n^3 - 13n^2 - 10n - 5n^2 + 13n + 10}{216} \\ &= \frac{5n^3 - 18n^2 + 3n + 10}{216} \end{aligned}$$

- If $n \equiv 2 \pmod{6}$, then

$$\begin{aligned} D_3^n(3) &= \frac{\binom{n-2}{2} \binom{n+4}{6}}{2} \binom{n-3}{6} + 2 \binom{n+4}{6} \binom{n-2}{6}^2 + \binom{n+4}{6} \frac{\binom{n-4}{2} \binom{n+4}{6}}{2} \\ &\quad + \frac{\binom{n-8}{6} \binom{n-2}{6}}{2} \binom{n+4}{6} + 3 \binom{n-2}{6} \frac{\binom{n-8}{6} \binom{n-2}{6}}{2} \\ &= \binom{n-2}{6}^2 \binom{n+4}{12} + \binom{n+4}{3} \binom{n-2}{6}^2 + \binom{n+4}{6}^2 \binom{n-2}{12} \\ &\quad + \binom{n-8}{12} \binom{n-2}{6} \binom{n+4}{6} + \binom{n-2}{6}^2 \binom{n-8}{4} \\ &= \frac{1}{216} (n-2)^2 (5n+2) = \frac{5n^3 - 20n^2 + 20n + 2n^2 - 8n + 8}{216} \\ &= \frac{5n^3 - 18n^2 + 12n + 8}{216} \end{aligned}$$

- If $n \equiv 3 \pmod{6}$, then

$$\begin{aligned} D_3^n(3) &= \frac{\binom{n-3}{6} \binom{n+3}{6} (n-2)}{2} + \binom{n+3}{6}^2 \binom{n-3}{6} + 2 \binom{n+3}{6} \frac{\binom{n-3}{6} \binom{n+3}{6}}{2} \\ &\quad + \binom{n+3}{6} \frac{\binom{n-9}{6} \binom{n-3}{6}}{2} + \binom{n+3}{6} (n-3)^2 + 2 \frac{\binom{n-9}{6} \binom{n-3}{6}}{2} \binom{n-3}{6} \\ &= \binom{n-3}{6}^2 \binom{n+3}{12} + \binom{n+3}{6}^2 \binom{n-3}{6} + \binom{n+3}{6}^2 \binom{n-3}{6} \\ &\quad + \binom{n+3}{6} \binom{n-3}{6} \binom{n-9}{12} + \binom{n+3}{6} \binom{n-3}{6}^2 + \binom{n-9}{6} \binom{n-3}{6}^2 \\ &= \frac{1}{216} (n-3)(5n^2-3n+18) = \frac{5n^3-3n^2+18n-15n^2+9n-54}{216} \\ &= \frac{5n^3-18n^2+27n-54}{216} \end{aligned}$$

- If $n \equiv 4 \pmod{6}$, then

$$\begin{aligned} D_3^n(3) &= \frac{\binom{n-4}{6} \binom{n+2}{6} (n-4)}{2} + 2 \binom{n+2}{6}^2 \binom{n-4}{6} + 3 \binom{n+2}{6} \frac{\binom{n-4}{6} \binom{n+2}{6}}{2} \\ &\quad + \frac{\binom{n-10}{6} \binom{n-4}{6}}{2} \binom{n+2}{6} + \binom{n-4}{6} \frac{\binom{n-10}{6} \binom{n-4}{6}}{2} \\ &= \binom{n-4}{6}^2 \binom{n+2}{12} + \binom{n+2}{6}^2 \binom{n-4}{6} + \binom{n+2}{6}^2 \binom{n-4}{6} \\ &\quad + \binom{n-10}{12} \binom{n-4}{6} \binom{n+2}{6} + \binom{n-4}{6}^2 \binom{n-10}{12} \\ &= \frac{5n^3-18n^2+12n-80}{216} \end{aligned}$$

- If $n \equiv 5 \pmod{6}$, then

$$\begin{aligned} D_3^n(3) &= \frac{\binom{n-5}{6} \binom{n+1}{6} (n-5)}{2} + \binom{n+1}{6}^3 + 4 \binom{n+1}{6} \frac{\binom{n-5}{6} \binom{n+1}{6}}{2} \\ &\quad + \binom{n+1}{6}^2 \binom{n-5}{6} + \binom{n+1}{6} \frac{\binom{n-11}{6} \binom{n-5}{6}}{2} \\ &= \binom{n-5}{6}^2 \binom{n+1}{12} + \binom{n+1}{6}^3 + \binom{n+1}{6}^2 \binom{n-5}{6} \\ &\quad + \binom{n+1}{6}^2 \binom{n-5}{6} + \binom{n+1}{12} \binom{n-11}{6} \binom{n-5}{6} \\ &= \frac{5n^3-18n^2+3n+26}{216} \end{aligned}$$

Table 3 summarizes what we have learned so far about $D_3^n(2)$ and $D_3^n(3)$:

$n \pmod{6}$	$D_3^n(2)$	$D_3^n(3)$
0	$\frac{n^2}{12}$	$\frac{5n^3-18n^2}{216}$
1	$\frac{n^2-1}{12}$	$\frac{5n^3-18n^2+3n+10}{216}$
2	$\frac{n^2-4}{12}$	$\frac{5n^3-18n^2+12n+8}{216}$
3	$\frac{n^2-9}{12}$	$\frac{5n^3-18n^2+27n-54}{216}$
4	$\frac{n^2-4}{12}$	$\frac{5n^3-18n^2+12n-80}{216}$
5	$\frac{n^2-1}{12}$	$\frac{5n^3-18n^2+3n+26}{216}$

Given that $D_3^n(2) = \lfloor \frac{n^2}{12} \rfloor$, it seems reasonable to suspect that

$D_3^n(3) = \lfloor \frac{5n^3-18n^2}{216} \rfloor$. Let us see if examining some values of $D_3^n(3)$ and $\lfloor \frac{5n^3-18n^2}{216} \rfloor$ will enlighten us.

Table 4: $D_3^n(3)$ and $\lfloor \frac{5n^3-18n^2}{216} \rfloor$

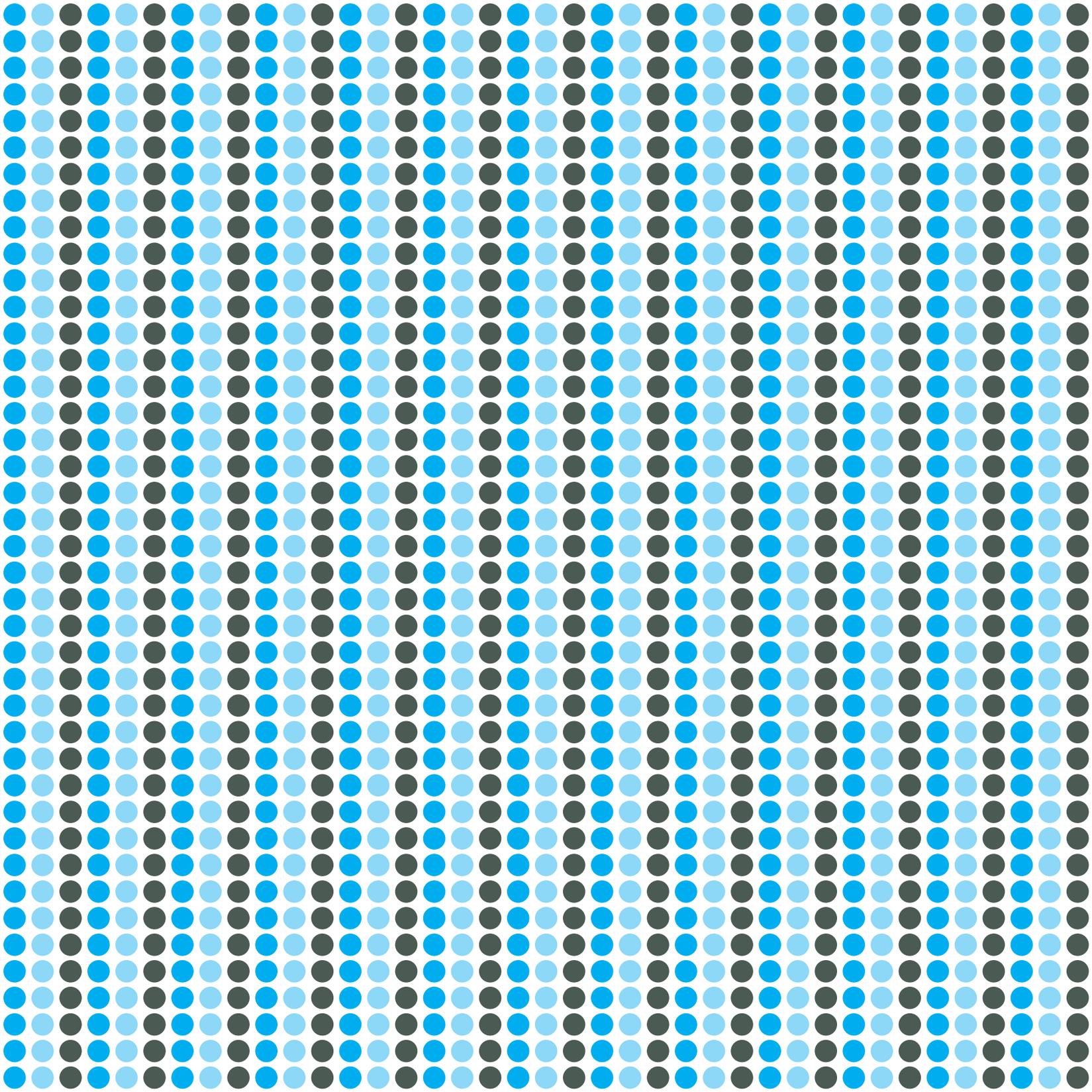
n	$D_3^n(3)$	$\lfloor \frac{5n^3-18n^2}{216} \rfloor$
0	0	0
1	0	0
2	0	0
3	0	0
4	0	1
5	1	1
6	2	2
7	4	4
8	7	7
9	11	11
10	15	15
11	21	21
12	28	28
13	37	37
14	48	48
15	61	60
16	74	74
17	90	90
18	108	108
19	129	129
20	153	152
21	180	178
22	207	207

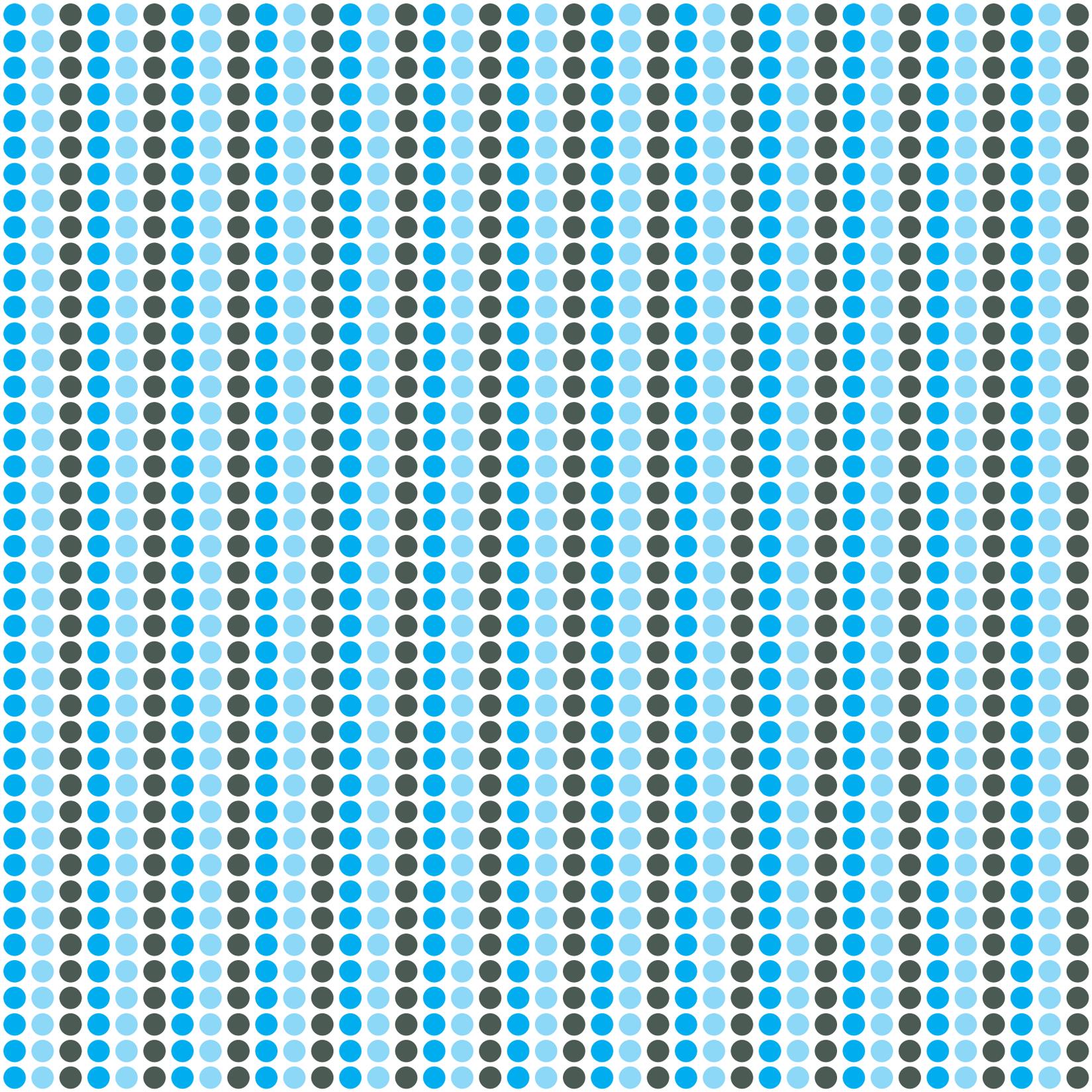
As evident from Table 4 above, $D_3^n(3) \neq \lfloor \frac{5n^3-18n^2}{216} \rfloor$, but they seem very similar. Determining the relationship between $D_3^n(3)$ and $\lfloor \frac{5n^3-18n^2}{216} \rfloor$ may be a topic for future research, but is beyond the scope of this paper.

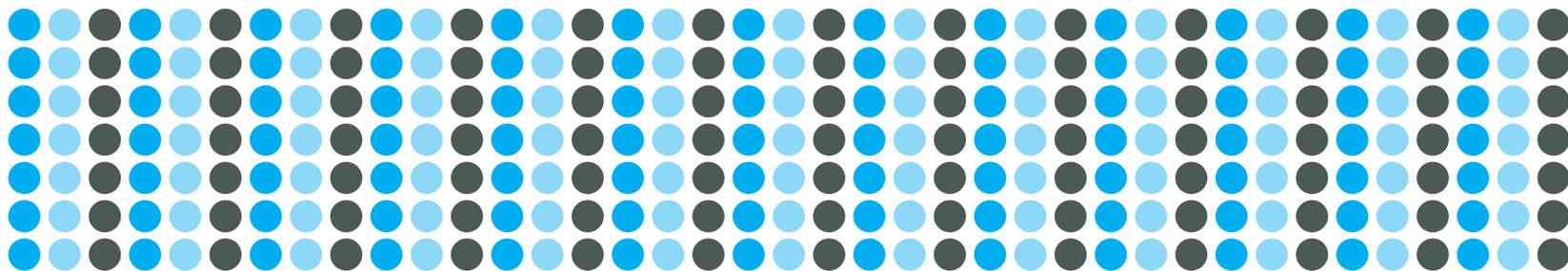
Finding $D_3^n(i)$ for greater values of i becomes increasingly difficult, perhaps even impractical. It is beyond the scope of this paper, but should a general form for $D_3^n(i)$ be found, one could, from a combinatorial perspective, corroborate the results of the second section, allowing one to find a different form for the explicit equation of $A_7^i(n)$. In other words, one would have yet another method to determine the number of dreibens of length n divisible by 7.

CONCLUSION

While we are still far from determining whether the set of prime dreibens is finite or infinite, our exploration of dreibens modulo 7 has cast much light on the problem. Now, we have several methods to determine how many dreibens of length n are divisible by 7, therefore allowing these dreibens to be ruled out during our search for prime dreibens. We have also opened up several opportunities for inquiry. For instance, explicit matrices for A^n where $n \equiv 1, 2, 3, 4, 5 \pmod{6}$ must still be determined. The relationship between $D_3^n(3)$ and $\left\lfloor \frac{5n^3 - 18n^2}{216} \right\rfloor$ remains a promising mystery, and we have yet to find a generalized formula for $D_3^n(i)$. Although dreibens remain a mysterious type of number, current research in dreibens show promise in both uncovering new mathematical problems and achieving our ultimate goal of finding infinitely many prime dreibens, if they exist.







AUTHOR BIOGRAPHIES



JULIANA BUTRON

Before coming to Boston College, Juliana studied visual arts at Fiorello LaGuardia, a public arts school, in New York City. Growing up in a diverse Brooklyn neighborhood exposed her to different points of view. This environment taught her that there are many sides to every story. As a result, she has developed a fondness for exploring timely issues in unique ways. This semester, she is excited to continue her role as a co-facilitator for the Thea Bowman AHANA and Intercultural Center's Dialogues on Race. After graduation, she hopes to pursue a master's degree in American Government.



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is a sophomore at Boston College from San Marino, California. While originally a Biology major, Arthur discovered a passion for mathematics during the fall semester of his freshman year, when his Calculus II professor Igor Minovich introduced him to various proofs, puzzles, and other topics in math. This initial experience spurred Arthur to expand his academic horizons. Since then, Arthur has worked on math research with classmates and continues to pursue his interests in both science and math. Currently a Biochemistry and Mathematics double major, Arthur is also a trombonist in the University Wind Ensemble and in the bOp! Jazz Ensemble.



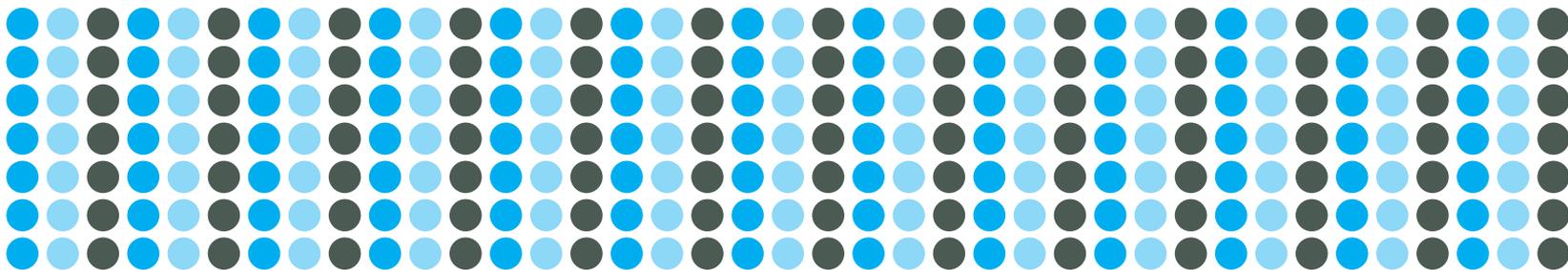
JENNIFER HEINE

is currently a senior in the Morrissey Arts and Sciences Honors Program at Boston College with a double major in English and Hispanic Studies and a minor in Creative Writing. A Dean's List student and a member of the Order of the Cross and Crown Honor Society, she plans to pursue graduate studies in comparative literature. Jennifer has been a member of the Dickens Fellowship since 2010, and her most recent research involves comparing the work of Dickens work to that of Cervantes and other picaresque writers. A fluent Spanish speaker, she studied at the Universidad Complutense in Madrid. In addition to her academic studies, she enjoys writing creatively, both editing and contributing to the Stylus.



KATELYN JOHNSON

is currently a senior in the Morrissey College of Arts and Sciences, majoring in Biochemistry and minoring in History. During the Summer of 2015, she took part in the Interdisciplinary Water Sciences and Engineering NSF REU program at Virginia Polytechnic Institute and State University. Working with Dr. Kang Xia and Ph.D. student Hanh Le, she completed research in a surface stream concerning neonicotinoid transport and transformation. Currently, her research comprises of deicer contaminant transport in the Charles River Watershed under the advisement of Dr. Rudolph Hon and Dr. James Besancon. After graduation, Katelyn plans on pursuing a Master's degree in Civil Engineering, with a focus on Water Resources. When she is not conducting research, you can find her playing her Baritone in the Boston College Marching Band, singing in the University Chorale, advising Venture Scouts, and leading students as the co-president of BC's student organization STITCH.



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is a senior majoring in English and minoring in Medical Humanities in the Morrissey College of Arts and Sciences. His research interests include twentieth and twenty-first century literature and art, narrative medicine, representations of illness, disability, grief, and trauma, and literary and cultural theory. Chris was a founder and editor-in-chief of the Medical Humanities Journal of Boston College. He has also worked as an intern with Health Story Collaborative and the Medical Humanities, Health, and Culture minor at Boston College.



YOON-SHIN (CLARA) LEE

is a junior studying Applied Psychology and Human Development and Sociology in the Lynch School of Education. She is originally from San Jose, California, but graduated high school in South Korea. She is currently in the Lynch Honors Programs and Sociology departmental honors. On campus, she is involved in UGBC, the Student Admissions Program, and various intercultural organizations. In her spare time, Clara also works in the Memory, Metacognition, and Learning Lab as a research fellow and volunteers at Boston Children's Hospital. After graduation, she hopes to attend graduate school and pursue a career in social justice and/or education.



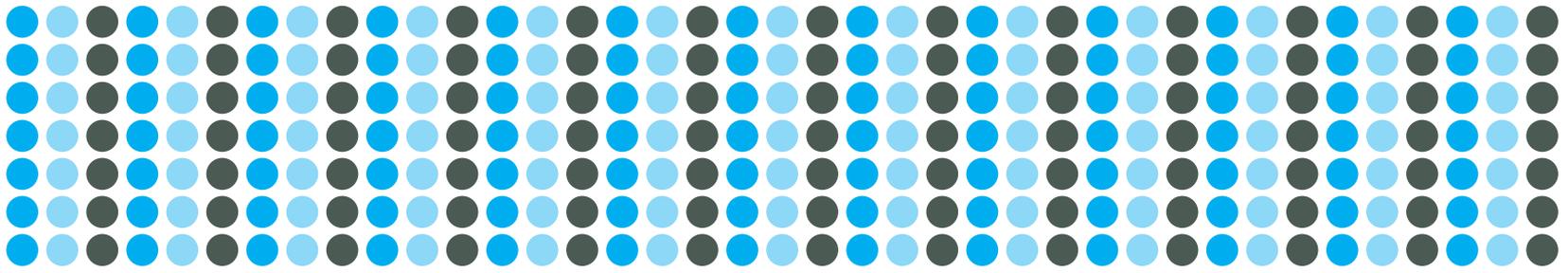
ALESSANDRA LUEDECKING

is a junior in the Morrissey College of Arts and Sciences double majoring in English and International Studies with a concentration in ethics and international social justice. After completing her undergraduate degree, she hopes to volunteer with the Jesuit Volunteer Corps in a two-year international program aimed at addressing social injustice and pursuing sustainable development in impoverished nations. She would like to teach English as a second language abroad, and then return to America to earn a master's degree and work for the United Nations. She is a member of the Christian a cappella group, Against The Current, and the Deputy Editor for *Elements*.



REBECCA MORETTI

is a junior in the Political Science Honors Program at Boston College. She was born in Los Angeles, but lived in Rome until the age of eight, before moving back to the United States, where she attended Harvard-Westlake school. She is interested in international security and diplomacy, and is fluent in five languages. At Boston College, Rebecca is a John Marshall Fellow and a staff writer for *The Heights*. Rebecca is passionate about writing and film and has published several plays that have been performed around the country. She is currently studying abroad at the University College London in the department of Political Science.



NATALIE PANARIELLO

is a senior at Boston College, majoring in Biology with a minor in Medical Humanities, Health, and Culture. To complement her academic interests in health policy and practice, Natalie has served as an editor for the Medical Humanities Journal of Boston College and interns at the health innovation center Ariadne Labs. Upon graduating from BC, Natalie hopes to pursue a J.D./M.P.H., which will prepare her for developing, advocating for, and implementing healthcare policy later in life. Her article “On the Wrong Side of the Tracks?” was written for the course HIV/AIDS and Ethics with Fr. James Keenan, SJ.



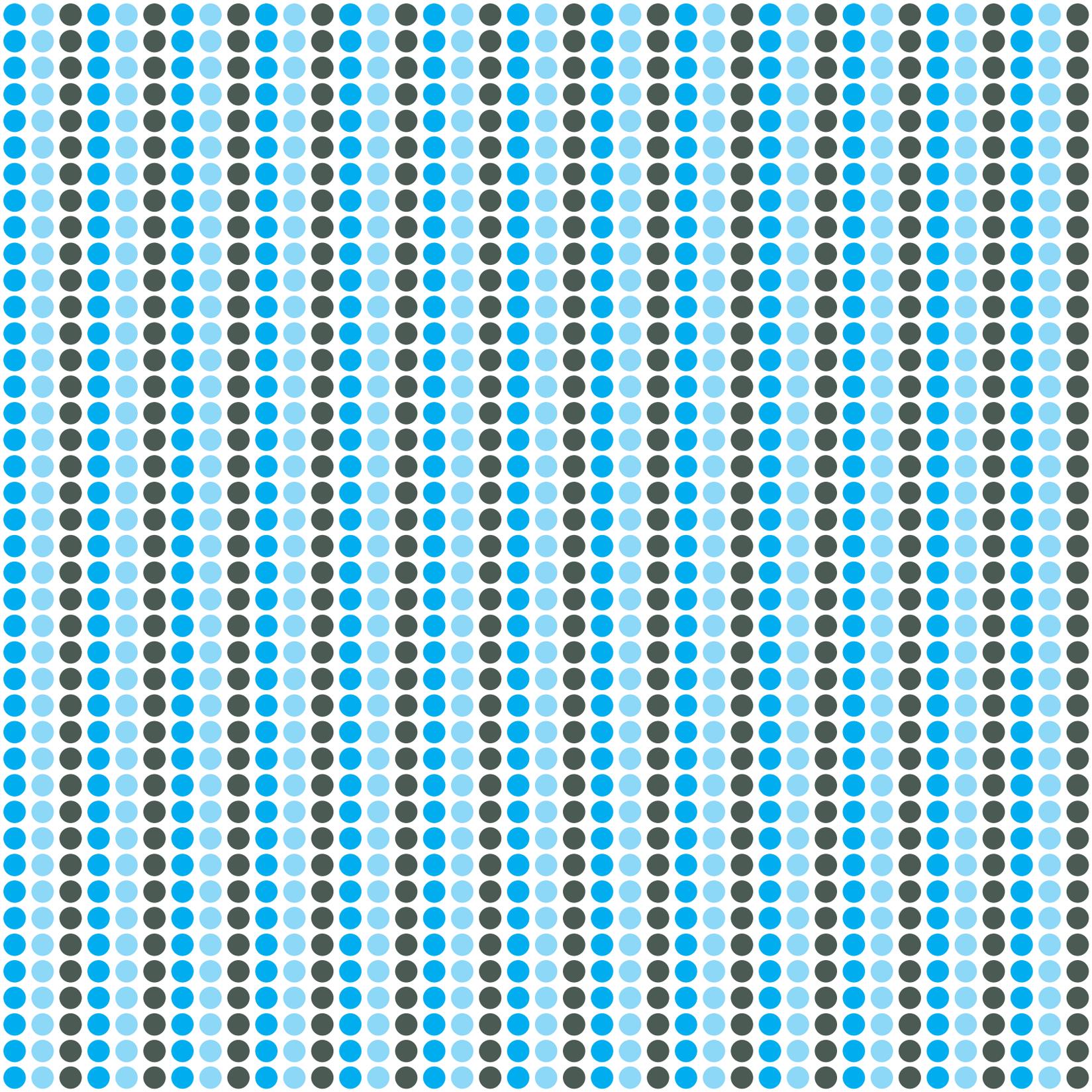
DANIEL PARK

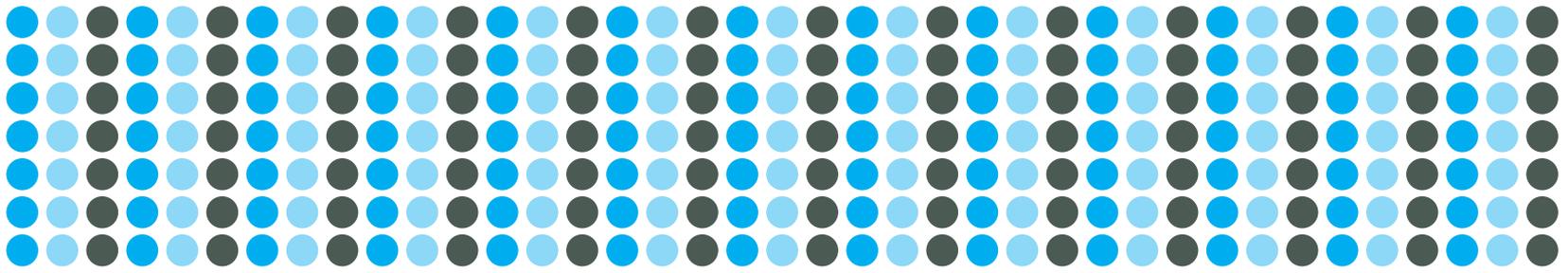
is a senior in the Morrissey College of Arts and Sciences majoring in International Studies. He was born in Los Angeles, lived in Israel, but now lives in Boston. After graduation, Dan is planning to attend graduate school to study international development to become a developmental consultant, while also working in corporate finance for a healthcare company during graduate school. In his free time, Dan enjoys spending time with friends and family, playing and watching sports, and making dumb jokes he thinks are funny.



KATHERINE QUIGLEY

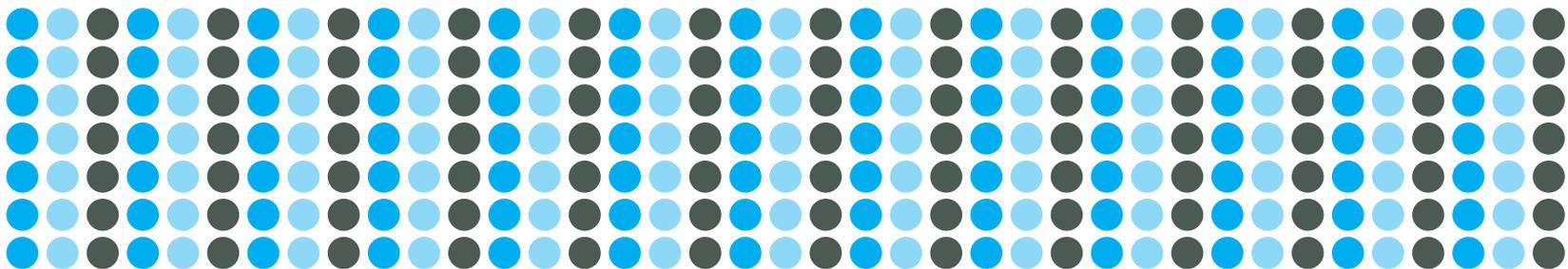
is a senior in the Morrissey College of Arts and Sciences. She is majoring in History and minoring in German and Women’s and Gender Studies. Last summer, she was awarded a fellowship at Historic Deerfield to study New England history, material culture, and museum studies. She is currently working on a Scholar of the College thesis about crime and gender in the late eighteenth century. After graduation, she plans to attend graduate school in order to work as a curator in a history museum.



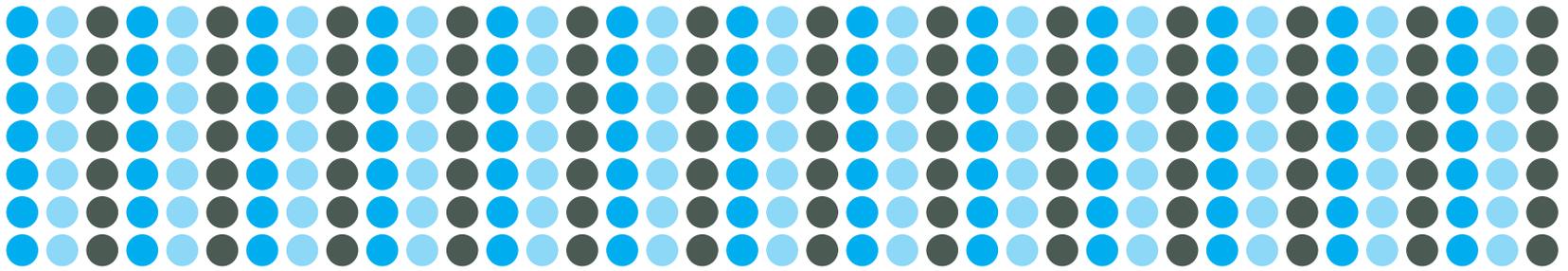


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