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Dear Reader,

I started working on the journal as an associate editor in 2019. Early on, the draw of the journal and its purpose struck a chord in me. Now, having worked every position in my time with the journal (some of them simultaneously), I was able to expand on past experiences to help me be the Editor in Chief. Understanding the importance of listening to members' ideas and concerns with an open mind allowed for a broader discussion of problems and approaches to solutions. Together, we cultivated an emotionally safe place where contributors can be creative and vulnerable—which I hope is reflected through this publication and the future of DUURJ.

Found in this issue are a wide range of topics including: The use of Buddhism by nationalists in religious violence and the misalignment of the Western pacifist view of Buddhism with local realities; An analysis of Defective Parking Function distributions through a multi-shuffle construction to investigate parking statistics; A policy paper regarding international seed aid policies and their effect on local agriculture sustainability and sovereignty; Finally, a discussion of how the differences between media outlet coverage of events change the audience's perception of the severity of the crime and the responsibility of offenders. Also included is an interview with Debak Das, Ph.D., and his engagement in international and nuclear politics, international security, his teaching career, and research. Interspersed throughout are stunning pieces of artwork ranging from photography to charcoal, to painting and screen-printing. Highlighted at the end of the publication are abstracts encompassing a vast array of undergraduate research conducted at DU this year.

The current journal efforts have been so enjoyable and rewarding, the team has moved past many difficulties, and the journal is now in a much stronger position for growth and longevity. Our largest shift for next year will be going from a bi-annual to an annual publication. This change enables us to work with the Writing Center to train editorial staff for a more well-rounded and consistent editorial process. It also allows space for engagement with peer reviewers and greater recruitment opportunities as well as greater selectivity in the works we choose to publish. Reorganization and training for next year's editorial staff were made a priority, and I could not be more appreciative of everyone's passion and commitment. With a stronger internal foundation, the journal can now focus on expansion and community engagement.

My tenure as Editor in Chief would have not been as successful were it not for all of the people that worked incredible hours, poured their blood and sweat onto the pages, and put their hearts into making the journal a valuable resource. I would like to thank Kate Tennis and Grace Warner for their advisory, support, and availability to me through this process. I would like to thank the current staff for all of their dedication and efforts and the incoming staff for setting a high bar for themselves and exceeding expectations. It was exciting to see so many of you grow through your willingness to step out of your comfort zone and cross into other editorial disciplines. I am confident in all members' collective ability to lead with conviction and continue to cultivate a safe place where students have a voice and feel engaged.

To next year's editorial staff, don't be complacent, have a creative eye, and continue to foster an inclusive environment. Focus on increasing outreach to bolster the quality and quantity of research submissions. Increase both internal and external DU community engagement. Push to make the journal a competitive place to publish where good critical feedback elevates the quality of submissions. I trust in you and your abilities, so have trust in yourselves and support each other to make it a truly enjoyable experience.

Sincerely,



Makenzie Bell
Editor in Chief



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Buddhist Nationalism: Rising Religious Violence in South Asia

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1 INTRODUCTION

Buddhist nationalism has contributed to expanding religious violence in many South Asian countries¹. The roots of this violent form of nationalism are complex and multi-faceted, making a clear solution difficult to achieve. Thailand, Sri Lanka, and Burma² are some of the most pressing and violent case studies in South Asia today and can illustrate the reliance of Buddhist nationalists on ethno-religious identities to relegate non-Buddhists to second-class status, to the point of massive acts of violence and aggression¹. This paper seeks to illuminate the complex social history driving the rise of Buddhist nationalism in these countries, particularly strong military-religion relationships, histories of colonial oppression, long-standing cultural tensions, and Western rhetoric regarding Buddhist values.

In the modern period, Buddhism has become increasingly politicized for the benefit of nationalist movements². Buddhist extremism is largely derived from the political contexts of increased ethnic nationalism and the influence of monks in Buddhist communities. Buddhist extremism often has more to do with ethnic tensions than religious tensions, though religious motivations are still substantial in many of the conflicts involving Buddhist extremists. In South Asian countries, the most substantial Buddhist nationalist movements tend to practice Theravada Buddhism. This Buddhist

¹The definition of “nationalism” used throughout this paper can be found in Merriam-Webster, and is as follows:

“loyalty and devotion to a nation

especially: a sense of national consciousness exalting one nation above all others and placing primary emphasis on promotion of its culture and interests as opposed to those of other nations or supranational groups”

<https://www.merriam-webster.com/dictionary/nationalism>.

²The use of “Burma” throughout this essay is intentional. The name Myanmar was enforced by the military junta that took over Burma in 1989. This was not a choice of the people, and most in Burma still prefer Burma to Myanmar. See this article for more information regarding the choice: https://www.voanews.com/a/east-asia-pacific_burma-or-myanmar-one-country-two-names/6201633.html

practice differs from other forms of Buddhism on the topic of non-violence and peace, aligning more closely with nationalist values and the connections between religion and state power; some Theravada sects view non-Buddhists as subhuman or second-class³.

2 HISTORY AND COLONIAL IMPACTS

The colonial legacy of many Buddhist nations is fundamental to the rise of Buddhist nationalism and the formation of national identity more broadly. With the exception of Thailand, all of the South Asian nations discussed in this paper have a history of British colonization. British occupation and colonization in Burma and Sri Lanka disrupted and ultimately ended thousands of years of royal patronage that Buddhists had enjoyed. In Sri Lanka, British colonists stripped local peasants of their land and forced many into indentured servitude. In Burma, both historical legacies and modern perceptions of Buddhism contribute to the religious persecution of Rohingya Muslims today. The British brought significant populations of immigrants from India, including Rohingya Muslims⁴, to fill government positions, though there were already some populations of these minority groups in Burma before British colonization. Colonial attitudes that condemned the practices and beliefs of Hindus and Muslims as well as those that elevated Buddhist practices of tolerance and pacifism have been used by Buddhist nationalists to justify violence towards and othering of the Rohingya Muslim population in Burma. Today, the Western perceptions of Buddhism as a peaceful and tolerant religion are similar to the tactics used by colonists to divide and control minority populations in Burma and Sri Lanka and may support a global discourse that perpetuates beliefs that have contributed to the vilification of Islam⁵. This essentializing of religions has amplified the tensions in South Asia between the diverse ethno-religious groups living in these countries⁶ and diminishes the reality of the delicate and complex situational history of these conflicts.

3 WESTERN PERCEPTIONS

Western perceptions of Buddhism tend to paint the religion as a broadly pacifist and peaceful religion. The values and precepts contained within the dharma of Buddhism would reasonably support this belief; however, regardless of the morals and values entrenched in the teachings of world religions, religions reliably fail to uphold these values and practitioners tend to regress to the broader spectrum of human nature. Buddhism is no exception to this pattern. As aptly put by Jarni Blakkarly in his article on Buddhist extremism, "It does not take much knowledge of Buddhism to realize just how irreconcilable the thinking of Buddhist extremists groups is with what the Buddha Gotama taught and the way Buddhism is practiced throughout most of the world"⁷. Much of the language used by Buddhist extremists to justify the marginalization of Muslims is borrowed directly from the Western discourse around Islam as a "dangerous" or "brutal" religion. Western narratives of Islam and Buddhism ignore complexities and the unique situations in which both religions are situated; both excessively positive and negative discourses are harmful. Even in the face of evidence of extreme violence executed or supported by Buddhist extremists, Western society still perpetuates the idea of Buddhism as a wholly peaceful religion, while simultaneously perpetuating stereotypes of Islam as a violent religion. Western intervention in the Middle East and North Africa has caused immense turmoil, while South Asian countries have not had the same experiences of conflict. These experiences influence Western perceptions of these religions and impact their ability to be critical of Buddhist nationalism. If Western nations were equally involved in regular and consistent military action in South Asia in the same way as they are in the Middle East and North Africa, perceptions of the inherent values of Buddhism and Islam would shift; however, Western nations are not engaged in military actions in South Asia in the same manner and are often blinded by the excessively positive perceptions of Buddhism, making them hesitant to engage with acts of violence perpetrated by Buddhist nationalists.

4 BUDDHISM AND VIOLENCE

Buddhist beliefs, sites, and practices have often been co-opted by nationalist movements in order to establish legitimacy with the public. In Burma, the government routinely and publicly uses Buddhist sacred sites, the sangha, and Buddhist teachings to legitimize their rule and to justify the marginalization of non-Buddhist citizens⁸. In Sri Lanka, Sinhalese Buddhist nationalist movements largely stem from Angarika Dharmapala, who was a Buddhist missionary and supporter of independence efforts in Sri Lanka. He used the

story of a Sri Lankan king from the second century BCE, Dutugemunu, in order to justify violence against the Tamils. The story itself focuses on the king's campaign against non-Buddhists, accompanied by Buddhist monks who told him that he had committed no sin in killing non-Buddhists because they were nonbelievers⁸. Thai nationalists have developed their ideology around a reinterpretation of the Buddhist concept of the Triple Gem—the Buddha, the dharma, and the sangha—that focused instead on the nation, religion, and king⁹. The precepts contained within the Eightfold Path, which specifically prohibits taking life from another or causing harm or injustice to others,⁷ would seem to be in direct opposition to the actions of extremist Buddhist nationalists, yet many find justifications for their actions.

A perceived decline of Buddhist teachings and influence relative to other religions (namely Islam and Hinduism) may also be contributing to the rise of Buddhist nationalist movements out of a desire to protect Buddhism from outside threats⁵. Much of this discourse focuses on Buddhism's reputation as a peaceful and tolerant religion while perpetuating the belief that Muslims, specifically Rohingya Muslims are an "exclusivist and proselytizing religion that is bent on geographical and cultural conquest through conversion and marriage"⁵. This is directly related to Burma's colonial history and the movement of Rohingya Muslims into Burma. In Sri Lanka, very similar nationalist movements have established themselves, but have been focused on the Sinhalese majority and the Tamil Hindu minority, rather than Muslim populations; the Sinhalese regard the Hindu presence as a threat to the "last bastion of true Buddhism,"⁵ and the nationalist movement has been focused on the creation of an exclusively Buddhist nation. In both situations, as with the ideology of other nationalist movements, the specific and deliberate othering of minority groups is key to establishing and legitimizing nationalist ideology.

5 CASE STUDIES

5.1 Sri Lanka

Sri Lanka is a predominantly Buddhist country, known today as the traditional home of Buddhism. Since its introduction to the island in the third century BCE, it has changed and adapted in many ways. During its colonial era, Buddhism was oppressed by the British in order to maintain control, but it flourished again in the post-colonial period. Buddhist Sinhalese nationalists have frequently made justifications for the use of violence in the name of identity protection, and the protection of Sri Lanka as the home of Buddhism. Many of these justifications come from historical Buddhist documents, which have been utilized by the Sinhalese majority to

support the removal of Tamils from Sri Lanka in order to preserve its role in Buddhist history. The post-colonial era in Sri Lanka created conditions that were encouraging of pro-Sinhalese ideology and violence and exclusionary politics. Many Buddhist monks in Sri Lanka became involved in Sinhalese nationalist movements as a result of their desire to be more politically active for their constituents¹. In tandem with the rise of Buddhist nationalism and extremism in Sri Lanka, one can also see a rise in Buddhist peace efforts, particularly following the end of a nearly 26-year-long civil war in 2009. In Sri Lanka, these peace efforts emphasize shared experiences over distinguishing minority differences and engage in meditation as a practice to prevent the thought processes that lead to violence. Additionally, they try to involve youth in grassroots social organizations and volunteering efforts in order to facilitate communal peace. Engaged Buddhism was one solution to the Sri Lankan war in 2009 and emerged as a major peace process in the wake of the war's conclusion². Buddhist nationalism is a loud minority within the broader Buddhist community in many South Asian countries, and there are significant efforts to combat the impacts of these agendas, particularly in Sri Lanka.

5.2 *Burma*

Following the end of Britain's colonial control over Burma, the Burmese military established Buddhist majority rule over other ethnic groups, exacerbating tensions in order to distract from the worsening economic situation within Burma³. The Rohingya genocide has predominantly been executed by a heavily armed military junta against a poorly resourced and significantly outmanned minority population⁶. The actions of the Burmese military have been supported by Buddhist extremists as well as the government of Burma; the President of Burma, also a Buddhist nationalist, has explicitly voiced support for the actions of the military toward the Rohingya⁴. Burma's condition of being a transitioning state moving from military rule towards greater democratization has led to exacerbating anxieties and tensions toward ethnoreligious minorities like the Rohingya. This has allowed the military to redefine and legitimize its role in the political sphere. The genocide in Burma is not simply a product of the military junta but is driven by modern confrontations resulting from the historical tensions between Rohingya Muslims and Rakhine Buddhists. The Rakhine (the Buddhist population in the region of Burma where the genocide is occurring) are not a majority in Burma and are also a struggling minority group in one of Burma's poorest regions, though the land itself has substantial natural resources¹⁰.

Atrocities and human rights violations have forced many Rohingyas to flee to Bangladesh. During the elec-

tion in 1990, the military used White Cards, a temporary citizenship card that allowed cardholders to vote, in order to escalate tensions between Rohingyas and Rakhines. Many of the cardholders were Rohingya, and the election results incited violent clashes between the groups, to which the military responded with an intense crackdown and massive human rights violations⁴. In another example, following a rumor that a Buddhist woman had been raped and murdered by Rohingya men, mass killings of Rohingyas took place at the hands of Rakhines, the military, and security forces. Following this event, the military and government cracked down on the Rohingyas, with the government asking Rakhines to evict Rohingyas from their homes, displacing 140,000 Rohingyas⁴. These actions reflect a long-held sentiment from Buddhist nationalists and monks demanding that the government and military remove Rohingyas from Burma, supported by nationalist perceptions of the Rohingya as foreign invaders and destabilizers.

Burma lacks a robust constitution and consistent enforcement and protection of rule of law and civil rights. Citizenship laws in Burma have routinely disenfranchised Rohingyas since the end of British control in 1948. Citizenship laws in 1982, for example, made citizenship for Rohingyas incredibly restricted, requiring them to both prove that they could speak one of the official languages and that their families had lived in Burma prior to its independence from the British in 1948⁴. Rohingya civil and human rights are still severely limited; their movement, rights to marriage and children, and other liberties are restricted by the government. Birth control legislation has been implemented, targeting ethnic minorities like the Rohingya in efforts to reduce population growth of non-Buddhist groups and to protect the Buddhist national identity through homogeneity, with the government referring to Rohingya civilians as "Bengali,"³ purposeful move to reinforce nationalist perceptions of the Rohingya as other and foreign.

5.3 *Thailand*

Thailand is the only case study covered here that does not experience colonization, yet still sees a rise in extremist Buddhist nationalist movements. As Thailand transitioned from an absolute monarchy to a constitutional monarchy in the 1930s, the monarchy was relegated to a ceremonial status while the Buddhist sangha secured greater power and influence within Thai society. During the Cold War, prominent members of the Buddhist sangha were complicit or even participants in mass killings of those suspected to be communists or sympathetic to communism, which were often also ethnic minorities. These groups were arrested, tortured, and killed by military and para-military regimes backed by the United States. Many leaders in the Thai sangha

supported the military regime and often endorsed or minimized the violence. The monk Kittivuddho is a strong example of this. Known by many as the "exterminator monk," Kittivuddho was famous for delivering a speech: "Killing Communists is Not a Sin" and for advocating a holy war against communism. He often preached that killing communists did not violate the Buddhist precept against taking another life because communists were not human beings, and even further, that killing communists was a spiritual and civic duty to fulfill⁹. Justifications of violence such as these are contradictory to traditional Buddhist beliefs, particularly regarding the value of human life. The rise of a religiously motivated and supported nationalist movement is unique in Thailand due to the lack of colonial legacy within Thailand itself, though it was influenced by the colonial impacts seen in neighboring nations like Vietnam, Cambodia, and Burma; the religious violence and nationalist ideas from neighboring countries often spilled over into Thailand⁸. Thai Buddhist nationalism was supported by the government and the community rather than suppressed or operating in spite of pressure from either the top or bottom of society. Thailand was incredibly successful at reducing the impacts and sway of Buddhist nationalism within Thai politics since the 1990s, but elections and military juntas have destabilized Thai politics, allowing Buddhist nationalism to rear its head once again⁸.

6 CONCLUSION

Buddhism encompasses many pacifist and peaceful dogmas and precepts, but that does not necessarily mean that the adherents of Buddhism will always abide by these tenets. Thailand, Sri Lanka, and Burma have all proven this in their individual experiences with Buddhist nationalism and the religious violence that stems from nationalist politics. From a Western perspective, it can be challenging to reconcile the Buddhism the West knows with the Buddhist nationalism that is rising in South Asia and to rationalize the news of atrocities perpetrated by Buddhist monks and laymen in the name of a religion the West considers to be pacifist and peaceful. Religions can set tenets and values for their adherents, but as Buddhist philosophers note, if everyone were capable of rational action and moral life, there would be no need for Buddhism⁵. It is ultimately the actions of the practitioners—like Kittivuddho and Dharampala—of religions that shape their existence in this world and their perception by other cultures. Not unlike extremist nationalists of other religions, many Buddhist nationalists have found ways to explain their actions within the context of Buddhism, absolving themselves of moral responsibility through scripture.

7 EDITOR'S NOTES

This article was peer-reviewed.

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CommUnity by Josephine Wilmes
Acrylic Paint on Canvas



Urban Architecture by Aaron Butwinick
Captured on iPhone

Asymptotic Behavior of Random Defective Parking Functions

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Abstract

Suppose that m drivers each choose a preferred parking space in a linear car park with n spots. In order, each driver goes to their desired spot and parks there if possible. If the spot is already occupied then the car parks in the first available spot after that; if no such spot is available then the car leaves the street without parking. When $m > n$, there will always be defects—cars that are not able to park. Building upon the work in Cameron et al. "Counting defective parking functions,"¹ we introduce a multi-shuffle construction to defective parking functions and investigate parking statistics of a defective parking function chosen uniformly at random.

Keywords: Parking function, Multi-shuffle, Asymptotic expansion

1 INTRODUCTION

The study of parking functions began when Konheim and Weiss² investigated linear probes of hashing storage structures in computer science. Since then, mathematical researchers have applied the concept of parking functions in many intersecting disciplines such as combinatorics, probability, and group theory. The parking problem has counterparts in the enumerative theory of labeled trees and forests³, in the analysis of non-crossing partitions and hyperplane arrangements,^{4,5} in the configuration of abelian sandpiles,⁶ among others. We refer to Yan⁷ for a comprehensive survey.

The general structure of a parking function problem takes the following form: Consider a parking lot with n parking spots placed sequentially along a one-way street. A line of m cars enters the lot, one by one. The i th car drives to its preferred spot π_i and parks there if possible. If the spot is already occupied then the car parks in the first available spot after that; if no such spot is available then the car leaves the street without parking.

Denote the list of such car preferences by $\pi = (\pi_1, \dots, \pi_m)$, where $1 \leq \pi_i \leq n$ for every $1 \leq i \leq m$. We study the situation that $m \geq n$ and at least $k \leq n$ cars park successfully, i.e., there are at most $n - k$ unoccupied spots. In the special case $m = n = k$, this reduces to the classical situation where all cars get to park and all spots are occupied. Allowing $m > n \geq k$ introduces more complication to the parking scenario, as not all cars can park under any circumstances and

there will always be cars that leave the street. These parking preferences are therefore referred to as "defective parking functions" (DPF) and are explored in depth by Cameron et al.¹ Their results include counting defective parking functions $\text{DPF}(m, n, k)$, providing an equivalent expression given by Abel's binomial theorem, and studying the asymptotics. If $m > n = k$, then no spots are left unoccupied, so in some sense it still describes a "successful" parking situation. We thus denote $\text{DPF}(m, n, n)$ for brevity by $\text{SPF}(m, n)$. By taking the difference of having at least $k + 1$ cars park successfully and at least k cars park successfully, we can also identify the parking preferences that lead to exactly k cars parking successfully.

The reader might be curious as to why we investigate the situation where at least k cars park when there are m cars and n spots rather than directly investigate under what condition exactly k cars park; the following proposition explains why by relating the parking preferences to \mathbf{u} -parking functions. Given a positive integer-valued vector $\mathbf{u} = (u_1, \dots, u_m)$ with $u_1 \leq \dots \leq u_m$, a \mathbf{u} -parking function of length m is a sequence $\pi = (\pi_1, \dots, \pi_m)$ of positive integers whose non-decreasing rearrangement $(\lambda_1, \dots, \lambda_m)$ satisfies $\lambda_i \leq u_i$ for all $1 \leq i \leq m$. We denote the set of \mathbf{u} -parking functions by $\text{PF}(\mathbf{u})$.

Proposition 1.1. *Take a sequence of positive integers $\pi = (\pi_1, \dots, \pi_m)$ with $1 \leq \pi_i \leq n$ for all $1 \leq i \leq m$. Then $\pi \in \text{DPF}(m, n, k)$ if and only if $\pi \in \text{PF}(\mathbf{u})$, where $\mathbf{u} = (n - k + 1, n - k + 2, \dots, n, \dots, n)$ is a vector of length m . Explicitly, \mathbf{u} is a concatenation of an increasing arithmetic*

sequence of length k starting from $n - k + 1$ and ending at n and a constant sequence of length $m - k$ where each term takes value n .

Remark 1. Note that Proposition 1.1 implies that the set of defective parking functions $\text{DPF}(m, n, k)$ is invariant under the action of \mathfrak{S}_m by permuting cars. This proposition also gives a criterion for defective parking functions.

Remark 2. To show this equivalence, we will use the pigeonhole principle to show that for a given $\text{DPF}(m, n, k)$ there is a \mathbf{u} -parking function that will produce the same parking result.

Proof. For cars that do not park, their preference can be any of the n available spots on the street. But for cars that are able to park, their preference needs to satisfy the pigeonhole principle. Having at least k spots taken is equivalent to ensuring that among those cars that park, we have at most one car prefer spot n , at most two cars prefer spot $\geq n - 1$, and for each $i \leq k$ at most i cars prefer spot $\geq n - i + 1$. This combined condition for parked and unparked cars is further equivalent to having at least $k - 1$ cars prefer spot $\leq n - 1$, at least $k - 2$ cars prefer spot $\leq n - 2$, and at least one car prefer spot $\leq n - k + 1$. Forming the non-decreasing rearrangement $(\lambda_1, \dots, \lambda_m)$ of the parking preference (π_1, \dots, π_m) involves a switch of coordinates from $(i, \#\{j : \pi_j \leq i\})$ to (λ_j, j) and gives the \mathbf{u} -parking function criterion. \square

This paper is organized as follows: Section 2 illustrates the notion of parking function multi-shuffle that decomposes a defective parking function into smaller components (Definition 2.3 and Theorem 2.5); Section 3 uses the multi-shuffle construction introduced in Section 2 to investigate parking statistics of a defective parking function chosen uniformly at random. We give exact and asymptotic formulas for the distribution of the first parking coordinate in Proposition 3.1 and Theorem 3.2. Due to permutation symmetry, the result may be interpreted for any parking coordinate. Section 4 provides some further directions for research.

1.1 Notations

Let \mathbb{N} be the set of non-negative integers. For $m, n \in \mathbb{N}$, we write $[m, n]$ for the set of integers $\{m, \dots, n\}$ and $[n] = [1, n]$. For vectors $\mathbf{u}, \mathbf{v} \in [n]^m$, denote by $\mathbf{u} \leq \mathbf{v}$ if $u_i \leq v_i$ for all $i \in [m]$; this is the component-wise partial order on $[n]^m$. In a similar fashion, denote by $\mathbf{u} < \mathbf{v}$ if $u_i \leq v_i$ for all $i \in [m]$ and there is at least one $j \in [m]$ such that $u_j < v_j$. For $\mathbf{v} \in [n]^m$, we write $[\mathbf{v}]$ for the set of $\mathbf{u} \in [n]^m$ with $\mathbf{u} \leq \mathbf{v}$.

Remark 3. With Proposition 1.1, we know that parking functions are shuffle invariant, so any ordering will

produce the same result. The set $[n]^m$ refers to all reorderings of the arithmetic series $[1 \dots n]$, which we have shown to be equivalent to the non-decreasing ordering $\{1, 2, \dots, n\}$.

Remark 4. We will use $[v]$ to refer to the set of vectors that produce the same parking result as v , so any results that apply to v will apply to those vectors which are component-wise less or equal.

Example 1.2

Let $\mathbf{v} \in \text{DPF}(6, 6, 1)$, $\mathbf{v} = (1, 3, 3, 5, 6, 6)$. The fact that \mathbf{v} is a parking function can be recovered by using Proposition 1.1. The set $[\mathbf{v}]$ will contain $u = (1, 1, 1, 5, 5, 5)$ as well as $u = (1, 3, 3, 5, 5, 6)$.

2 PARKING FUNCTION MULTI-SHUFFLE

From Proposition 1.1, we see that in order to characterize the structure of parking preferences in $\text{DPF}(m, n, k)$, we will be primarily concerned with examining \mathbf{u} -parking functions where \mathbf{u} is a concatenation of an increasing arithmetic sequence and a constant sequence, and either of these sequences may be empty in the extreme case ($k = 1$ and $m = k$ respectively). In this section, we explore the properties of such \mathbf{u} -parking functions through a parking function multi-shuffle construction. The construction is an extension to the framework studied in Yin⁸ where generic \mathbf{u} -parking functions $\mathbf{u} = (u_1, \dots, u_m)$ with $u_i < u_{i+1}$ for every i was considered.

Remark 5. Multi-shuffles are a construction in which some of the elements of the parking vector are given, and the rest of the vector can be filled in with some possibilities based on the number of successes k given. The multi-shuffle is the set of possible values that would satisfy k . This construction allows us to study more general Defective Parking Functions by working with a family of Parking Functions instead of one explicit vector.

We will write our results in terms of parking coordinates π_1, \dots, π_l for explicitness, where $1 \leq l \leq m$ is any integer. But due to permutation symmetry established in Proposition 1.1, they may be interpreted for any coordinates. Temporarily fix π_{l+1}, \dots, π_m . Let

$$A_{\pi_{l+1}, \dots, \pi_m} = \{\mathbf{v} = (v_1, \dots, v_l) : (v_1, \dots, v_l, \pi_{l+1}, \dots, \pi_m) \in \text{DPF}(m, n, k)\}, \quad (2.1)$$

where \mathbf{v} is in non-decreasing order.

Proposition 2.1. Fix π_{l+1}, \dots, π_m . Then $A_{\pi_{l+1}, \dots, \pi_m} = [\mathbf{v}]$ for a unique \mathbf{v} .

Remark 6. Here we are fixing the last $m - l$ elements of the vector. Then we show that $[\mathbf{v}]$ is exactly the set of vectors which when combined with $(\pi_{l+1}, \dots, \pi_m)$ will be in the set of $\text{DPF}(m, n, k)$.

Proof. From the equivalence shown in Proposition 1.1, it is sufficient to display the unique maximal \mathbf{v} so that $(v_1, \dots, v_l, \pi_{l+1}, \dots, \pi_m) \in \text{PF}(\mathbf{u})$, where $\mathbf{u} = (n - k + 1, n - k + 2, \dots, n, \dots, n)$ is a vector of length m . We arrange π_i for $l + 1 \leq i \leq m$ in non-decreasing order, denoted by $\pi_{(l+1)} \leq \dots \leq \pi_{(m)}$. Set $n_l = 0$. We find the minimum index n_i in order, starting with n_{l+1} , such that $n_i > n_{i-1}$ and $u_{n_i} \geq \pi_{(i)}$ for each $l + 1 \leq i \leq m$. If such u_{n_i} 's cannot be located, then $A_{\pi_{l+1}, \dots, \pi_m}$ is empty. Otherwise excluding these u_{n_i} 's from \mathbf{u} gives the optimal \mathbf{v} . From the parking scheme, if $\mathbf{v} \in A_{\pi_{l+1}, \dots, \pi_m}$, then $\mathbf{w} \in A_{\pi_{l+1}, \dots, \pi_m}$ for all $\mathbf{w} \leq_{\mathcal{C}} \mathbf{v}$, where $\leq_{\mathcal{C}}$ is the component-wise partial order. This implies that if $A_{\pi_{l+1}, \dots, \pi_m}$ is non-empty, then there is a unique maximal element in component-wise partial order in $A_{\pi_{l+1}, \dots, \pi_m}$, when we require that \mathbf{v} is arranged in non-decreasing order. \square

Example 2.2. Take $m = 8, n = 6$, and $k = 4$. Consider $\text{DPF}(8, 6, 4)$ with associated $\mathbf{u} = (u_1, \dots, u_8) = (3, 4, 5, 6, 6, 6, 6, 6)$. Take $l = 5$ and set $\pi_6 = 6, \pi_7 = 4$ and $\pi_8 = 6$. Then $A_{\pi_6, \pi_7, \pi_8} = [\mathbf{v}] = [(u_1, u_3, u_6, u_7, u_8)] = [(3, 5, 6, 6, 6)]$. See illustration below.

v_1		3	u_1
$\pi_{(6)}$	4	\leq	4
v_2		5	u_3
$\pi_{(7)}$	6	\leq	6
$\pi_{(8)}$	6	\leq	6
v_3		6	u_6
v_4		6	u_7
v_5		6	u_8

We conclude from Proposition 2.1 and Example 2.2 that when the last $m - l$ parking preferences of an element of $\text{DPF}(m, n, k)$ are given, we only need to find the largest feasible first l parking preferences. Correspondingly, we introduce a combinatorial construction which we term a parking function multi-shuffle to \mathbf{u} -parking functions of the form $\mathbf{u} = (n - k + 1, n - k + 2, \dots, n, \dots, n)$. This construction will connect the identification of the maximal element in $A_{\pi_{l+1}, \dots, \pi_m}$ to the decomposition of π_{l+1}, \dots, π_m into a multi-shuffle.

Definition 2.3 (parking function multi-shuffle). Take $1 \leq k \leq n \leq m$ and $1 \leq l \leq m$.

- (Generic mixed case) Let $\mathbf{v} = (v_1, \dots, v_l) \in [n]^l$ be such that $n - k + 1 \leq v_1 < \dots < v_r < v_{r+1} = \dots = v_l = n$ for some r with $r \leq k - 1$ and $l - r \leq m - k + 1$. Say that π_{l+1}, \dots, π_m is a parking function multi-shuffle of $r + 1$ \mathbf{u} -parking functions $\alpha_1 \in \text{PF}(n - k +$

$1, n - k + 2, \dots, v_1 - 1), \alpha_2 \in \text{PF}(1, 2, \dots, v_2 - v_1 - 1), \dots, \alpha_r \in \text{PF}(1, 2, \dots, v_r - v_{r-1} - 1)$, and $\alpha_{r+1} \in \text{PF}(1, 2, \dots, n - v_r, \dots, n - v_r)$ if π_{l+1}, \dots, π_m is any permutation of the union of the $r + 1$ words $\alpha_1, \alpha_2 + (v_1, \dots, v_1), \dots, \alpha_{r+1} + (v_r, \dots, v_r)$. (Some α_j might be empty.) We will denote this by $(\pi_{l+1}, \dots, \pi_m) \in \text{MS}(\mathbf{v})$.

- (Special case: increasing arithmetic sequence) Let $\mathbf{v} = (v_1, \dots, v_l) \in [n]^l$ be such that $n - k + 1 \leq v_1 < \dots < v_l < n$ with $l \leq k - 1$. Say that π_{l+1}, \dots, π_m is a parking function multi-shuffle of $l + 1$ \mathbf{u} -parking functions $\alpha_1 \in \text{PF}(n - k + 1, n - k + 2, \dots, v_1 - 1), \alpha_2 \in \text{PF}(1, 2, \dots, v_2 - v_1 - 1), \dots, \alpha_l \in \text{PF}(1, 2, \dots, v_l - v_{l-1} - 1)$, and $\alpha_{l+1} \in \text{PF}(1, 2, \dots, n - v_l, \dots, n - v_l)$ if π_{l+1}, \dots, π_m is any permutation of the union of the $l + 1$ words $\alpha_1, \alpha_2 + (v_1, \dots, v_1), \dots, \alpha_{l+1} + (v_l, \dots, v_l)$. (Some α_j might be empty.) We will denote this by $(\pi_{l+1}, \dots, \pi_m) \in \text{MS}(\mathbf{v})$.

Example 2.4. Take $m = 10, n = 8, k = 6$, and $l = 3$.

- (Generic mixed case) Set $v_1 = 4, v_2 = 6$, and $v_3 = 8$. Take $\alpha_1 = (3) \in \text{PF}(3), \alpha_2 = (1) \in \text{PF}(1)$, and $\alpha_3 = (2, 1, 1, 1, 2) \in \text{PF}(1, 2, 2, 2, 2)$. Then $(7, 5, 3, 8, 7, 8, 7) \in \text{MS}(4, 6, 8)$ is a multi-shuffle of the three words $(3), (5)$, and $(8, 7, 7, 7, 8)$.
- (Special case: increasing arithmetic sequence) Set $v_1 = 3, v_2 = 5$, and $v_3 = 7$. Take $\alpha_1 = \emptyset, \alpha_2 = (1) \in \text{PF}(1), \alpha_3 = (1) \in \text{PF}(1)$, and $\alpha_4 = (1, 1, 1, 1, 1) \in \text{PF}(1, 1, 1, 1, 1)$. Then $(8, 8, 6, 4, 8, 8, 8) \in \text{MS}(3, 5, 7)$ is a multi-shuffle of the four words $\emptyset, (4), (6)$, and $(8, 8, 8, 8, 8)$.

Theorem 2.5. Take $1 \leq k \leq n \leq m$ and $1 \leq l \leq m$. Let $\mathbf{v} = (v_1, \dots, v_l) \in [n]^l$ be in non-decreasing order as in Definition 2.3. Then $A_{\pi_{l+1}, \dots, \pi_m} = [\mathbf{v}]$ if and only if $(\pi_{l+1}, \dots, \pi_m) \in \text{MS}(\mathbf{v})$.

Remark 7. Here we are expanding on the result from Proposition 2.1 by allowing $(\pi_{l+1}, \dots, \pi_m)$ to be non-consecutive, we need the extra requirement that $(\pi_{l+1}, \dots, \pi_m)$ is in the set of multi-shuffles for \mathbf{v} .

Remark 8. For the special case where \mathbf{v} is a constant sequence with $v_1 = \dots = v_l = n$ and $l \leq m - k + 1$, $A_{\pi_{l+1}, \dots, \pi_m} = [\mathbf{v}]$ if and only if $(\pi_{l+1}, \dots, \pi_m) \in \text{PF}(\mathbf{u})$, where $\mathbf{u} = (n - k + 1, n - k + 2, \dots, n, \dots, n)$ is a vector of length $m - l$. Trivially, it is a multi-shuffle of only one word.

Proof. Following the equivalence established in Proposition 1.1, set $\mathbf{u} = (n - k + 1, n - k + 2, \dots, n, \dots, n)$ to be a vector of length m .

" \implies " Take $\pi = (v_1, \dots, v_l, \pi_{l+1}, \dots, \pi_m)$ a \mathbf{u} -parking function, where \mathbf{v} is maximally compatible with the fixed π_{l+1}, \dots, π_m . Therefore we must have $v_i \geq n - k + 1$ and $v_i = u_{v_i - n + k}$ for every $1 \leq i \leq l$ since otherwise the value of v_i may be increased, contradicting the maximality assumption.

Hence excluding the first l cars, π has exactly $v_1 - n + k - 1$ cars with preference $\leq v_1 - 1$ (name the subsequence α_1), exactly $v_2 - v_1 - 1$ cars with preference $\geq v_1 + 1$ and $\leq v_2 - 1$ (name the subsequence α_2'), \dots . Construct $\alpha_2 = \alpha_2' - (v_1, \dots, v_1), \alpha_3 = \alpha_3' - (v_2, \dots, v_2), \dots$. It is clear from the above reasoning that $\alpha_1 \in \text{PF}(n - k + 1, n - k + 2, \dots, v_1 - 1), \alpha_2 \in \text{PF}(1, 2, \dots, v_2 - v_1 - 1), \dots$. By Definition 2.3, $(\pi_{l+1}, \dots, \pi_m) \in \text{MS}(\mathbf{v})$.

" \longleftarrow " We first show that $\pi = (v_1, \dots, v_l, \pi_{l+1}, \dots, \pi_m)$ is a \mathbf{u} -parking function. This is immediate, since from Definition 2.3, the non-decreasing rearrangement of π is a concatenation of $\alpha_1, v_1, \alpha_2 + (v_1, \dots, v_1), v_2, \dots$.

Next we show that $\pi^i = (v_1, \dots, v_{i-1}, v_i + 1, v_{i+1}, \dots, v_l, \pi_{l+1}, \dots, \pi_m)$ is not a \mathbf{u} -parking function for any $1 \leq i \leq l$. This is clear when $v_i = n$. Suppose $v_i < n$, then the non-decreasing rearrangement of π^i only differs from the non-decreasing rearrangement of π in the $(v_i - n + k)$ -th position with value $v_i + 1 > v_i = u_{v_i - n + k}$.

Combining, we have $A_{\pi_{l+1}, \dots, \pi_m} = [\mathbf{v}]$. □

Remark 9. Even though multi-shuffle is not explicitly mentioned in the main proof of Theorem 3.2, being able to construct multi-shuffles on parking functions is a very important technique that allows for the counting of parking functions.

Example 2.6 (Continued from Example 2.4). Take $m = 10, n = 8, \text{ and } k = 6$. Consider $\text{DPF}(10, 8, 6)$ with associated $\mathbf{u} = (3, 4, 5, 6, 7, 8, 8, 8, 8, 8)$. Then $A_{7,5,3,8,7,8,7} = [(4, 6, 8)]$ is equivalent to $(7, 5, 3, 8, 7, 8, 7) \in \text{MS}(4, 6, 8)$ and $A_{8,8,6,4,8,8,8} = [(3, 5, 7)]$ is equivalent to $(8, 8, 6, 4, 8, 8, 8) \in \text{MS}(3, 5, 7)$. See illustration below.

$\pi_{(4)}$	3	\leq	3	u_1		v_1		3	u_1	
v_1			4	u_2		$\pi_{(4)}$	4	\leq	4	u_2
$\pi_{(5)}$	5	\leq	5	u_3		v_2		5	u_3	
v_2			6	u_4		$\pi_{(5)}$	6	\leq	6	u_4
$\pi_{(6)}$	7	\leq	7	u_5		v_3		7	u_5	
$\pi_{(7)}$	7	\leq	8	u_6		$\pi_{(6)}$	8	\leq	8	u_6
$\pi_{(8)}$	7	\leq	8	u_7		$\pi_{(7)}$	8	\leq	8	u_7
$\pi_{(9)}$	8	\leq	8	u_8		$\pi_{(8)}$	8	\leq	8	u_8
$\pi_{(10)}$	8	\leq	8	u_9		$\pi_{(9)}$	8	\leq	8	u_9
v_3			8	u_{10}		$\pi_{(10)}$	8	\leq	8	u_{10}

3 PARKING STATISTICS

In this section, we use the multi-shuffle construction introduced in Section 2 to investigate parking statistics of random defective parking functions and identify a sharp transition. We will utilize some counting formulas from Cameron et al¹ where it was shown that

$$\begin{aligned}
 |\text{DPF}(m, n, k)| &= (n - k + 1) \sum_{j=k}^m \binom{m}{j} (n - k + j + 1)^{j-1} (k - j - 1)^{m-j} \\
 &= n^m - (n - k + 1) \sum_{j=0}^{k-1} \binom{m}{j} (n - k + j + 1)^{j-1} (k - j - 1)^{m-j},
 \end{aligned} \tag{3.1}$$

and in particular,

$$|\text{SPF}(m, n)| = \sum_{j=n}^m \binom{m}{j} (j + 1)^{j-1} (n - j - 1)^{m-j} = n^m - \sum_{j=0}^{n-1} \binom{m}{j} (j + 1)^{j-1} (n - j - 1)^{m-j}. \tag{3.2}$$

Here the equivalence of the expressions is due to Abel's binomial theorem. Recall that parking coordinates satisfy permutation symmetry, so the statements in this section may be interpreted for any parking coordinates and not just the first parking coordinate.

Proposition 3.1. Take $m > n \geq k$. The number of defective parking functions $\pi \in \text{DPF}(m, n, k)$ with $\pi_1 = j$ is

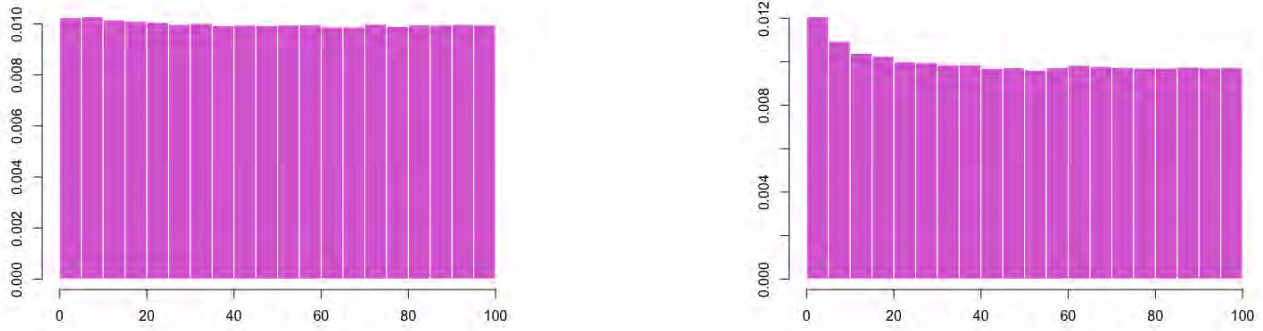


Figure 1. The distribution of π_1 (the first parking coordinate) in 100,000 samples of defective parking functions chosen uniformly at random from DPF(120, 100, 95) (left plot) and DPF(120, 100, 99) (right plot).

Remark 10. We were most interested in the behavior for $\pi_1 = 1$ because, as the distributions show, the asymptotic behavior is more present at smaller values

$$\begin{aligned}
 & \sum_{v=\max(j, n-k+1)}^{n-1} \binom{m-1}{n-v+m-k} (n-k+1)v^{k-n+v-2} \\
 & \cdot \left[(n-v)^{n-v+m-k} - \sum_{s=0}^{n-v-1} \binom{n-v+m-k}{s} (s+1)^{s-1} (n-v-s-1)^{n-v+m-k-s} \right] \\
 & + \left[n^{m-1} - (n-k+1) \sum_{s=0}^{k-1} \binom{m-1}{s} (n-k+s+1)^{s-1} (k-s-1)^{m-s-1} \right]. \tag{3.3}
 \end{aligned}$$

Proof. From the parking scheme, if $\pi_1 = j$, then $A_{\pi_2, \dots, \pi_m} = [v]$ for some $\max(j, n-k+1) \leq v \leq n$. By Theorem 2.5 and utilizing the equivalence between \mathbf{u} -parking functions and defective parking functions derived in Proposition 1.1, we have the number of defective parking functions with $\pi_1 = j$ is

$$\begin{aligned}
 & \sum_{v=\max(j, n-k+1)}^{n-1} \binom{m-1}{n-v+m-k} |\text{DPF}(k-n+v-1, v-1, k-n+v-1)| \\
 & \cdot |\text{SPF}(n-v+m-k, n-v)| \\
 & + |\text{DPF}(m-1, n, k)|. \tag{3.4}
 \end{aligned}$$

The conclusion readily follows. See Figure 1. □

Theorem 3.2. Take m and n large with $m = cn$ for some $c > 1$. For a defective parking function π chosen uniformly at random from $\text{SPF}(m, n)$, we have

$$\mathbb{E}(\pi_1) = \frac{\sum_{j=1}^n j \#\{\pi \in \text{SPF}(m, n) : \pi_1 = j\}}{|\text{SPF}(m, n)|} = \frac{n}{2} \left(1 + \frac{1}{n} \left(1 - \frac{d}{c(1-d)} \right) + O\left(\frac{1}{n^2}\right) \right), \tag{3.5}$$

where d is the unique solution in $(0, 1)$ satisfying $ce^{-c} = de^{-d}$. In particular, $d = 1$ if $c = 1$, and $d \rightarrow 0$ if $c \rightarrow \infty$.

Remark 11. $ce^{-c} = de^{-d}$ is a Lambert W Function. This function has two roots, one greater than 1 and one between 0 and 1. We know c from $m = cn$, so the other root d must be less than 1. When we have found these two roots, the formula is quite good for finding the expected distribution.

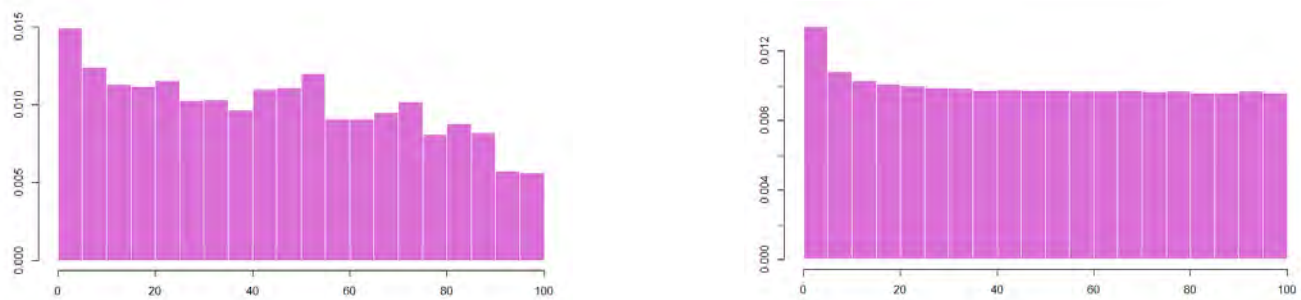


Figure 2. The distribution of π_1 (the first parking coordinate) in 100,000 samples of defective parking functions chosen uniformly at random from $\text{SPF}(100, 100)$ (left plot) and $\text{SPF}(120, 100)$ (right plot).

Remark 12. Take $m = n$ large, it was derived in Kenyon & Yin⁹ that

$$\mathbb{E}(\pi_1) = \frac{n}{2} \left(1 - \sqrt{\frac{\pi}{2n}} + \frac{10}{3n} + O(n^{-3/2}) \right). \tag{3.6}$$

We observe a sharp change as $c \rightarrow 1$ in the next leading order term of the moment asymptotics. See Figure 2. In this notation, $O(n^{-3/2})$ means all the preceding terms are omitted as their contribution is relatively small.

Remark 13. The asymptotics in Equation (3.5) is quite accurate. Take $m = 240$ and $n = 200$ with $c = 1.2$. The exact value of $\mathbb{E}(\pi_1) = 98.8379$, while the asymptotic approximation gives 98.5551.

Proof. By (3.2), the denominator of (3.5) is

$$\begin{aligned} |\text{SPF}(m, n)| &= n^m - \sum_{j=0}^{n-1} \frac{m^j}{j!} n^{m-j} e^{-c(j+1)} (j+1)^{j-1} \\ &\cdot \left(1 - \frac{j(j-1)}{2cn} - \frac{c(j+1)^2}{2n} + \frac{j(j+1)}{n} + O(n^{-2}) \right). \end{aligned} \tag{3.7}$$

The tree function $F(z) = \sum_{j=0}^{\infty} \frac{z^j}{j!} (j+1)^{j-1}$ is related to the Lambert W function via $F(z) = -W(-z)/z$, and satisfies $F(ce^{-c}) = \frac{d}{c}e^c$, where d is the unique solution in $(0, 1)$ such that $ce^{-c} = de^{-d}$. By the chain rule,

$$\begin{aligned} F'(z) &= \frac{F^2(z)}{(1 - zF(z))'} \\ F'(ce^{-c}) &= \frac{d^2}{c^2(1-d)} e^{2c}, \quad F''(ce^{-c}) = \frac{d^3(3-2d)}{c^3(1-d)^3} e^{3c}. \end{aligned} \tag{3.8}$$

We recognize that (3.7) is of the form

$$n^m \left[1 - e^{-c} \sum_{j=0}^{\infty} \frac{(ce^{-c})^j}{j!} (j+1)^{j-1} \left(1 + \frac{1}{n} (A_1 + A_2j + A_3j^2) + O(n^{-2}) \right) \right], \tag{3.9}$$

where

$$A_1 = -\frac{c}{2}, \quad A_2 = -c + \frac{1}{2c} + 1, \quad A_3 = -\frac{c}{2} - \frac{1}{2c} + 1. \tag{3.10}$$

Using $F(z)$ this can be written as (with $z = ce^{-c}$):

$$n^m \left[1 - e^{-c} \left(F(z) + \frac{1}{n} \left(A_1F(z) + A_2zF'(z) + A_3(z^2F''(z) + zF'(z)) \right) + O\left(\frac{1}{n^2}\right) \right) \right]. \tag{3.11}$$

From Proposition 3.1, the numerator of (3.5) is the sum of I_1 and I_2 , with

$$I_1 = \left[\sum_{j=1}^n j \right] \left[n^{m-1} - \sum_{s=0}^{n-1} \binom{m-1}{s} (s+1)^{s-1} (n-s-1)^{m-s-1} \right], \tag{3.12}$$

$$I_2 = \sum_{j=1}^{n-1} j \sum_{v=j}^{n-1} \binom{m-1}{m-v} v^{v-2} \left[(n-v)^{m-v} - \sum_{s=0}^{n-v-1} \binom{m-v}{s} (s+1)^{s-1} (n-v-s-1)^{m-v-s} \right]. \tag{3.13}$$

For I_1 , we have

$$I_1 = \frac{n^2}{2} \left(1 + \frac{1}{n} \right) \left[n^{m-1} - \sum_{s=0}^{n-1} \frac{m^s}{s!} n^{m-s-1} e^{-c(s+1)} (s+1)^{s-1} \cdot \left(1 - \frac{s(s+1)}{2cn} - \frac{c(s+1)^2}{2n} + \frac{(s+1)^2}{n} + O(n^{-2}) \right) \right]. \tag{3.14}$$

We recognize that (3.14) is of the form

$$\frac{n^{m+1}}{2} \left(1 + \frac{1}{n} \right) \left[1 - e^{-c} \sum_{s=0}^{\infty} \frac{(ce^{-c})^s}{s!} (s+1)^{s-1} \left(1 + \frac{1}{n} (B_1 + B_2s + B_3s^2) + O(n^{-2}) \right) \right], \tag{3.15}$$

where

$$B_1 = -\frac{c}{2} + 1, \quad B_2 = -c - \frac{1}{2c} + 2, \quad B_3 = -\frac{c}{2} - \frac{1}{2c} + 1. \tag{3.16}$$

Using $F(z)$ this can be written as (with $z = ce^{-c}$):

$$\frac{n^{m+1}}{2} \left(1 + \frac{1}{n} \right) \left[1 - e^{-c} \left(F(z) + \frac{1}{n} (B_1F(z) + B_2zF'(z) + B_3(z^2F''(z) + zF'(z))) + O\left(\frac{1}{n^2}\right) \right) \right]. \tag{3.17}$$

For I_2 , we have

$$\begin{aligned} I_2 &= \sum_{v=0}^{n-2} \binom{m-1}{v} (v+1)^{v-1} (n-v-1)^{m-v-1} \frac{(v+1)^2}{2} \left(1 + \frac{1}{v+1} \right) \\ &\quad - \sum_{v=0}^{n-2} \sum_{s=0}^{n-v-2} \binom{m-1}{v, s, m-1-v-s} (v+1)^{v-1} (s+1)^{s-1} (n-v-s-2)^{m-v-s-1} \frac{(v+1)^2}{2} \left(1 + \frac{1}{v+1} \right) \\ &= \frac{1}{2} \sum_{v=0}^{n-2} \frac{m^v}{v!} n^{m-v-1} e^{-c(v+1)} \left((v+1)^{v+1} + (v+1)^v \right) \left(1 + O(n^{-1}) \right) \\ &\quad - \frac{1}{2} \sum_{v=0}^{n-2} \sum_{s=0}^{n-v-2} \frac{m^{v+s}}{v!s!} n^{m-v-s-1} e^{-c(v+s+2)} \left((v+1)^{v+1} + (v+1)^v \right) (s+1)^{s-1} \left(1 + O(n^{-1}) \right). \end{aligned} \tag{3.18}$$

The generalized tree functions $G(z) = \sum_{s=0}^{\infty} \frac{z^s}{s!} (s+1)^s = \left(\sum_{s=0}^{\infty} \frac{z^s}{s!} s^{s-1} \right)'$ and $H(z) = \sum_{s=0}^{\infty} \frac{z^s}{s!} (s+1)^{s+1} = \left(\sum_{s=0}^{\infty} \frac{z^s}{s!} (s-1)^{s-1} \right)''$ are related to the tree function $F(z)$, and respectively satisfy

$$G(ce^{-c}) = \frac{d}{c(1-d)} e^c, \quad H(ce^{-c}) = \frac{d}{c(1-d)^3} e^c. \tag{3.19}$$

We recognize that (3.18) is of the form

$$\begin{aligned} &\frac{1}{2} n^{m-1} e^{-c} \sum_{v=0}^{\infty} \frac{(ce^{-c})^v}{v!} \left((v+1)^{v+1} + (v+1)^v \right) \left(1 + O(n^{-1}) \right) \\ &\quad - \frac{1}{2} n^{m-1} e^{-2c} \sum_{v=0}^{\infty} \sum_{s=0}^{\infty} \frac{(ce^{-c})^{v+s}}{v!s!} \left((v+1)^{v+1} + (v+1)^v \right) (s+1)^{s-1} \left(1 + O(n^{-1}) \right). \end{aligned} \tag{3.20}$$

Using $F(z)$, $G(z)$, and $H(z)$ this can be written as (with $z = ce^{-c}$ and $I(z) = G(z) + H(z)$):

$$\frac{1}{2}n^{m-1}e^{-c} \left[I(z) + O\left(\frac{1}{n}\right) \right] - \frac{1}{2}n^{m-1}e^{-2c} \left[I(z)F(z) + O\left(\frac{1}{n}\right) \right]. \tag{3.21}$$

Dividing (3.11) into (3.17)+(3.21) and simplifying we get our desired result. □

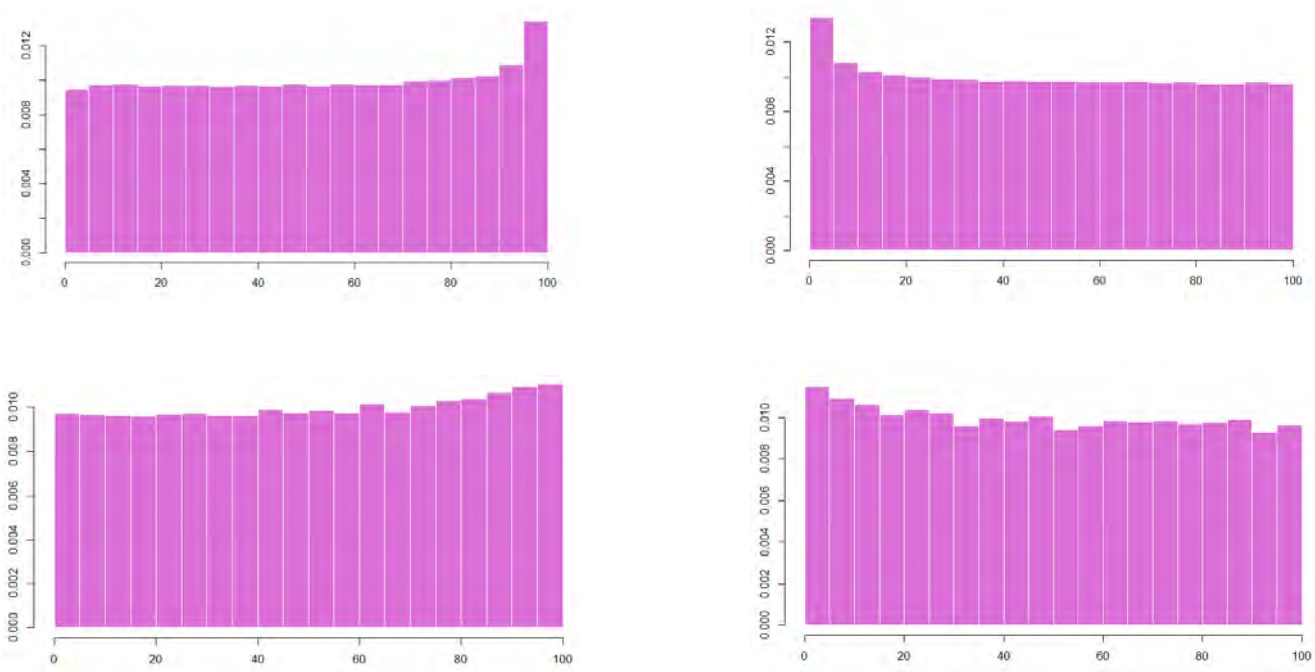


Figure 3. The distribution of π_1 (the first parking coordinate) in 100,000 samples of defective parking functions chosen uniformly at random from $\text{SPF}(120, 100)$. The upper left plot is for $p = 0$ and the upper right plot is for $p = 1$. The lower left plot is for $p = 0.1$ and the lower right plot is for $p = 0.9$. Note the preference symmetry between p and $1 - p$. $p = 1$ corresponds to the deterministic parking protocol studied in this paper.

4 FURTHER RESEARCH

In Durmic et al¹⁰, a probabilistic parking protocol was considered, which added one more layer of complexity to the parking scenario. Fix $p \in [0, 1]$ and consider a coin that flips to heads with probability p and tails with probability $1 - p$. If a car arrives at its preferred spot and finds it unoccupied it parks there. If instead the spot is occupied, then the driver tosses the biased coin. If the coin lands on heads, with probability p , the driver continues moving forward in the street. However, if the coin lands on tails, with probability $1 - p$, the car moves backward and tries to find an unoccupied parking spot. We see that the deterministic parking protocol where the car always moves forward if its desired spot is taken corresponds to $p = 1$.

Only the effect of the probabilistic protocol on the classical parking situation ($m = n = k$) was investigated in Durmic et al¹⁰. The authors are further interested in similarly researching the probabilistic effect on defective parking functions. See Figure 3 for some initial simulations.

5 CONCLUSION

The focus of our paper was to analyze the asymptotic behavior of Defective Parking Function distributions. First, we looked at the equivalence of $\text{DPF}(m, n, k)$ to some u -parking functions, which allowed us to more easily analyze DPFs. We also analyzed the multi-shuffles of DPFs and exhibited an algorithm for building multi-shuffles. The main results were in counting the number of Defective Parking Functions as well as the distribution of certain preferences which exhibited the asymptotic behavior that we see in the graphs.

6 AUTHOR'S NOTE

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7 EDITOR'S NOTES

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Apollo and Hyacinthus by Alex Blom
Hardground Etching with Aquatint

Seed Aid: The Importance of Local Decision-making

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1 ISSUE DEFINITION

This policy paper focuses on the disconnect between donor and recipient states regarding seed aid and the implications of seed aid on local agricultural sovereignty and sustainability; it proposes that a reevaluation of international seed aid policies is needed. International food security organizations and food aid donors should prioritize local seeds for seed aid purposes to support local biodiversity and food sovereignty, and the stability and sustainability of local agricultural systems in the long term. Making adequate and accurate assessments of situations is crucial, and sourcing locally is an integral aspect of supporting local seed systems¹. The fundamental problem with the seed distribution system today is the limited availability of local seeds. Responding to food crises with an influx of seeds from donor countries poses a serious risk of undermining the livelihood security of farmers by disrupting local seed systems, risking local biodiversity, and resulting in genetic erosion. Therefore, efforts to increase food security in crisis situations should focus on supporting local seed production in the region or country whenever possible rather than bringing seeds in from outside or abroad.

2 BACKGROUND CONTEXT

Thousands of fruit and vegetable species are grown for food globally, yet less than two-hundred make substantial contributions to global food production. Additionally, thousands of plant species and varieties that used to be grown for food have become extinct². The reliance of the global food system on such a limited number of crops, in the volatile conditions created by climate change, has made global food systems highly susceptible to loss or shocks. If even a handful of the major food crops were to experience shocks—crop failures, loss of environmental niches due to climate change, or extinction—food security across the globe would be at risk. Local and indigenous communities are most at risk of losing local varieties despite being major contributors to conservation and agrobiodiversity. This is due to a global food system that lacks adequate protections for these varieties in favor of hybrid and genetically

modified organism (GMO) varieties created by public and private research and development efforts.

Creating a stable seed protection system that is focused on preserving local seeds would be an effective solution to reduce these risks. Seeds are key inputs for successful smallholder production, and the systems in place around seed saving, acquisition, and distribution are often disrupted in crisis and conflict situations. Some seed aid programs do exist, but the large majority of them utilize seeds from donor countries, like the US, rather than providing access to seeds from regions where food insecurity exists. This undermines growers' ability to be self-sufficient and inhibits the effectiveness and capacity of local growers by increasing their dependency on seed aid from international donors. Often, seed aid development programs focus on providing high-yield varieties to boost agricultural production, but they frequently fail to consider why farmers in the region choose and continue to use local varieties³. These programs do not recognize that local varieties are more appropriate for cultivation, both culturally and agronomically, because they are more resistant to local stressors, fare better under low-input conditions, and have more stable yields.

Seed aid systems perpetuate the underlying issues and trap farmers in dependency cycles that donor countries and multinational corporations benefit from, but this was not the original intention of the system. As Louise Sperling, an analyst for the International Center for Tropical Agriculture notes, seed aid started as a very innovative solution to giving food; it sought to empower people rather than make them feel like victims⁴. The problem arises in the disconnect between donors and the reality on the ground. Seed handouts often mean that farmers are less incentivized or capable of being self-sufficient, especially if that seed aid returns season after season, as it has in many African nations like Burundi and Ethiopia⁴. As noted by the emergency relief organization Cordaid, in crisis or conflict situations food insecurity does not necessarily mean seed insecurity and crop failures do not necessarily mean that seeds are not available¹. For example, following a drought in Kenya, 85% of the next season's seed came from local crop yields despite the devastating crop losses faced

in the region⁴. In an attempt to address these issues, donors like the Office of US Foreign Disaster Assistance have reduced the funding they direct towards seed handouts and prioritized voucher programs for local markets to support local economies after disasters⁴.

3 CAUSAL FACTORS

Western countries, particularly the United States, largely dominate discussions around food aid policies. Food crises have long been defined by Western global leaders as issues of inadequate regional food production, and Western countries often use these food crises as an opportunity to introduce corporate seeds, chemical fertilizers, and market systems into struggling countries³. In essence, what looks like seed aid in the short term becomes agribusiness in the long term. Current policies overwhelmingly benefit donor states, making them unwilling to change the status quo. Some nations, like the UK, have made changes but the biggest player in international seed aid, the US, is resistant to change.

The Food and Agriculture Organization, or FAO, an arm of the United Nations, included many key goals focused on public and private sectors or economic policies geared towards diversifying farmer revenues during recent discussion of seed aid policies. The FAO was also responsible for the Global Conference on Green Development of Seed Industries, which was organized as an opportunity for industry leaders, FAO partners, and other stakeholders to discuss “how best to make quality seeds of preferred productive, nutritious and resilient crop varieties available to farmers”⁵. The main objectives of this conference, through the debate of evidence and sharing updated knowledge, were: increasing awareness for seed industry contributions to green innovation; promoting cooperation between the public and private sectors; setting priorities; and pooling scientific, technical, and financial resources needed for strengthening seed systems⁵. They also substantially focused on improving farmers’ abilities to access new and improved varieties, but paid little attention to local seed varieties, biodiversity, or improving local resiliency⁶. There is no mention as to how the conference intends to support smallholder farmers or how initiatives would protect local interests, including local varieties and biodiversity. The conference failed to address these issues, reflecting the shortcomings of the FAO’s goals to reach broader objective goals.

The privatization of agriculture in the last several decades has disrupted the seed aid process dramatically. Historically, seed aid largely relied on the public sector, and usually was supplied for free to farmers in need. Today, a small number of multinational companies control more than half of the global seed market. Most conversations around seeds today in the food aid world revolve around private seeds that farmers now have to buy with

strings attached³. Farmers thirty years ago could have given excess seeds to a neighbor in need, but now they are disincentivized to do so on multiple levels due to use restrictions imposed by seed corporations. The surging agricultural commodity prices caused by rapidly increasing demand have triggered a rush by major corporations to take advantage of the entire food chain in developing countries. Major companies are moving towards greater involvement in food production through contract farming, which has transferred agricultural control from farmers to CEOs and politicians. The interests of farmers and corporations are rarely aligned, as businesses want to control seed supplies that feed global commodity markets and have little, if any, interest in local seeds or the preservation of biodiversity that farmers tend to prioritize. In Africa, for example, 90% of the seeds used are local varieties, and local food systems rely on diversity for success³. However, with increasing investment and interest from corporations, a struggle has developed between corporate control over a globalized industrial food system versus efforts to support and expand local food sovereignty. Additionally, seed companies have become increasingly reliant on subsidies, which has led to volatility in seed production. For example, when Mozambique was dealing with food insecurity, the Emergency Seed Program supported seed production internally, and the Seed Company of Mozambique (SEMOC) saw annual sales increase to 14,000 metric tons during the crisis in 1993. As soon as the emergency seed subsidies dried up in 1997, their sales plummeted to 3,000 metric tons⁷. This volatility is destabilizing to international seed systems and can result in additional shocks as seeds and seed aid become unreliable and highly fluctuating.

4 CASE STUDY: BENIN

Benin is a country that has been experiencing ongoing issues with food security. In 2008, Benin was spending \$7 million in subsidies to provide farmers with improved seed varieties in order to meet food production goals. Despite widespread efforts and funding for the dispersal of the improved hybrid seeds, there was no support for the distribution and multiplication of local and traditional varieties³. Benin struggles with food sovereignty and self-sufficiency, relying on imports for 90% of their rice³. Local organizations believe that supporting Benin’s efforts toward greater self-sufficiency would help alleviate the ongoing food crisis. This could be done by implementing policies that support biodiverse farming and guarantee adequate prices for small-scale producers. In addition to their struggle for self-sufficiency, Benin is fighting against the threat of GMOs. Benin has a regionally unique moratorium on GMOs in their country, and have been closely monitoring seed and food aid from outside sources. Most of their con-

cerns lie with neighboring Burkina Faso, who had allowed the production of two GMO cotton varieties from Monsanto, which could easily cross the border and disrupt local biodiversity and Benin's food sovereignty³. Benin has made its goals and expectations for food aid clear, and honoring these goals is core to supporting Benin's food sovereignty. Additionally, supporting local groups' efforts to put an emphasis on biodiversity, local heritage, and price protection in the name of food sovereignty is crucial. As of now, Benin is still struggling with food security and has been limited in its capacity to practice food sovereignty policies due to a lack of international support for self-sufficient agricultural practices.

5 CASE STUDY: THE PHILIPPINES

In an effort to address food crises in the Philippines, the government created a program called FIELDS. FIELDS was designed to provide subsidies and loans to farmers in order to establish rice self-sufficiency because the Philippines are one of the world's largest importers of rice. The seeds promoted by this program are mostly privately developed, and while they are predominantly owned by a local Filipino firm, foreign corporations like Bayer and Monsanto are also major players³. Filipino farmers and activists are concerned that the program would only serve to make rice farmers reliant on private companies. Wilhelmina Pelegrina of SEARICE, an NGO (Nongovernmental Organization) working on the conservation and development of local seeds with farming communities in the Philippines, said that "providing input subsidies for hybrid rice is not a sustainable way of achieving rice self-sufficiency and addressing the rice crisis"³. Not only are private companies heavily involved in distributing rice hybrids in The Philippines, but they are being handed the reins of hybrid rice commercialization in the country, giving them access to publicly held germplasm and exclusive rights to commercialize rice hybrids that were developed through public research programs³. The privatization of hybrid rice commercialization could have devastating results for local food sovereignty and biodiversity. While the full impacts of these policies have yet to be seen or researched, it is clear that the privatization of seed research and development does little to support local biodiversity or smallholder rights, and impedes progress towards food sovereignty.

6 CASE STUDY: SENEGAL

In 2008, Senegal's president Abdoulaye Wade launched an initiative to make the country's food self-sufficient by 2015 by supporting the production of basic food and feed crops. The government earmarked \$792 million for this project and intended \$443 million to sub-

sidize fertilizer purchases, \$120 million to subsidize seed purchases, and \$30 million to subsidize pesticide purchases³. Many of the companies involved in the production and distribution of the aforementioned subsidies are foreign-owned and are likely to profit from this project. The National Rural Exchange and Cooperation Council, Senegal's main farmers' organization, was not consulted about the project and opposed its failure to address long-standing structural issues preventing farmers from accessing fair market prices for crops.

Senegal has made several efforts over the years to move towards self-sufficiency and food sovereignty but has often met resistance to their efforts. In 2012, local communities in Senegal demanded the return of agricultural land that had been stolen from them a decade before by the foreign agribusiness corporation that currently controls the land without consent from the community, but they have yet to see their land returned to them⁸.

In 2016, Senegal took steps to desalinate agricultural land in their efforts toward food self-sufficiency⁸. This initiative was designed to support farmers who had been forced to develop techniques to retain water runoff and to use different crop varieties that were more suitable as a result of the land salinization. The project's goals included poverty reduction and the strengthening of food security. In terms of impacts, the affected regions saw greater food security, improved incomes, diverse economic activities, and the protection and regeneration of the ecosystem. Local people have been more involved in local initiatives like market gardening, bee-keeping, stock-breeding, and fishing, as less time and effort has been focused on water retention⁸. This initiative has been considered successful in providing greater arable land and reducing the burden on farmers in the target regions. In 2017, Senegal recorded record yield, attributing their success to substantial investments in the agriculture sector, better selection of seeds, and better mechanization of the agricultural process⁹.

Continuous efforts are being made to modernize, develop strategies for producers to deal with climate change impacts, and support pastoralism⁹. While support for local biodiversity is unclear in these projects, Senegal seems to be meeting many of their goals set in regard to reducing hunger and supporting food security. If Senegal can continue to invest in these practices, it could be possible to achieve a degree of self-sufficiency and food sovereignty.

7 POLICY RECOMMENDATIONS

Based on the research presented, this paper recommends three specific policies to be introduced individually or in collaboration with each other.

7.1 *Restructuring who is in charge of food aid systems and interventions*

States that are experiencing, or have experienced, food insecurity should be in charge of defining what aid looks like and where it is coming from. The countries experiencing food insecurity and instability should have a say in what resources would be most beneficial, and what will allow them to reach toward greater food system stability and sovereignty. This policy will also serve to provide greater representation for smallholder and community voices and support local biodiversity efforts. It will likely decrease profits for donor countries like the US but contribute to greater international stability and reduce the need for future aid, thus curtailing overall expenses in the long run.

7.2 *Investment in seed banks*

Investment in seed banks helps to protect seed biodiversity in the face of shocks. Seed banks are created in order to prepare for natural disasters and climate change effects which could impact seed biodiversity. Seed banks are mainly a preventative measure, meant to be a failsafe in case other preservation methods fail, or in the occurrence of a natural disaster, war, or disease outbreak¹⁰. Seed banks can protect heritage and local crop varieties against genetically modified plants and climate change reducing the available land. Moreover, ensuring the conservation of local crops through seed banks is important given these varieties are already adapted to their regions and can provide appropriate agricultural stability when crises occur.

7.3 *Support for long-term efforts to build resilient agriculture systems*

Building resilient agriculture systems is more cost-effective than repeated emergency interventions. A system structured around long-term efforts would have to be conflict-sensitive and would include reviving seed markets at local, regional, and national levels¹¹. Kenya has established a start to such efforts with the Kenya Cereal Enhancement Program–Climate Resilient Agricultural Livelihoods program. This program emphasizes crop diversification and climate resiliency alongside training in agricultural economic practices and financial literacy in order to encourage farmers to adopt new and appropriate varieties⁷. While this program has a ways to go in terms of proving its success and ensuring that local varieties and local heritages are preserved, the foundation it is built on are in the direction of where seed systems need to go in order to be resilient and responsive. This policy would likely include a shift from vouchers or direct donations to cash transfers in emergency situations. Cash allows farmers the ability to

independently decide whether to invest in seed or other resources based on individual needs. If farmers chose to purchase seeds, cash would allow them to decide which varieties of crops and where to purchase them⁷. This also serves to strengthen local seed systems and broader economic markets, contributing to stability and resilience.

8 AUTHOR'S NOTE

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9 EDITOR'S NOTES

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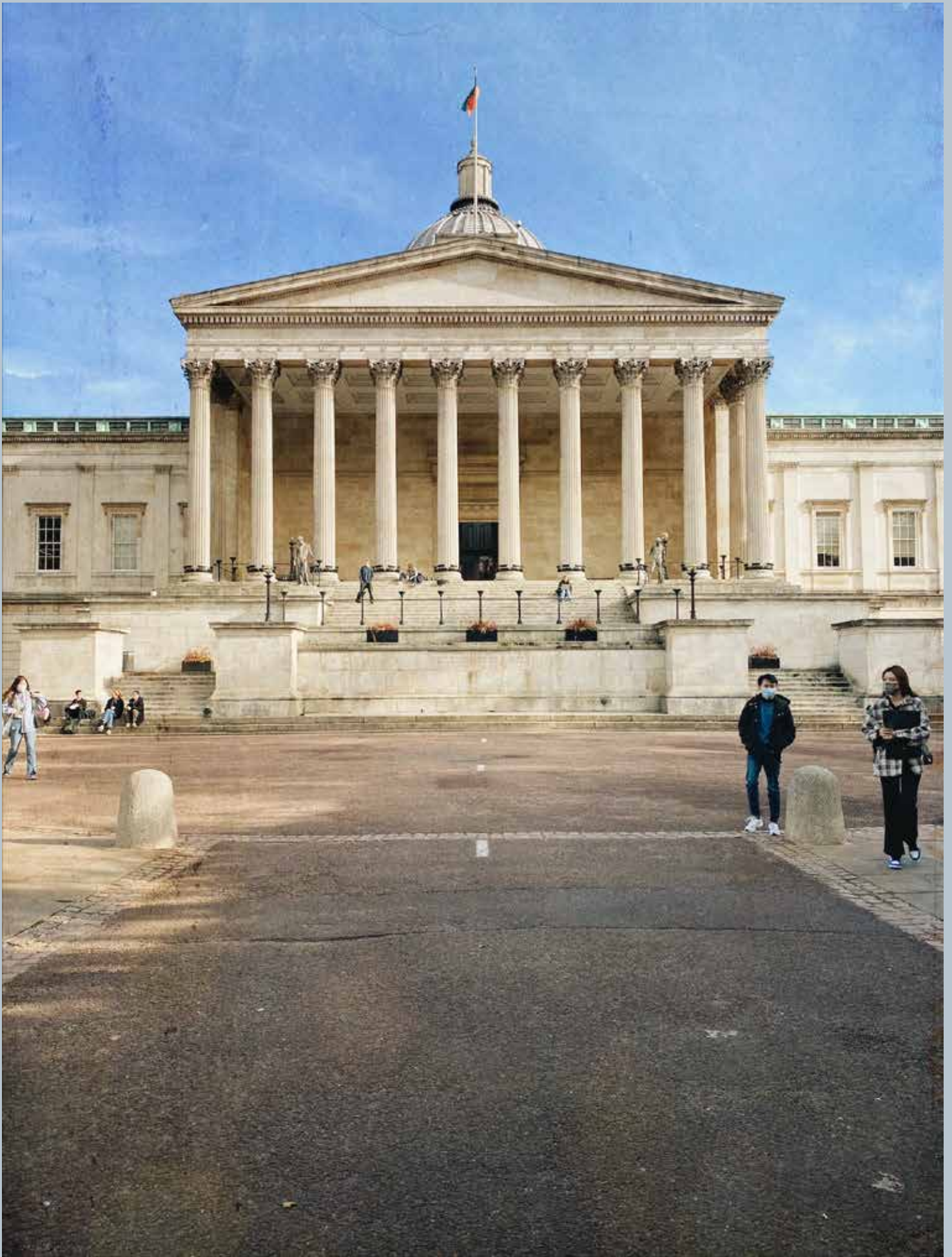
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Urban Architecture by Aaron Butwinick
Captured on iPhone

2017 Charlottesville Riots – Media Coverage Paper

Media & Terrorism

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1 INTRODUCTION

On August 12th, 2017, a gathering of counter-protestors were opposing the “Unite the Right” rally in Charlottesville, Virginia, when a Dodge Challenger suddenly accelerated into the crowd. As the vehicle backed away it was badly damaged and spattered with flesh and blood. In the aftermath one woman was killed and thirty-five others were left injured. The driver of the vehicle, James Alex Fields Jr., had already driven hundreds of miles before he made that fateful and murderous decision to drive one block more. Fields had previously endorsed white supremacist and neo-Nazi beliefs and in Charlottesville, he and thousands of other alt-right gatherers were protesting the removal of Confederate General Robert E. Lee’s statue from a public location. Their actions were a display of prejudice, threat, and radical ideology. Klansmen, fascists, militiamen, and supremacists marched through the streets brandishing emblems of hate and violence. With their rifles slung over shoulders tatted with swastikas and arms swinging confederate flags, the protest unfolding was a terrorist act.

The FBI defines terrorism as, “the unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives”^{1;2}. These supremacists were committing a terrorist act through their attempted threats to a group of counter-protesters, who wielded rainbow flags and flashed peace signs in rejection of white supremacist values. Following the Charlottesville events there were weeks of discourse trying to capture what had unfolded. This discussion attempted to dissect the trajectory of the supremacist group and how to interpret the violence that unfolded. The driver involved in the attack, James Fields Jr., was found guilty of first-degree murder and dozens of hate-crime charges. Hate crimes are defined by Oxford English Dictionary as, “a crime, typically one involving violence, that is motivated by prejudice on the basis of ethnicity, religion, sexual orientation, or similar grounds”. Media surrounding this event did

not attach the terms “terrorism” or “terrorist” to this attack. While both terrorism and hate-crime definitions share themes of violence, terrorism requires more distinct motivations. Hate crimes do not carry the intention of “furtherance of political or social objectives,” which is a critical distinction regarding the coverage of the attack. This event closely fits this definition of terrorism but was not labeled as such. This is typical of American mainstream media and revealed the hesitations to use a term with as much gravity as “terrorist.” The magnitude and objective of a terrorist act are easily curtailed through the hate crime distinction. This paper explores the media coverage of the Charlottesville “Unite the Right” marches and car attack were terrorist events in U.S. partisan media and shows how the event was framed differently by emphasizing “terrorism” in liberal media, while de-emphasizing and deflecting it in conservative news.

2 METHODS

The objective of this analysis is to describe and discuss the Charlottesville marches and car attack through the lenses of generally contrasting American media: MSNBC and Fox News. These outlets were selected because of MSNBC’s liberal sociopolitical tendencies and Fox News’ conservative leanings. This media polarity is necessary to fully examine media coverage and how stories can be manipulated. A comparison of multiple publications will demonstrate how this event was covered from different sociopolitical stances by both outlets. This event will be contextualized and interpreted using the FBI’s definition of terrorism. A concept that drives much of this analysis is media framing, which is defined as, “the way that information is selected, organized, and presented in the media... to make stories that make sense to their writers and audiences”³. Headlines, perpetrator identity, imagery, and tone will be used as variables to capture the social and political atmosphere of this event and how the two media organizations covered it differently.

A breakdown of many publications through these

variables will show that “perpetrators espousing domestic extremist ideologies may be incorrectly charged with hate crimes when the crime more accurately reflects an act of terrorism”^{4,5}. James Fields Jr. and accompanying protesters marched with intentions of intimidation and enabling their political ideologies. The events of Charlottesville were an exhibition of terrorism, by definition, but were not publicized or litigated accordingly. MSNBC adopted a perspective that was adamant on holding Fields and the other alt-Right protestors accountable for their actions, while Fox News held a more defensive tone—attempting to deflect the reality of the event. The variables above influenced the framing of the Charlottesville attack and were crucial in the discussion of this event as a possible terrorist act. This paper will consider relevant media surrounding this event and discuss the incorrect labeling of an event representative of a more meaningful term: terrorism.

3 MEDIA CASE STUDIES & DISCUSSION

3.1 Definitions

It is necessary to dissect the provided definition of “terrorism.” The essential words within the FBI’s established definition are, “intimidate or coerce a government the civilian population, or any segment thereof in furtherance of political or social objectives.” Nowhere are there specifications that sensational weaponry (bombs, vehicles, or other military-grade equipment), mass deaths, or a massive counterterrorist movement are necessary for an event to qualify as terrorism. Designating this definition is important because “terrorism” has a variety of definitions and is ever-evolving. The FBI’s verbiage has not been diffusely accepted, and different departments within the United States government may have unique and conflicting definitions. This extends to media coverage, as Fox News and MSNBC may be referencing different definitions of “terrorism,” however, neither news article discussed included an explicit definition or otherwise indicates what definition they are using. This lack of coordination is one factor that contributes to the media differences that will be discussed below. One reason there is such variety for this term is that “the terrorism label has implications for the government’s available response options and for the public’s perceptions of such groups”⁶. This is relevant to Charlottesville, as the national response to the event could have been drastically different if it had been labeled as terrorism. The repercussions of such a profound title could include a more sustained use of armed forces, investigation of the individuals and groups involved, and likely ongoing pressure for dissolution. Without the terrorism label, the events are viewed as isolated and the persons involved can easily be ignored. Throughout this discussion, the ambiguity

associated with the term is an underlying consideration that influences the included sources.

3.2 Headlines

The wording of headlines was one variable that illuminated certain differences between the media coverage of the Charlottesville events. Headlines are a crucial variable because they introduce the general emotions and argument that an article or video provides. Before engaging the full story, a headline expresses an immediate opinion. In a comparison of MSNBC and Fox News, their headlines differed by using more passive or more pointed language. For example, the MSNBC video headlined, “Why Won’t Trump Call the Charlottesville Attack Terrorism?” contrasts the Fox News counterpart, which is headlined, “McMaster Calls Violence in Charlottesville ‘Terrorism’, as Trump Pressed to Reject Group”^{7,8}.

The MSNBC headline very clearly designates the events as a terrorist attack. The headline is presented as a question as if begging the former president to do something deemed obvious. The title is confrontational and desperate for Trump to acknowledge the reality of this situation. His failure makes the question essentially rhetorical, suggesting there is no debate that the attacks were a terrorist act. The Fox News article is much more indirect and attempts to minimize the statements of the Lieutenant General and former National Security Advisor, H.R. McMaster, who considers the event terrorism. Instead of confronting the issue headstrong, Fox News navigates around the consequence of the “terrorism” label. Mentioning McMaster, the National Security Advisor, shows that “terrorism” had been considered, but is not again mentioned in the article. The article moves away from H.R. McMaster’s statements and instead summarizes other information about the event, diluting the article and realigning focus away from the pertinent quote by McMaster. Adding the phrase “... Trump Pressed to Reject Group” also diminishes the focus on the subject, which is terrorism. The entire title aims to take focus away from the word terrorist in favor of other noteworthy names (McMaster and Trump). Fox News deploys a wordy and confusing headline to establish that they (as a media outlet) are not associating the event with the terrorism term, it was just the quote of a lone person. As shown by these two sources, headlining represented broad differences in the approach to the Charlottesville attacks.

3.3 Perpetrator Identity

The next critical variable showing the differences between these two outlets is perpetrator identity, given that these depictions change the perception of the attack. Perpetrator identity regards different qualities and

groupings of the individual(s) involved in an event. These typically include race, religion, gender, socioeconomic status, and other descriptors. Media utilizes these qualities to characterize perpetrators, which develops their story and assigns blame. Many of these traits are subject to stereotyping, which has exposed some (general) sociopolitical differences between outlets. One source may show tendencies to utilize language consistent with traditional stereotypes, while another strives to adopt progressive terminology and utilize appropriate descriptors. Biased perpetrator identity reporting is part of the reason MSNBC is considered a more liberal outlet, while Fox News is described as conservative. Media outlet perpetrator framing can shape these sociopolitical stories because the language subtly introduces certain qualities of protagonists and antagonists. A careful approach to perpetrator identity is important for a consumer base, as it often avoids biased portrayals of perpetrators, such as white supremacists in Charlottesville in Fox News reporting. The use and focus on certain perpetrator characteristics regularly shape the tone of a publication and establish how blame is placed.

Perpetrator identity is important in media analysis because it shows the biases of each outlet. The MSNBC article frames the perpetrator by generalizing the perpetrator as extremist alt-right, instead of only mentioning Fields⁹. Blame is assigned to a broader group instead of the lone individual. By framing the perpetrator through their membership in these groups and through their engagement in hate speech and violence, the “social objectives” of the event are more visible. A Fox News article only focuses on Fields and uses terms such as “prosecutors say...” and “allegedly...” to avoid asserting connections between the perpetrator and hate groups, which minimizes blame¹⁰. For MSNBC, the perpetrator identity was necessary to expose broader influences, such as white supremacist group membership. Fox News attempts to isolate the perpetrator and framed Fields Jr. differently to remove this context. By separating the entities of the car attack and Unite the Right protests, the combined event loses effect. Perpetrator identity is critical because it combines multiple elements together and explains how the violent event came to fruition. This framing contributes to the interpretation of the attacks as terrorism, or not.

3.4 Imagery

The imagery included in different publications surrounding this event also distinguishes the outlets. Differences in media coverage of this event demonstrate racial bias prevalent in American social media. This bias is displayed in a video by MSNBC where they find “terror attacks by Muslim perpetrators receive 449% more media coverage than other attacks”⁸. This coverage bias is relevant to Charlottesville because the perpetrator

was a white man and ensuing coverage inadequately reported the event. Underlying trends contribute to the differences in coverage, especially with reference to perpetrator identity. The statistic reveals a hesitation for certain individuals and events to be identified by terms such as “terrorist,” much like the white supremacists and their actions.

The inclusion of pictures and clips of violence and threatening actions helped this MSNBC content to intensify the situation. Weapons and slurs helped frame the perpetrator(s) in a more violent and hateful manner. Fox News article only included a single image—the mugshot of Fields Jr., which minimized the intensity of the situation at hand¹¹. There were no images of the actual attack or of protests. The Fox News sources incompletely covered the actions of this event, which had a diluting effect regarding the perpetrators. Demagnifying the violence and hate displayed by the white supremacists was indicative of disproportionate race reporting, most commonly found in conservative media. Multiple MSNBC video clips reveal supremacist shouting racist remarks, wielding torches, brandishing weapons, and flying flags of hate symbols, which the reporters suggest are clearly indicative of terrorist action and comply with the FBI’s definition. MSNBC emphasized the violence and terror with images of weapons and injury, whereas Fox News downplayed these actions by avoiding more gruesome content. MSNBC effectively illuminated the reality and magnitude of the situation, whereas Fox News was more engaged in avoiding this coverage.

3.5 Tone

Tone was the most important variable in distinguishing the media coverage of the Charlottesville attacks. Differences in tone were exhibited in each of the variables discussed above and are the culmination of the framing utilized by MSNBC and Fox News. Examining the tone helps show why and how the demonstrations of hate, threats, and violence were presented differently. The value of the tone is demonstrated through the cascade of criticism that followed Donald Trump’s failure to condemn the white supremacists responsible in the Charlottesville attacks. In a very brief passage from an MSNBC article, the author effectively captured the emotions of the event¹². Through the lens of Trump, who “... preferring to remain maddeningly vague, could’ve condemned neo-Nazis, white nationalists, and terrorists – when someone deliberately uses a car as a weapon, driving into a crowd...” the author emphasizes themes of hate and violence¹³. These themes and the tone are pivotal in MSNBC’s framing of this event.

One month after the attack, a Fox News article written by Kaitlyn Schallhorn took a very defensive and almost apologetic stance. Instead of addressing the

moment or criticizing Trump, this article used language to develop an excuse of sorts. The language used was matter-of-fact and did not use passionate or accusatory language like seen in the MSNBC publications. In a long and drawn-out timeline of events and quotes, Schallhorn avoids distress and intensity. The tone was established by words such as “accusation.” For example, “police say a Nazi sympathizer plowed his car through a group of counter-protesters” has a much milder tone than beginning the sentence with “a Nazi sympathizer. . .”¹⁴. The simple addition of “police say. . .” weakens the effect of this statement. The intention here is to alleviate the tension surrounding this event. Tone is essential for these outlets to effectively frame the moment.

The tone continued to shape the framing of this event, even years after the “Unite the Right” rallies, when a medley of trials provoked new discussion surrounding the Charlottesville attack. An MSNBC article emphasized that “when speech demonstrably incites violence, the perpetrators of that violence must be held accountable. The Charlottesville trial offers an opportunity to demonstrate that”⁹. The author explicitly suggests that the perpetrators used speech to incite violence. This confrontational tone is relevant to framing, especially considering the FBI’s definition, as speech was used as a form of intimidation and coercion. This accusatory tone is also essential because it drives the claim that “First Amendment protections do not excuse violence,” which eliminates excuses for the event⁹. The Fox News response to the Fields trial (different than Unite the Right trial) had a very defensive tone, stating “James Alex Fields Jr. . . was “scared to death” after witnessing violent clashes between protesters and counter-protesters”¹⁰. The use of language such as “scared. . .” and mentioning “clashes between protesters. . .:” weakens the conviction of accusations. This defensive tone redirects blame and changes the framing of this event by also marking the actions of counter-protestors. Overall, the tone is the ultimate variable in the consideration of “terrorism” and how violence is framed.

4 CONCLUSIONS

There are marked differences in the coverage of the Charlottesville “Unite the Right” marches and the deadly car attack. MSNBC chronicled the event through critical headlines, emphasizing the extremist ideologies of the perpetrator, showing frightening images surrounding the event, and ultimately using a tone focused on illuminating the terror of these attacks. Fox News was more committed to deflecting blame instead of confronting the tragedy and terror. The headlines were more matter-of-fact and less accusatory, the perpetrator was often framed in an isolated role acting out of fear, and the publications lacked imagery of violence

and terror. These differences in framing culminated in the application, or not, of the label of “terrorism.” This discussion reflects a broader trend, “despite the cases of domestic terrorism prosecutions identified by Aaronson (2019), it appears that most instances of right-wing extremist violence are not prosecuted as such”⁴. For these media outlets, there were more than political differences involved in the framing of the attacks. This event reflected broader trends in America—the presence of white supremacist radical groups, criticisms of leadership and their actions, and the enabling of violence. MSNBC aimed to emphasize these trends, while Fox News was keen on minimizing the perceived reality of these ideas.

The Charlottesville “Unite the Right” marches and the car attack were terrorist events. Following the FBI’s definition of terrorism, all these actions are intended to intimidate a population and provoke the “furtherance of political and social objectives”¹. Brandishing weapons, hateful remarks, and killing an innocent counter protestor each support this judgment. However, this was not the conclusion of the collective news media. MSNBC and Fox News covered the event differently. Fox News did not engage in critical and active coverage of the event, which diminished the magnitude of this event and allowed their publications to navigate away from the “terrorism” label. MSNBC contrasted this detachment by exposing the consequences and developing a more critical depiction of the entire episode, including use of “terrorism.” The broader implications of avoiding the “terrorism” label for this event is the protection and enabling of white supremacist groups. “Hate-crimes” do not capture the true magnitude and intensity of this event. Failing to acknowledge terrorist attacks by misrepresenting their violence as hate crimes reflects the prejudiced underpinnings of this country.

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Gothic Landscape by Lily Wilson
Charcoal



Burnt Umber by Lilly Wilson
Charcoal and Conté



Pluto by Alex Blom
Oil on Canvas



Dr. Debak Das

Josef Korbel School of International Studies

Elijah Kruger¹, on behalf of the Editorial Board

¹DUURJ Editor at Large, University of Denver



1 WHERE DID YOU GO TO SCHOOL? WHAT INTERESTED YOU IN BEING A HISTORY MAJOR?

I'm originally from Kolkata in West Bengal in India. I did my schooling there, I grew up there and I went to college at a school called Presidency College, where I studied history. At that point in time, I was generally interested in history and had always been interested in different aspects of it. But it was really as I got deep into that study that I realized I was more interested in Cold War history, or modern history as we know it. That led me towards International Relations which is what I did my master's in. My master's was at the Jawaharlal Nehru University in New Delhi, and I did an M.A. in Politics with a specialization in International Relations. That's how I got more deeply engrossed in the questions of international politics, nuclear politics, international security and as I did that, I found myself to be more and more drawn toward questions of nuclear security and disarmament. I finished my M.A. and started an M. Phil

which is kind of a research master's degree, between an M.A. and a Ph.D. I did an M. Phil in Diplomacy and Disarmament and worked on India's ballistic missile defense program. Through that process, I got to meet a lot of policymakers who were dealing with nuclear politics with a lot of engagement on India and Pakistan issues, from both sides of the border. That really got me interested in trying to understand more and learn more, of course. That's why I decided to do a Ph.D. That's also when I came to the United States. I went to Cornell University where I did my Ph.D. in the Government department.

2 WHAT LED YOU TO DU?

There are a few things that led me to DU. First of all, after I was done with my Ph.D. at Cornell, I was on the academic job market, and I was looking for a place which had a number of characteristics that the Korbel School at DU has. One of them was that I have always been interested in being engaged with the policy world. Through my graduate career, and even before that, I tried to be engaged with think tanks, and with policymakers, and learn how they think about things. So, Korbel's policy focus, in line with its deep academic engagement was one of the factors that pulled me toward the school. The other thing that I really liked about Korbel, which made me think I would be a good fit is its interdisciplinary focus. I'm from a political science department and got my Ph.D. in government, but I also do a lot of archival work and have a background in history. It was important for me to be at a department that is interdisciplinary which involves history, sociology, and policy, and has folks who are doing extremely relevant work in the broader International Studies field. It's a great and dynamic academic and intellectual community. I was drawn by that characteristic of the school. Finally, I'd say that I found the school to be aligned with the politics of a fundamental need for greater scholarship coming from the Global South. Looking to incorporate a diverse set of views, voices, visions, and scholars from these areas of the world. This is important because a large part of academia and especially Western

academia, looks very similar and talks in very similar ways. Korbels commitment to try and break that mold and diversify the voices that are engaging in important scholarship was something that I thought was fantastic.

3 WHAT ARE YOUR TEACHING INTERESTS? WHAT ISSUES DO YOU ENJOY TEACHING?

I've taught two classes at DU that I've really enjoyed. One is a class on nuclear security and international relations, called, "Nuclear Weapons and International Security." That's a class that I taught for undergraduates. I've found that to be extremely enjoyable, mostly because I thought there was a very good understanding already among undergraduates of the topics we were talking about. In some ways, I found students to be very engaged, to be committed to the course, and doing far more background reading than I thought they would. I was very, very impressed, pleasantly surprised, and it was an absolute joy to teach. I think the students were pushing the class forward toward intellectual directions, which were at a way higher than an undergraduate class. The other class was called, "Emerging Issues in International Security," for master's students. That's also a class that I really enjoyed teaching because it talks about different issues that are important and contemporary. We started off with the Ukraine War and the return of great power politics. We also talked about nuclear security, cyber-politics, drones, AI, hypersonics, climate change, the role of the Global South in international politics, and wrapped up with the Indo-Pacific. It was a lot, but it was also important in terms of applying theory to real-world international situations. We talked about different issues, applied theories, and about policy options for each of the salient crises that are happening in the world right now. Running the Sie simulations with Dr. Hillary Matfess has been one of the highlights of my time at Korbels. Participants have been so engaged in the different scenarios that we've created, bought into the story and generally created realistic policy responses that we would expect elite policymakers to make. Curating such immersive experiences at DU has certainly been very rewarding.

4 HOW WOULD YOU DESCRIBE YOUR CURRENT BOOK PROJECT TO A LAYMAN?

The way I describe the book project is that I'm trying to understand how states build their nuclear delivery vehicles. We know a fair bit about why states build the nuclear bomb: why they do it and how they do it. What we haven't researched as much is what they do after they build the bomb. How do they take that bomb and deliver it to another location? This question is important because as you look at international politics today, you see Iranian missile tests being important,

you see North Korea testing ICBMS and IRBMS. That really catches the eye of the international community as well as anyone engaged in the conversation of international security. South Korea is thinking about building submarine-launched ballistic missiles. It is really a question that's come up time and again and is extremely salient right now. I'm trying to understand what about the international system or the global non-proliferation order allows states to build these systems. I have three case studies in the book: India, the UK, and France. I've done archival work and interviews in all these countries, as well as the United States.

5 IS THERE ANY OTHER RESEARCH THAT YOU'RE CURRENTLY WORKING ON THAT YOU WOULD LIKE TO SHARE?

I'll mention two co-authored projects that I'm working on. One is related to the nuclear world and my book. This is about the question of definitions and how things get defined in international law. I've found through my research that the term "nuclear weapons" is not defined in the nuclear non-proliferation treaty, and it's not defined in the treaty to ban nuclear weapons. This leads to the question of why do important things that a treaty is trying to address or constrain the spread of, not get defined? This is a paper that I'm co-authoring with Dr. J. Luis Rodriguez, at the Center for International Security and Cooperation at Stanford (CISAC). We just presented the paper at the International Studies Association conference. The other project that I'll mention is one with Dr. Shubha Kamala Prasad at the Hertie school in Berlin. We're working on a paper about whether public opinion matters in democracies in the non-Western world when it comes to security issues. There's a lot of work in Western democracies that look at public opinion and how that might shape policy. We're interested in the democracies that are in the non-Western world and whether they operate in similar ways or if there are important differences there. The paper is on the intersection of democratic thought and values and how it intersects with international security.

6 HAS THERE BEEN A DEFINING MOMENT IN YOUR CAREER?

I spent a couple of years at the Center for International Security and Cooperation at Stanford, and I found my experience there to be extremely formative in many ways. It was an excellent experience with the most supportive and collaborative set of academics. Scholars who were in political science, in history, in anthropology, as well as nuclear scientists that came together in the same community and supported each other's work. This was all in the middle of the pandemic, making it all the more special to be around this extraordinary

group of individuals. That really shaped my intellectual growth and opened me up to a bunch of different outlooks. It was definitely a career highlight and critical formative experience.

7 WHERE WAS YOUR FAVORITE PLACE TO CONDUCT ARCHIVAL RESEARCH?

My favorite spot to conduct archival research is India. It's one of those places that is not necessarily easy to conduct research, but it is very rewarding. There are all kinds of historical details that have come at me, regarding different issues. Not just about my own research but about adjacent political issues that I've always found fascinating. From personal letters that politicians are writing to each other or to high-level bureaucrats and generals to others. Things that you don't read in the history books or aren't common knowledge. While that's true of most archival research, I've found that archival work in India has been rewarding because of the different aspects of the Indian history that I am interested in. You stop thinking of historical personalities as these distant characters or people in the newspapers and start thinking of them as people who might be doing similar things as you. One of my favorite things that I've found in Indian archives was about this diplomat called T.N. Kaul an Indian Foreign Secretary who was the ambassador of India to the United States and later the USSR. I found an article about him hosting dinners. It was an interview with him, where there were these recipes that he had written for a magazine, and they were in the archives. One could go out and cook these recipes if they wanted to!

8 WHAT TWO OR THREE ISSUES DO YOU THINK ARE MOST IMPORTANT FOR PEOPLE TO KEEP THEIR EYE ON AROUND THE WORLD?

The first would be nuclear weapons and the potential for their use and escalation, particularly in Ukraine, but also in other theatres. The reason I say this is because it's important for us to think of nuclear weapons as being potentially used in a battlefield, but also their accidental use leading to nuclear escalation. Last year, India accidentally launched a missile into Pakistan. It wasn't loaded of course but it could easily have been misconstrued as being an attack. The second issue is artificial intelligence and how there is a revolution that, in many ways is coming not just to the world of international security but also the broader world, writ large. Things are changing in small but important ways. I think it's going to be very interesting to see how these technologies level up, how we respond to them, how we might deal with cyber issues, or how the day-to-day military world might change due to AI. Finally,

the third issue people should pay attention to is non-western approaches to international relations. In the context of the Ukraine war, if you look at the number of countries that abstained or have not really condemned Russia's invasion, it makes you think, "What is going on here?" Why is it that so many countries in the non-Western world are not aligned with what we think are straightforward political stances to take? I think we don't understand what is going on because we don't pay attention to local and regional politics that inform a lot of political positions that non-Western states take. To some extent, it is Western hubris. To some extent, it's this idea that great powers matter and other don't, which to me, are very limiting ways of looking at the world and understanding international politics.

9 WHAT DO YOU LIKE TO DO WHEN NOT CONDUCTING RESEARCH OR TEACHING?

This relates to something we talked about earlier. I enjoy cooking. Hence, finding an ambassador's recipe in the middle of the archives is an intersection of the personal and professional. I tend to cook as a form of unwinding. Whipping up different kinds of recipes from different cuisines is always challenging and enjoyable and takes your mind off things.

10 RECOMMEND ONE PODCAST AND ONE BOOK FOR PEOPLE INTERESTED IN THE FIELD

Let me give you two book recommendations and a podcast recommendation. The first book is called, *Command and Control* by Eric Schlosser. It talks about different nuclear accidents that have taken place in the United States. You tend to think of the United States as a nuclear force that is extremely professional and top-of-the-line. There's no doubt that they are but it shows that even a force that is as disciplined as the United States could have massive lapses in handling nuclear weapons. It is a sobering read, but also very interesting. It talks about the time that the United States nearly had its most powerful nuclear bomb explode in rural Arkansas in an ICBM silo. The second book I enjoyed recently is a book by Togzhan Kassenova called *Atomic Steppe*. It's about Kazakhstan inheriting nuclear weapons from the Soviet Union that had just collapsed, and the processes that led to Kazakhstan giving up nuclear weapons. A podcast recommendation is called *Press the Button from the Ploughshares Fund*. It's one of those podcasts that deals with the latest developments in international security on a weekly basis.



Yellowstone by Bethany Carideo
Captured on iPhone13

DU Undergraduate Showcase: Research, Scholarship, and Creative Works

Abstracts

MILITARY MASCULINITIES AND HONORARY MEN: A COMPARATIVE ANALYSIS OF UNITED STATES AND UNITED KINGDOM APPROACHES TO IRAQ SECURITY SECTOR REFORM

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The 2003 Iraq War marked the first time the United States and United Kingdom deployed gender-specific units in support of active combat operations. As manifestations of changing gendered norms within American and British defense institutions, these Team Lioness units became symbolic of defense transitions to a more diverse fighting force for the future. Following the Iraq War, the United States and United Kingdom were authorized as governing entities over the post-conflict Security Sector Reform process. Responsible for reconstructing Iraqi defense institutions, Coalition US-UK forces focused reconstruction efforts on addressing the immediate security needs of the country. To this end, prior feminist literature has criticized the lack of formalized gender-inclusive policies in such post-conflict spheres given the prominence of Team Lioness units during the war itself. Such debates, however, ignore the broader consideration of how gender impacts post-conflict reconstruction. More specifically, there remains the question of how United States and United Kingdom defense institutions perform gender and to what extent such normative cultures impacted Security Sector Reform efforts in post-conflict Iraq. Thus, utilizing a Feminist Institutionalism theoretical perspective, this research will investigate the militarized masculinities of US and UK fighting forces embodied within defense behaviors and policies. Based on a qualitative descriptive analysis of United States and United Kingdom Women, Peace, and Security legislation, alongside interviews with five former gender advisors and servicemembers, this research investigates how gendered normative patterns can help explain American and British approaches to post-conflict reconstruction in Iraq.

LATINX STIGMA, SCULPTURE INFORMED BY STEREOTYPES

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Latinx/Latino stereotypes are a common, casual aspect of contemporary life in the United States. By conducting research into Latino / Latinx stereotypes, local resources in Denver and at DU, this data will be translated as a tangible, large scale sculpture. By engaging with what appears to be welcoming sculpture, a closer look will encourage contemplation about stigma, assumptions and stereotypes.

SPECTROPOLARIMETRIC ANALYSIS OF THE SUPERNOVA M12045

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As a massive star nears the end of its lifetime, its core contracts and heats, producing helium, carbon, oxygen, neon, silicon, and iron through nuclear fusion. Since iron is the heaviest element that can be fused in a star, the force produced by nuclear fusion can no longer act against gravity and the star energetically collapses and explodes, spewing clouds of elements and producing a supernova. These events are particularly exciting and important as supernovae are one of the most dominant sources of elements in our universe and many of the elements in our bodies and on Earth were once supernova remnants. By analyzing spectropolarimetric data, our team is able to extract information about the structure of supernova explosions that are located at an inconceivably substantial distance away from us. Our data comes from the Supernova Spectropolarimetry Project, which is a collaboration between our lab, San Diego State University, and the University of Arizona. The observatory at UArizona collected multiple epochs of spectropolarimetric data for over 100 supernovae shortly after discovery. Throughout the summer of 2022, I utilized Python to analyze a type Ib supernova discovered in 2014 named M12045, which lives over fifty million light years away in the barred spiral galaxy NGC 4080. Supernovae are classified according to their spectral features, and type Ib supernovae are characterized by strong helium lines and no hydrogen lines in their spectra. My analysis is consistent with this classification as the most prominent features in the spectra for M12045 were the helium 5876Å and 7065Å lines. Additionally, we saw the signature of an oxygen doublet at 6300Å and 6363Å emerge in later epochs. Plots of the polarization components with velocity also show an asymmetrical explosion geometry as they are nonlinear. This ongoing research greatly contributes to our understanding of supernova explosion mechanisms.

METHODS IN UNDERGRADUATE COMPUTER ETHICS EDUCATION

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The field of computer ethics examines the applied philosophy of best practices, guidelines, and values in the use of computers. This includes anything that can be done with a computer, like machine learning, language processing, writing algorithms, or how those are applied. The application and use of these programs can have detrimental real-world consequences. Already there have been major concerns raised about the risk new technologies pose by worsening inequality, reinforcing bias, and spreading misinformation. However, these potential ethical consequences are not always obvious or easy to see when complex systems are developed. It is therefore crucial that computer scientists learn early how to recognize and evaluate their work through an ethical lens. Towards this end it is essential to integrate ethics in the computer science curriculum. Computer science students, especially those at the university level, represent the future of computer science work and will undoubtedly help shape the future of the technological world. My work is a review of current methods in undergraduate computer ethics education that investigates best practices of integrating ethics into the computer science curriculum, examines how current students learn computer ethics, explores student perspectives, and suggests practical use cases on how ethics can be integrated within the computer science program at the University of Denver.

INDUCTIVE ANALYSIS OF MEDIA NARRATIVE REGARDING 2020 GEORGE FLOYD PROTESTS IN MINNESOTA

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My project aims to examine how two newspapers in the Twin Cities covered the George Floyd Protests of 2020, and how that coverage changed over time. As a resident of Minnesota, I was at the epicenter of these events, and they had a marked impact on my interests and plans going forward. These protests inspired my choice of major and future field, and I wanted my final project to reflect the impact they've had on me. Given the prevalence of research regarding the origin and outcome of these events, I found a niche that allowed me to examine them from a new angle. My project itself centers around two newspapers, both locally distributed in the Twin Cities, the Minneapolis Star Tribune, and the Twin Cities Pioneer Press. Using these papers, I aimed to determine how the actors present, namely the protesters, the police, and city or state officials, were narratively presented, and how that presentation changed over time or differed between papers. To this end, I read every article containing the words "George Floyd" and "Protest" between two set dates and, using an inductive scheme I created as I read, coded each for the presence of certain words or phrases I deemed to be representative of defined perspective. Collating this data has shown me that both papers marched in rough lockstep through June, where their coverage began to differ. Namely, the Pioneer Press, a more conservative outlet, leaned heavily into covering property crime and portraying the protesters as criminal, while the Star Tribune began to center their coverage on the positive changes brought to the city. Using this research, I hope to advance the larger retrospective on these events by providing a methodology that can be applied to other media outlets, and can be referenced for other cities.

EFFECTS OF RED DRAGON FRUIT (HYLOCEREUS POLYRHIZUS) EXTRACT ON SPINAL MOTOR NEURON SURVIVAL AND GLIOSIS IN THE G93A MUTANT HSOD1 MOUSE MODEL OF ALS

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Amyotrophic lateral sclerosis (ALS) is a fatal disorder characterized by progressive degeneration of motor neurons due to various factors such as inflammation, oxidative stress, and mitochondrial dysfunction. Betacyanins are a type of nutraceutical found in red dragon fruit which have been shown to demonstrate anti-inflammatory, antioxidant, and free-radical scavenging properties. These features of betacyanins indicate that they could be beneficial in slowing disease progression in ALS. This study explored the therapeutic effects of red dragon fruit extract (DFE) on spinal motor neuron survival and gliosis in a transgenic mouse model of ALS (G93A hSOD1). The groups consisted of three sex-matched littermates, two G93A hSOD1 mutant mice, and one wildtype (WT) control mouse. The treated ALS mouse received DFE ad libitum (5% v/v in water), and the other mutant and WT got regular water. All of the mice were euthanized when the untreated mutant reached end-stage of the disease (at approximately 120 days of age), when their hind limbs are paralyzed, and it cannot flip over when put on its back. Lumbar spinal cord tissues were collected and immunostained for astrogliosis, microgliosis, and alpha motor neurons. Each staining method was done to compare how the DFE might have a protective effect on the histopathological symptoms observed in ALS. The stained tissue was imaged using a fluorescent microscope, then quantified to compare the number of alpha motor neurons and gliosis between the treated and untreated ALS mice. The treated G93A hSOD1 mice show less inflammation and a higher number of alpha motor neurons compared to the untreated mutants, indicating that DFE could be a novel therapeutic treatment for ALS.

TRADE WARS, COVID-19, USMCA, AND PROTECTIONISM: EXOGENOUS FACTOR INFLUENCE ON U.S- MEXICO SUPPLY CHAINS IN THE AUTOMOTIVE INDUSTRY

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This research explores the presence of COVID-19, the U.S-China trade war, and the implementation of NAFTA as USMCA, have had on U.S.-Mexico trade relations focusing on the automotive industry. With rising trends of protectionism in international trade, this research focused on the language that Tesla and General Motors company sites in Mexico used from 2021 to March 2023 in their released articles to the public and how frequently the variables of COVID19, the U.S China trade war, USMCA and protectionism were discussed. Articles in both Spanish and English were included in this analysis. It is of particular importance to focus on the automotive industry as it is the largest industry in trade for Mexico with the U.S. In the 2021-2023 period, the Mexico General Motors and Tesla company websites collectively released 97 articles. The sample greatly consisted of articles from General Motors. However, because the presence of General Motors is much more established in Mexico than is Tesla's this is logical. The presence of these exogenous variables of COVID19, USMCA, U.S China Trade War, and rising protectionism caused major impacts in the global economy. Through content analyses of the released media articles from General Motors and Tesla, it was found that these factors which deeply impacted the global economy are being discussed in a smaller level of automotive supply chains.

VICTIMS OF TERRORISM IN THE BASQUE COUNTRY THROUGH TESTIMONY AND MEMORIALIZATION

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The Basque Country, a region of northern Spain home to a unique language and thousands of years of history, has been riddled with an independence movement since the turn of the 20th century. In 1959, ETA (Euskadi Ta Askatasuna, a phrase in the Basque language that stands for Basque Homeland and Freedom), a Basque terrorism organization, emerged. While exercising violent means in the fight for independence, they took the lives of more than 800 individuals, ranging from politicians to children. Since the 2011 cease-fire and the official disbandment of the organization in 2018, the Basque Community has been faced with the issue of how to recover from a state of internal conflict, working to create a historical narrative of what happened throughout the last six decades. In such a context, wherein Basques are fighting against Basques on the grounds of nationalism and independence, the term "victims" deserves an explanation. While the most visible victims of ETA are those that were assassinated or physically wounded, the Basque community as a whole has suffered the consequences of an active terrorism organization — from the families of those murdered to the families of terrorists that were incarcerated in distant prisons, to innocent bystanders caught in the crossfire. Today, streets remain lined with graffiti and posters calling for the liberation of incarcerated terrorists, while family members of those killed by ETA walk the same streets.

EFFECTS OF BIOCHAR ON SHORT TERM GROWTH IN ROCKY MOUNTAIN LODGEPOLE PINE

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Rocky Mountain lodgepole pine (*Pinus contorta* var *latifolia*) is a fire-adapted pine species that has evolved to survive a fire with serotinous cones that open to release seeds at specific temperatures. However, the increased temperature and frequency of modern wildfires has led to decreased germination of lodgepole pines, and a combination of thick stands and recent widespread drought have weakened the immune systems of lodgepole pine, causing increased infestation of mountain pine beetle. As a result, there is a need for improved forest regeneration techniques in lodgepole pine forests. One method of improving revegetation could be through use of a biochar, a carbon-based substance that is produced when woody biomass is burned in a high-temperature environment during a process referred to as pyrolysis. Numerous studies have found that biochar has generally positive impacts on soil health and plant productivity. However, more research is needed on its impact on native plants, especially lodgepole pine and other species with serotinous mechanisms. This study looks to address how different applications of biochar can be utilized in early greenhouse growth of lodgepole pine, the primary step of many revegetation efforts. In the Olin Hall Greenhouse, following a stratification process, we are currently comparing short term (6 months) growth of lodgepole pine seeds sown in potting soil, potting soil incorporated with biochar, and biochar on top of potting soil. Our procedure is based on protocols developed by the Colorado State Forest Service nursery, the Native Plant Network's Propagation Protocol Database, U.S. Forest Service studies, and other academic studies. In our initial observations following germination, soil plots with biochar amendments are more successful in promoting early growth of lodgepole pine. If this holds true throughout the study, there would be valuable implications on revegetation efforts for an ecosystem increasingly challenged by a changing climate.

INVESTIGATION OF SEPTINS IN DROSOPHILA MELANOGASTER

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Septins are relatively under-researched binding proteins that play important roles in the development and physiology of cells in most organisms. Septin proteins are known to support the cytoskeleton of cells, mainly the microtubules and actin filaments, aiding in process such as cell division, cell-cell adhesion, and membrane trafficking. Through my investigation of septins in the common fruit fly, *Drosophila melanogaster*, I aimed to determine and film with a confocal scanning microscope the location of an important septin, Septin 2, and how the lack of another septin, Septin 4, would affect cells. These experiments were performed on the embryos of *Drosophila melanogaster* flies during the process of germ band extension, a period of rapid cell division where the body segments of the fly begins to form. Through my experiment, I was able to determine the location of Septin 2 within the cells, being widely spread throughout the cell, though being particularly focused in the membrane of each cell. I also discovered that cells that lack Septin 4 also have a greatly decreased amount of Rab35 puncta, a grouping of developmental proteins found near the surface of the cell. This has led me to believe that septins play an important role in keeping the structural integrity or the development of Rab35 puncta. This project allowed me to learn important laboratory techniques, deepen my knowledge of the development of cells, and discover what role septins play in that development.

GENETIC INTERACTIONS OF PROTEINS ASSOCIATED WITH FRAGILE X SYNDROME

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Fragile X Syndrome (FXS) is a genetic disorder that causes neurodevelopmental issues in humans and is the most common single gene mutation causing autism. The loss of the expression of Fragile X Mental Retardation protein (FMRP) is a principal cause of FXS but surprisingly little is known about how FMRP functions in cells. One fact that is clear is that FMRP associates with additional RNA binding proteins (RBPs) to function in neurons. The focus of my research is to explore the genetic interactions of FMRP and another RBP, Syncrip in the *Drosophila melanogaster* model organism. Based on unpublished studies in the Barbee lab, it has been identified that Syncrip and FMRP interact at the physical level, meaning they bind to each other directly. Furthermore, a study by McDermott et al. has shown that loss of function of either /or FMRP and Syncrip results in similar phenotypes. Lastly, my previous work in the Barbee lab has proven the colocalization of FMRP and Syncrip in cytoplasmic granules of a neuronal cell line. This evidence strongly suggests the possibility of a genetic interaction between FMRP and Syncrip affecting the same genetic pathways. I hypothesize that Syncrip and FMRP interact genetically to control synaptic development in neurons.

EVALUATING THE PRIVACY AND SECURITY PERSPECTIVE OF OLDER ADULTS TOWARDS ONLINE DATING

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The use of online dating applications has become increasingly popular among younger populations, but older adults aged 65 and above are also engaging in this practice. However, the provision of personally identifiable information (PII) required by these applications raises serious privacy and security concerns, particularly for older adult users who are more vulnerable to online abuse and scams. This research aims to investigate the implications of these challenges in older adults use of online dating applications. The approach involves mixed methods research, including a survey-based crowdsourcing experiment and semi-structured interviews with older adults who have used online dating applications. The survey-based experiment will seek to collect quantitative data on older adults' attitudes towards privacy and security. The semi-structured interviews will explore older adults' experiences and perspectives on privacy and security in greater depth. The expected results will provide insight into the privacy and security challenges faced by older adults, including their attitudes towards sharing PII and experiences with online abuse and scams. This research will also explore potential solutions for mitigating these risks, including the development of tools and interventions to enhance privacy and security in online dating applications. Ultimately, this research can contribute to the development of safer and more secure online dating applications for all users. It should be noted that this research is still in progress, and we are currently working on building out the surveys to be sent out to the participants.

EVALUATING THE VARIOUS FACETS OF ACCOUNT REMEDIATION APPROACHES OF POPULAR USER-CENTERED INTERACTION SERVICES

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This project aims to evaluate the various facets of account remediation approaches of popular user-centered interaction services. The motivation behind this project is the increasing dependence of individuals and businesses on online services for various purposes, making online security and privacy a significant concern. Despite the increasing need for secure online services, there is a lack of research on the effectiveness of account remediation approaches implemented by user-centered interaction services.

REPORTED SCHOOL CLIMATE FOR DIVERSITY AND FEELINGS OF BELONGING FOR LATINE STUDENTS: MODERATION OF FEELINGS OF BELONGING BY PARENT'S ACADEMIC ASPIRATIONS AND EXPECTATIONS

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School belonging, the extent to which students feel accepted, respected, included, and supported by others in school (Goodnow, 1993), has been shown to impact children's social-emotional well-being as early as elementary school (Castro-Kemp et al, 2019). Students with a higher sense of school belonging demonstrate more school engagement, and intrinsic motivation (Byrd & Chavous, 2011). A positive school climate, the emphasis placed on norms and values of race and interracial interaction in the school atmosphere (Green et al., 1988), has been shown to protect Latinx youth's feelings of belonging by buffering the deleterious impacts associated with ethnic discrimination (Heikamp et al., 2020; Roche & Kuperminc, 2012). Additionally, parental aspirations and expectations can act as moderating factors on the student's feelings of belonging (Vang et al., 2022).

The purpose of this study is to examine associations between teachers' perceptions of school climate and 3rd-5th grade Latinx children's school belonging. Previous research investigating Latinx students' feelings of belonging and associations with school climate has focused on adolescent populations, therefore, this study will extend the literature by investigating these associations with children in middle childhood. We hypothesize that Latinx students will report more school belonging when teachers report a positive school climate compared to a negative school climate. Additionally, considering previous research has shown students' parental involvement can protect minoritized students' feelings of belonging, we predict that parental involvement will moderate the association between teachers' perceptions of school climate and Latinx children's school belonging.

WRITING ABOUT LITERATURE AT THE UNIVERSITY OF DENVER, 1997–2002

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In the 1990s, debates over the nature of writing education at the undergraduate level erupted across North America. These discourses ultimately proved foundational to the evolution of the modern writing curriculum, generating novel approaches to the writing course. However, although theoretical conversations concerning writing education at the turn of the century abound, little research into the practical impacts of composition pedagogy during this time period exists. To understand the implications of these debates over composition theory, this research project preserved, investigated, and analyzed the University of Denver's archival material pertaining to first-year writing courses taking place between 1997 and 2002, while examining the interplay of these diverse composition pedagogies in a classroom setting. The project worked to reconcile and recontextualize composition theory with the practices and content of writing education at the University. Ultimately, this research project produced insights into the practices and content utilized in the University of Denver's first-year writing courses in relation to composition theory.

CONTRIBUTION OF THE LOADING-UNLOADING BALANCE MECHANISM WITH VARIOUS FOOT PLACEMENTS

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Balance and motor control are affected in concussed athletes. Despite the use of standing balance tests in concussion diagnosis, the required foot placements are often inadequate for the outcomes to be sensitive to concussion recovery. Winter et al (1996), suggested that the primary motor mechanisms used can be determined from additional foot placements. To our knowledge, these additional foot placements have not been pursued in concussion research or another field. The objective of this research is to examine whether a continuum of balance motor mechanisms exists during various foot positions. We hypothesize that as the difficulty of each stance increases, one's natural reliance on the loading and unloading mechanism of balance will increase. Understanding this information will allow concussion researchers to utilize appropriately difficult stances while also evaluating the overreliance on irregular motor systems. Each participant stood still in various foot positions repeated on the opposite foot with eyes open and closed (side by side (0 deg), 30 deg, 45 deg, 60 deg, and tandem (90 deg)). A force platform under each foot sampled at 1000 Hz, filtered at a 6 Hz cut-off was transformed into the center of pressure (COP). These COP signals were mathematically computed into two mechanisms: 1) coordinated joint control (COPc) and 2) loading and unloading each limb (COPv). The reliance on the load/unload mechanism was assessed using the total range of the COPv. Our initial results demonstrate that the range of COPv gradually increases from 0 to 90 degrees. This finding indicates a systematically increased involvement of the loading/unloading mechanism with increasingly challenging stances. These methods will allow therapists treating concussions to recognize the level of motor compensation present. Restoring the typical motor mechanism of coordinated joint control—instead of loading/unloading—in a patient could be an intervention target for athletes recovering from a concussion.

IDENTIFICATION OF THERAPEUTIC TARGETS FOR PARKINSON'S DISEASE

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Our lab has successfully identified the aggregation-prone amino acid sequence that is important for the aggregation of α -Synuclein protein (aS), which is the process responsible for production of Parkinson's Disease (PD) phenotypes, with symptoms such as impaired motor functions. My goal is to further confirm the role of these sequences in aggregation and identify individual amino acid(s) within that sequence that are important for aS aggregation. This will be accomplished using design of aS variants with point mutations, created by substituting alanine for amino acids within the aggregation-prone sequence. Thioflavin T (Th T) fluorescence assays, transmission electron microscopy (TEM), cellular assays, and confocal microscopy will then be performed on the purified aS variants. This study will further develop understanding of the role of individual amino acid(s) in facilitating aS aggregation. In addition, this will advance identification of potential therapeutic targets for the treatment of PD. With this amino acid sequence identified, synthetic molecules can be synthesized to bind and potentially inhibit aggregation of aS.

DETECTION OF GASEOUS ETHYLENE USING BODIPY ETHYLENE PROBES WITH APPLICATIONS IN PLANT BIOLOGY

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Ethylene is a gaseous plant hormone that plays a large part in plant growth; by monitoring and detecting concentrations of gaseous ethylene, information on fruit ripening or flower growth can be provided and analyzed. This project proposes a gaseous ethylene detection system with applications in various fields, such as plant biology, environmental science, agriculture, and horticulture. Key objectives of the detector are accuracy, stability, speed of data retrieval, ease of operation, and simplicity. The project allows for an understanding of the most optimal detection set up that matches the objectives listed as closely as possible. The Michel Lab has developed several ruthenium based Bodipy Ethylene Probes (BEPs) based on olefin metathesis with varying kinetic and stability profiles, however these have almost exclusively been evaluated in solution to date. Initial evaluations will function similarly to the preliminary tests but will consist of evaluation of different substrates such as silica or variations of alumina, varying the amount of the probe used, adjusting spot sizes of substrate spotted on thin-layer chromatography (TLC) plates, and changing solvents. Thus far, data has been collected on at least 8 variations of probes, 2 solvents, various probes amounts and concentrations, and different substrates ranging from TLC plates to printer paper. The probes tested so far include BEP-4, SIPr-BEP-4, Neo-BEP-4, Phenoxy-BEP-4, 2-Ad-BEP-4, Con-BEP-4, SIPr-Ox-BEP-4, and Ox-NF5-BEP-5.

SELECTION FREQUENCY & AFFECTIVE OUTCOMES OF REAPPRAISAL TACTICS

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Cognitive reappraisal is an effective emotion regulation technique, but there is a lack of research focused on the selection frequency and affective outcomes of specific cognitive reappraisal tactics. The present study evaluated the selection frequency and affective outcomes of three cognitive reappraisal tactics: change current circumstances, change future consequences, and acceptance. Forty-seven participants completed a computerized emotion regulation task in which they reappraised (“decrease” condition) or passively viewed (“look” condition) one hundred-forty-four negative images. Following each image, participants were asked to rate how negative they feel, and to indicate how they changed the meaning of the picture. Results indicate differences in the frequency of tactics used across conditions ($F(1.70, 44) = 128.30, p < .001, \eta p^2 = .75$). For the “decrease” condition, the change current circumstances tactic was selected most frequently, while for the “look” condition, the acceptance tactic was selected most frequently. For affective outcomes, the “decrease” condition resulted in better affective outcomes compared to the “look” condition ($F(1, 5801.80) = 11.70, p < .001$) with the change current circumstances tactic being the most successful at decreasing negative emotions. Knowing which reappraisal tactics are most frequently selected, and their affective outcomes may help us better understand how to improve people’s ability to use reappraisal to achieve their emotional goals.

THE ROLE OF EARLY POSTPARTUM DEPRESSION SYMPTOMS ON HEMODYNAMIC RESPONSE TO INFANT CRY AND PARENTAL BEHAVIORS

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Gestational parents experiencing clinical depression during the first postpartum year have demonstrated dampened neural and behavioral responses to infant stimuli. There is limited literature surrounding these trends in subclinical populations during the immediate postpartum period. A total of 58 gestational parents, 2.58 ± 2.53 weeks postpartum on average, reported EPDS ($m = 4.76 \pm 4.27$) and completed a 10-minute interaction with their infant in which behavioral responses were coded using the Emotional Availability scale. Participants completed an additional task using Functional Near-Infrared Spectroscopy that measured hemodynamic response to their own and another infant cry. EPDS was positively correlated with neural activation across channel S3:D4 in the dorsomedial PFC in response to other infant cry ($r(58) = .423, p < .001$) and own infant cry ($r(58) = .261, p = .048$). Higher EPDS score was also associated with increased activation in response to other infant cry across channel S6:D6 ($r(58) = .265, p = .044$) in the dorsomedial PFC and channel S8:D7 ($r(58) = .361, p = .005$) in the dorsolateral PFC. Whereas there was no significant relationship between neural activation and maternal sensitivity, hostile parenting behaviors were positively correlated with neural activation in response to other infant cry across channel S6:D6 ($r(58) = -.327, p = .032$) in the dorsomedial PFC. Results suggest that EPDS can have an effect on hemodynamic response in clinical and subclinical populations, that there is a relationship between neural reactivity and parenting outcomes, and that the relationship between EPDS and parental behaviors may not be capable of measurement in the very early postpartum period. These findings could have important implications for research on the risks of depression symptoms toward the development of parent/child interactions and future work should target early-intervention programs for parents.

FRENCH AS A SUBJECT AND LANGUAGE AT UNITED STATES' UNIVERSITIES

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The United States is continually shaped and influenced by its many comprising cultures and languages. As such, foreign language study has long been an integral component of many primary, secondary, and university level education systems. Both historically and in modern times, one language (other than Spanish) has maintained consistent enrollment rates, particularly at the university level: French. By evaluating different university French departments throughout the United States, this study sought to understand potential distinguishing characteristics that have led to the language's academic success. The study evaluated departmental perspectives through academic research and qualitative staff interviews, as well as student perspectives through a qualitative online survey. These interviews and survey suggest that French as a subject continues to move away from more traditional language study to the study of French's fundamental role in the Francophone world. Both faculty and student perspectives demonstrate an increasing interest in the opportunities that French language makes available. French's increasingly important role in a rapidly globalizing world is a leading catalyst for this shift. Additionally, foreign languages are experiencing significant enrollment decreases at the university level. Many departments hope that this shifting model will attract more students, while it simultaneously embraces the true nature of French's role in the modern world. French's historic prevalence in United States' culture has allowed it to maintain a certain power at many universities, but it still suffers from similar enrollment struggles. Further research is needed to better understand student motivations for enrolling in language courses such as French, as opposed to those that increasingly choose not to. Not only would such research help struggling departments recover enrollments, but it is important for contextualizing cultural and linguistic understandings in an increasingly globalized world.

DO AGE AND DIET INTERACT TO AFFECT FALL WEBWORM PARASITISM?

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Bottom-up (host plant) and top-down (natural enemy) pressures both can affect how insect herbivores select their host plants. Here we investigated which fall webworm (*Hyphantria cunea*, hereafter FW) parasitoids, an important natural enemy for FW, attack FW at different ontogenetic stages in the field on different host plants. To determine whether FW parasitism was dependent on the FW developmental stage, we placed FW early (8-10 days till hatching) and late term (12-13 days till hatching) eggs and 10-day old larvae, and 20-day old larvae at field sites in Boulder, Colorado (USA). We deployed both the eggs and larvae on 4 host plants commonly eaten by FW in Colorado: chokecherry, black willow, narrowleaf cottonwood, and thin-leaf alder. We kept eggs and larvae at the field sites for one week before retrieving these samples. We are currently rearing collected FW eggs and larvae to pupation in the lab and collecting emerging parasitoids. All parasitoids will be identified to the lowest taxon possible. Our results will contribute to understanding the ontogenetic stages that specific parasitoid species attack. Our research will help us to understand the host selection process among parasitoids of a local herbivore.

RACIAL BIASES IN PAIN CARE RECOMMENDATIONS AND THE MODERATING EFFECT OF PROVIDERS' EXPERIENCE WITH DIVERSE COMMUNITIES

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Despite Black Americans reporting greater pain than White Americans (Mechlin et al., 2005; Rahim-Williams et al., 2012), Black Americans' pain is underestimated and undertreated (Mack et al., 2018; Schoenthaler & Williams, 2022). Previous work suggests clinician biases (e.g., implicit prejudice, empathy gaps) may contribute to pain treatment disparities across race (Drwecki et al., 2011; Moskowitz et al., 2012). However, past work has yet to systematically examine pain treatment of multiracial individuals, who may be subject to discrimination documented in monoracial pain care but also may experience unique biases in healthcare settings with implications for equitable care (Chen et al., 2018; Freeman et al., 2016; Kteily et al., 2015). A pilot study conducted with a convenience sample indicated racial bias in pain care recommendations, where Black/White multiracial individuals received the least intensive pain care recommendations. The current work adopts an experimental approach and recruits a sample of pain care providers to investigate clinician biases in pain care for Black, White, and Black/White multiracial hypothetical patients. Pain care providers' experience with diverse communities is examined as a moderator to better understand how diversity exposure may attenuate or exacerbate patterns of racial bias in pain treatment recommendations. In sum, this work investigates patterns of clinician racial biases in pain treatment and potential moderation by experience with diverse patient populations (e.g., Are racial biases in pain care stronger or weaker for healthcare providers serving more diverse communities?). As an aspiring healthcare provider in a sub-field that commonly treats pain (i.e., emergency medicine), it is important to me to better understand and actively contribute to our collective understanding of how racial biases interfere with equitable and just pain care. The goal of this work is to motivate more equitable and higher quality care for all patients.

EVALUATION OF STERIC EFFECTS FOR FASTER BEPS (BODIPY ETHYLENE PROBES)

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Ethylene is a hormone released during key life cycle events in plants and commonly associated with fruit ripening. Recently, the Michel Group has reported fluorescent small molecule probes for the detection of ethylene through a selective reaction-based approach. To improve the sensitivity and selectivity of these probes, it is necessary to synthesize analogues and evaluate how structural changes will influence their photophysical properties such as limit of detection and fluorescence turn-on. A series of advancements upon original BODIPY Ethylene Probes BEP-4 and BEP-5 have provided evidence that faster reaction kinetics results in a probe that is more sensitive to ethylene. To further evaluate this hypothesis, we developed a synthetic route for a target probe BEP-3, with the goal of determining if steric effects would significantly impact ethylene sensitivity. Early photophysical data on BEP-3 demonstrates rapid reaction with ethylene and a turn-on with ethylene similar to previous fast-initiating probes in the Michel Lab. Additional evaluation of the ethylene detection ability of BEP-3 will be presented including limit of detection and kinetic profile data.

MORE THAN A HEADSTONE

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While most American citizens are aware of the overarching history of America's military conflicts, few have salient knowledge about individual veteran's experiences during the periods they served in and the lives they had afterwards. Many more veterans have had their remains sit unclaimed for decades in funerary homes, waiting for honorable burial. Through in-depth research, fact finding and interviews with the local Vietnam Veterans of America Chapter 1071 as well as the surviving family members of veterans buried at Fort Logan National Cemetery, my research with the DU History Department has helped collect these untold veterans' stories and deliver their remains for proper burial. These veteran's experiences have been assembled in *More Than a Headstone*, a part of the National Cemetery Administration's Veterans Legacy Program. In collaboration with Vietnam Veterans of America Local 1071, the DU History Department has been collecting veterans remains and stories from the Denver Area. (Visit Morethanaheadstone.org)

HUMAN NEURON MODEL OF RETT'S SYNDROME

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Rett Syndrome is a neurodegenerative disorder that affects between 1 in 10,000 and 1 in 15,000 females, and is lethal in males. Symptoms of Rett syndrome include loss of speech, developmental delay, abnormal gait, breathing dysfunction, and seizures. While there is no cure for Rett Syndrome, this disorder is known to be caused by a mutation of the gene that codes for methyl CpG binding protein 2 (MeCP2). Much research has been done on the disorder and the mutated gene, but very little has been in human models. This research utilizes human induced pluripotent stem cells (hiPSCs), which have been modified to contain mutated MeCP2 genes through CRISPR technology, in order to examine the key differences between healthy human excitatory neurons (wild type), and human neurons affected by the mutation that causes Rett syndrome. Although more data is necessary, preliminary results are consistent with the current research, and shows Rett Syndrome neurons are hyperactive in the absence of stimulus compare to wild type neurons, and also influx more calcium than wild type do when exposed to the same stimulus. These findings help confirm pilot findings in human models and add to the growing field of knowledge about the mechanism that causes Rett Syndrome. Further studies that build on this research will hopefully one day lead to a treatment or cure for this disorder.

NATO'S INTERVENTION IN KOSOVO: AN INTERSECTIONAL GENDER ANALYSIS

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In 1999, NATO began a widespread bombing campaign and peacebuilding mission in Kosovo to thwart Milosevic's regime from spreading its violence across Eastern Europe. The intervention was justified after the fact to end the suffering of the tens of thousands of women subjected to sexual and gender-based violence, these women paradoxically faced stigma and marginalization for voicing their experience of the violence they endured. The aim of this project is two-fold. First, to determine whether NATO's intervention in Kosovo considered the disproportionate impact of sexual and gender-based violence on women. Second, is to uncover if violence against women was at all considered by NATO leaders when intervening and subsequently rebuilding the country. United States-led international organizations such as NATO often escape criticism for their policy decisions. This is where the significance of the project lies: the lack of women-centered peacebuilding was a major oversight in the intervention of Kosovo and deserves to be examined by the academic community.

JEWISH BASEBALL PLAYERS AND THEIR IMPACT ON THE LESSENING OF ANTI-SEMITISM IN SPORTS IN THE 1930S – POST WORLD WAR II ERA

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For my project, I needed to further my research for my history capstone thesis on whether Jewish baseball players of the 1930s and 1940s contributed to Jews integrating into American culture. In my thesis, my goal was to explore the role of Jewish baseball players in challenging negative stereotypes of the Jewish community in the 1930s to post-War era. I mainly wanted to investigate whether leisure activities such as watching baseball was able to lessen antisemitism and allow Jews to become perceived as secular figures instead of racially different. Jewish players such as Hank Greenberg became popular figures through their play, so I wanted to see if these players became perceived as secular and helped lessen antisemitism in America.

My approach to the project was to investigate primary sources such as newspaper articles, interviews, and memoirs to learn if there was a change in attitudes towards Jewish Americans and Jewish players from the 1930s to the post-War era. In my findings, I discovered that Jewish players began to become treated as secular and became perceived as American instead of racially different after World War II. While a lot of this can be attributed to Americans understanding the dangers of antisemitism from the rise of Nazi Germany and Jews making a name for themselves through their work in the clothing and garment industries, I also discovered that baseball played a role in antisemitism lessening. This was due to players such as Hank Greenberg becoming popular and secular figures instead of racially different figures whose worth was based on their religion. The proof can be seen in the media slowly ending their racialization of Jewish players. The implication of the project is I was able to exemplify the importance of baseball in lessening antisemitism in America.

THE EFFECTS OF STRESS ON SLEEP AND COPING

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Threatening experiences can cause high levels of stress over long periods of time, which can negatively impact both physical and mental health. Adaptive coping mechanisms are critical to mitigate the negative effects of stress. Research studies have shown that how people perceive their stress will determine how they cope with it (Lazarus and Folman, 1984). The relationship between stress and cope with poor sleep quality as a mediator has not been previously examined. Using a dataset examining self-reported physical health and coping mechanisms in the aftermath of a threatening experience, we will examine relationships between perceived stress, cope, and sleep quality. We predict that the type of coping mechanism that participants employ in response to stress will be influenced by poor sleep quality. This study will contribute to knowledge about the efficacy of different coping mechanisms in reducing stress, and further understanding of the importance of healthy sleep as a way of coping with stress.

CAPRIN1 AND FMRP GENETICALLY INTERACT TO REGULATE THE DEVELOPMENT OF THE LARVAL DROSOPHILA NEUROMUSCULAR JUNCTION

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Fragile X Syndrome (FXS) is the most prevalent inherited neurodevelopmental disorder worldwide and the most common signal gene cause of autism. Lack of FMRP causes the synaptic phenotype associated with FXS. It is known that RNA-binding proteins like FMRP usually do not act alone and have several binding partners. Caprin1 was identified as a possible binding partner that physically interacts with FMRP by an experiment performed in the Barbee laboratory at the University of Denver. The objective of the current project was to determine if Caprin1 and FMRP genetically interact and regulate synaptic development in *Drosophila*, a fruit fly. *Drosophila* is a well-understood model system for studying FXS because the genes for both FMR1 and Caprin1 are homologous to humans. Mutated copies of FMR1 and Caprin1 were crossed into a genetic line, micro-dissected, stained, and imaged by scanning confocal microscopy then statistically compared against control lines. If they interact it was expected to see significant synaptic overgrowth at the neuromuscular junction. The synapses were analogous to the overgrowth seen in the FXS brain. Thus, FMR1 and Caprin1 interact genetically to regulate the synaptic development of the neuromuscular junction in the fruit fly. It is also clear that Caprin1 has a function in synaptogenesis, whether it is pre- or post-synaptic or both would be a direction for future research. There is currently no cure for FXS and limited therapeutics. To develop better therapeutics and a potential cure the underlying mechanisms of the disease must be understood. Thus, the more known about the mechanisms and how the involved proteins function within the cell is beneficial to the scientific and general population altogether. Ultimately, the interaction between FMRP and Caprin1 could provide a possible therapeutic target for investigation and this research has provided insight into the happenings at the cellular level in FXS.

THE ROLE OF MEDIA REPRESENTATIONS OF FEMINICIDES IN INFLUENCING PERSPECTIVES OF FEMINICIDE IN MEXICO

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Femicides are defined as misogynistic killings of women where men kill women simply for being women. Feminist scholars have focused on bringing to light femicide's structural gender-based nature and the state's complicity in the continuance of this misogynistic violence. They have argued that media representations of femicide play a role in influencing citizen perspectives on femicides. However, empirical evidence is missing to support the claim that negative media portrayals of femicides lead to negative perspectives or that ethical and activistic portrayals lead to activistic perspectives. This study will aim to bridge the gap in this claim. My research question is: how do ethical/activistic and negative representations of femicide influence Mexican citizens' perspectives on the issue of femicides? I measure Mexican citizens' perspectives by analyzing Facebook media comments under negative and ethical/activistic portrayals from Mexican news sources to uncover how these differences in portrayal language impact perspectives. It is found that the effects of negative and ethical/activistic portrayals differ between "perfect victim" femicide cases and those that do not fall under this frame. Compared to negative portrayals, comments under ethical/activistic portrayals of "perfect victim" femicide cases show more sympathy for the victim but did not curb victim blaming or perpetrator justification. Comments under ethical/activistic portrayals of femicides that did not fall under the "perfect victim" frame contained significantly less victim blaming and minimally decreased perpetrator justification but did not increase sympathy for the victim. Ethical/activistic portrayals of both femicides had slightly more comments demonstrating a systemic understanding of femicide. These differences support the claim that ethical/activistic portrayals can influence ethical/activistic perspectives, but they also further complicate the claim by revealing they may influence them in different ways depending on the "perfect victim" frame.

ETHYLENE ACTIVATION OF LATENT CATALYSTS AS A DETECTION STRATEGY TO REDUCING FOOD WASTE

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Food waste is a significant issue that occurs at all levels of the food supply chain and depletes natural resources. The processing and commercial sale of fresh produce contributes to 33% of food waste in the U.S. agricultural system due, in part, to premature ripening. The plant hormone ethylene triggers the ripening process of climacteric fruit. However, premature ripening can result in the degradation and waste of harvested fruits and vegetables before sale or consumption. Therefore, it is necessary to be able to detect ethylene at concentrations that can trigger the ripening process (~10 ppm). To address this challenge, the Michel Lab is investigating ethylene detection methods by activating latent catalysts. Preliminary results suggest that ethylene can react with latent catalysts, whereas other substituted alkenes are blocked by steric interactions. Upon exposure to ethylene the catalyst is activated and increases the kinetics of a cyclization reaction which can be analyzed using fluorimetry. I synthesized new versions of the fluorogenic substrates to modulate the difference in reactivity with latent and activated catalysts. Progress on the synthesis and evaluation of these new substrates will be presented.

WHAT DO I MAJOR IN? THE FACTORS THAT INFORM STUDENT'S CHOICE OF COLLEGE MAJOR

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When college students speak about their majors, it's assumed they selected it because it is a topic of interest to them. Which is not wrong, but what other factors do students rely on with and without even knowing? Literature expresses the correlation between high socioeconomic statuses and non-lucrative majors, as well as the significance parental roles play in student's lives. Less understood is detailed accounts of motivations for majors that include student's generation, racial/ethnic identities, and childhood experiences. Drawing on this research project, 27 in-depth interviews of college students at a private western institution spoke about the experiences that led up to them selecting their major(s). It was found that first generation students face the pressures of graduating college and earning a high income to move upward in social mobility. Second generation students have different experiences based on their racial/ethnic identities. In addition, common motivations for major selection were seeking financial security, creating social change, and distinct childhood experiences. With this knowledge, students who have trouble selecting a major can observe why others selected their major(s). These findings can help faculty and staff members better understand why their students decided to join their departments. As found, students rely on their identities and experiences to select their career pathways that includes their major(s) in college.

THE LINK BETWEEN SEBA FRUIT BATS AND STALACTITES

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The motivation of this project was to create a more enriching space in the Denver Zoo temporary enclosures for the Seba short-tailed fruit bat (*Carollia perspicillata*). Previous research suggests *C. perspicillata* tends to roost in caves that contain naturally formed stalactites. Stalactites are often present in bat caves and provide structures for roosting. *Carollia perspicillata* roost in large clusters of over 1,000 individuals, therefore, living with other bats is essential for this species. Our goal was to investigate whether adding environmental complexity changed the clustering behavior of the *C. perspicillata* within their temporary enclosure, which originally lacked environmental complexity. We predicted that if environmental complexity provides bats with more choices of where to roost, then bats may disperse more and congregate in smaller clusters. We manipulated environmental complexity by adding 3-D printed stalactites to the ceilings of the temporary enclosures. This study was based on observational research that used video cameras to record *C. perspicillata* clustering behavior throughout the night and day. Our results show that cluster sized decreased following the addition of stalactites during the day, but this difference was absent at night. Furthermore, video footage and anecdotal observations confirm that the bats huddle between stalactites and hang from these structures. Additional research is needed to determine whether changes in cluster size are associated with physiological variables, such as eustress or distress.

DIFFERENT HOST PLANTS AFFECT IMMUNE RESPONSE IN A GENERALIST CATERPILLAR

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Generalist herbivorous insects are widespread and often occur in a variety of environments. Across their geographic range, herbivorous insects can encounter variable plant traits as they feed on high-quality or low-quality plants. Herbivorous insect larvae experience both bottom-up (host plant) and top-down (parasitoid) factors. Host plant quality can affect larval growth and survival in that larvae feeding on low-quality plants often suffer reduced fitness. However, different host plants are also subject to different levels of parasitism. High-quality plants confer stronger larvae performance (survival, number of offspring), but larvae may also face higher parasitism. In some herbivore systems, diet mediates larvae immune function. The generalist insect herbivore fall webworm (*Hyphantria cunea*, hereafter FW) is a moth found in Colorado, and its larvae have considerable variance in their performance when reared on different host plants. We investigated if the FW immune system is affected by larvae feeding on good and bad quality host plants. We measured immune function by melanization of a nylon filament. We found significant differences in immune response across host plants, meaning diet mediates immune function in fall webworm larvae. Our study helps elucidate the factors that cause variation in immune response in a generalist herbivore.

THE WEIGHT OF CULTURE: INVESTIGATING THE RELATIONSHIP BETWEEN STEREOTYPES AND FOREIGN POLICY THROUGH THE CASE STUDY OF HEIDELBERG, GERMANY 1871-1917

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The frames, stereotypes and myths that together construct visions of “cultures” as unitary and monolithic groups of individuals simultaneously formulate and constrain the range of possible actions that a member of any particular culture can choose from. This paper aims to shed light on this process, by utilizing qualitative case-study analysis to examine dominant stereotypical representations of Germans and Russians between the unification of Germany in 1871 and the October Revolution in 1917, focusing on the city of Heidelberg as a nexus of Russo-German intercultural interactions at the time. Through a constructivist lens, the paper examines private writings by contemporary German and Russian residents of Heidelberg to track and analyze changes in prevailing narratives of what makes a German “German” or a Russian “Russian,” then maps the observed changes to corresponding shifts in German and Russian foreign policy behavior. Ultimately, this research demonstrates that perceptions of culture can have a significant impact on decision-making, particularly in the foreign policy space.

MOTIVATION AND COGNITIVE CONTROL IN CHILDREN WITH AND WITHOUT ADHD

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ADHD is one of the most common childhood disorders. A diverse range of behavioral symptoms characterizes this neurodevelopmental disorder, including constant fidgeting or restlessness, difficulty focusing, deficits in self-control, and emotional difficulties. Differences in executive function may play a key role in ADHD. Executive function encompasses goal-oriented behavior such as planning, mental flexibility, organization, working memory, and inhibitory control. Decreased inhibitory control has been underlined as a core deficit in ADHD, which involves a decreased ability to stop an inappropriate but dominant response. However, motivation impairments or under-responsivity to incentives may be underlying factors in this disorder, consistent with potentially disrupted dopamine in individuals with ADHD. Yet, there has been little research on the motivation-cognitive control interaction in ADHD and how this interaction is affected in children.

The present study is investigating motivation-cognitive control interaction in a sample of children ages 8-16 years with and without ADHD. In this study, participants are completing a reward-incentivized cognitive control task called the AX Continuous Performance Task (AX-CPT). The AX-CPT is a cue-probe task allowing for characterization of the timing of cognitive control – specifically, separating between preparatory or proactive cognitive control, in response to the anticipatory cue, versus reactive control, allocated in response to the later target. Differences in proactive and reactive cognitive control have been previously characterized with age and psychopathology, and in neurotypical individuals, evidence suggests that reward might specifically benefit preparatory or proactive control. Along with AX-CPT performance, we are collecting pupillometry data using an eye-tracker. Changes in pupil dilation are an established measure of cognitive effort with high temporal resolution. We are interested in using both task and pupil measures to investigate whether children with ADHD show similar or different cognitive control timing, as well as increases in proactive control with reward, to neurotypical children or not.

DOES CHILD OPPORTUNITY INDICES (COI) PREDICT BIRTH WEIGHT?

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Socioeconomic disadvantages, even at the neighborhood level can exacerbate health outcomes at all levels of life and contribute to pervasive health disparities. Issues concerning health at and before birth can impact development well into adulthood and lead to chronic health conditions. There are significant external factors at play in the prenatal stages of life. Using Child Opportunity Index (COI) and medical records of pregnant individuals this current study explores how child opportunity indices encompassing, educational, health, environmental, and socioeconomic opportunity during pregnancy associate with birth weight outcomes. Birth weight being an important indicator for many infant health outcomes with long-lasting consequences throughout development and into adulthood. Observing that COI does have an impact on birth weight even when accounting for other factors. Hopefully, this study will enable those in the fields of psychological, health, and public policy research to further this investigation and better understand the systemic effects on health. With the hopes that one day, with increased research and awareness, there will be greater consideration and change in how resources and healthcare are administered and distributed to bridge the gaps in health outcomes due to systemic inequalities.

SIBLING LOSS DURING THROUGHOUT DEVELOPMENT AND DEPRESSION

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Youth who experience a stressful life event, including the death of a sibling, are at increased risk of developing mental health disorders across the lifespan, including depression. Sibling death during development may be a uniquely difficult stressor with wide ranging impacts given the role siblings play in socioemotional development. Less is known about whether the stage of development that sibling death occurs in differentially predicts depressive symptoms in young adulthood. We first aimed to determine whether experiencing sibling death during development increases presence of depressive symptoms. We next aimed to determine if depressive symptoms in young adulthood differed depending on the developmental stage sibling death occurred in. We used data from Wave IV of the National Longitudinal Study of Adolescent and Adult Health (Add Health) Study. We compared bereaved participants (n=1,981) to nonbereaved participant (n=13,691) using an ANCOVA and logistic regression test. We further compared bereaved participants by which developmental stage they were in when they lost a sibling (before birth, early childhood, middle childhood, adolescence, and young adulthood) using an ANCOVA. Results indicated that individuals who lost a sibling had higher depressive symptom levels than individuals who had not lost a sibling. However, there was not a significant difference of depressive symptom levels between individuals who lost a sibling at different stages of development. Data from this study suggests experiencing the loss of a sibling may increase an individual's risk of experiencing elevated depressive symptoms but that an individual's developmental stage at the time of sibling bereavement does not.

DISPARITIES IN CROWD-DIRECTED FORCE BEHAVIORS: EXAMINING THE EFFECTS OF CROWD RACIAL COMPOSITION AND CROWD SIZE ON CROWD-DIRECTED FORCE BEHAVIORS IN A CONTEXTUALLY RICH VR EXPERIMENT

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In response to protests following the murder of George Floyd, long-range acoustic devices were increasingly used to disperse crowds of civilians. The central aim of this work is to examine the effects of crowd composition (i.e., size of a crowd, race ratio of a crowd) on differential crowd-directed force behaviors (i.e., noise burst). In a pilot study participants (N=58) viewed crowds varying in size and racial composition and administered a noise burst they believed would disperse the crowd. Participants also rated how physically sensitive and threatening they perceived the average Black individual to be relative to the average White individual. We found significant effects of crowd size and crowd race ratio on noise burst loudness, such that, as the size of a crowd and the ratio of Black to White individuals in a crowd increased, participants administered louder noise bursts. The effect of race ratio on loudness was strongest among participants who believed Black individuals were less sensitive to physical stimuli and more threatening than White individuals. The current study aims to further investigate the influences of crowd composition on trait inferences and crowd-directed force behaviors in a contextually rich experiment in VR. The computer-based judgment task used in the pilot study lacked mundane realism (i.e., crowds were portrayed as face images on a screen). I seek to address this issue by integrating virtual reality (VR) technology. This current work is both theoretically rich and advances the practical value of behavioral research. This work seeks to advance our understanding of the cognitive mechanisms that may underlie biases in perceptions and behaviors toward crowds. This work would also establish the efficacy of integrating VR technology into social psychological research. The current VR project is currently in a pilot phase as we learn how to integrate the study in VR.

EXPRESSING ALPHA-SYNUCLEIN IN RCSN-3 CELLS TO IMPROVE THE STUDY OF PATHWAYS IN PARKINSON'S DISEASE

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Alpha-synuclein (α S) is a dopamine-regulating protein in the brain that can form aggregates, clusters of misfolded proteins, and cause neurodegeneration in the form of Parkinson's Disease (PD). This ongoing research project explores the furthered development of the RCSN-3 cell line where it can express fluorescently tagged human α S. The development of this in vitro model will necessitate transfection of α S DNA, fluorescence microscopy, and differentiation of the cells into neurons, with the ultimate goal of having a better model to both screen small-molecule drugs that could inhibit α S aggregation and study other related pathways, such as the polyamine pathway. With an efficacious working model of dopaminergic neurons, we can now work to replicate the results of cell viability and aggregation assays accomplished by our lab in past years to show the applicability of the findings to the pathogenesis of PD. We went about furthering the RCSN-3 cell line using DNA plasmid transfection protocols, seeding of preformed α S fibrils into confluent cell culture, and fluorescence microscopy to establish the viability of the cell line as a model. Our next steps involve differentiating the cells into neurons and replicating assays with previously established results to expand on data implicating the polyamine pathway in PD pathogenesis, as well as obtaining samples to send for Proteomics and Metabolomics analysis.

THE ROLE OF COGNITIVE CONTROL IN THE PROCESSES UNDERLYING EASY AND DIFFICULT RISKY MONETARY DECISION-MAKING

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Risky decision-making leverages other cognitive functions as part of the processes underlying valuation and choice, but the direct connections between these domains of cognitive function and risky choice have only recently been examined. A total of 50 participants, age 18-22, completed an online experiment with a two-part task. First participants completed a novel risky decision-making task in which they initially completed an identical static choice set of gamble options, followed by a dynamic choice set tailored to the individual and designed to equate subjective difficulty of choices across participants. Both choice behavior (probability of gambling, choice, output) and reaction time (seconds) were measured. An additional task, a digit span measure, was used to quantify participant working memory capacity, defined as cognitive control capacity. The study concluded with a Need for Cognition Questionnaire and additional demographic questionnaires. Thus far, results suggest an effect of current trial type (i.e., difficulty) on reaction time ($\beta = -0.030$, SE = 0.00228, $p < 2 \times 10^{-16}$), but no effect of the previous trial's difficulty ($\beta = 8.27 \times 10^{-4}$, SE = 2.32×10^3 , $p = 0.723$). However, when looking at a continuous model of choice difficulty, there is a weak effect of previous difficulty on reaction time ($\beta = -0.0195$, SE = 0.00793, $p = 0.01418$) and a significant interaction between choice difficulty and capacity (high or low; $\beta = -0.0238$, SE = 0.00791, $p = 0.00269$). These results will be further analyzed to better elucidate the relationship between cognitive capacity, choice difficulty, and risky monetary decision making. This work could have important implications for quantifying of a potential relationship between control and risky choice.

INVESTIGATION OF BARIUM AS A TEMPERATURE PROXY IN CORALS

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Trace element concentrations in the aragonite skeletons of massive coral colonies can be measured to reconstruct seasonal- to centennial-scale variability in sea surface temperature (SST). Coral strontium-calcium (Sr/Ca) ratios are commonly used as a proxy for SST. However, barium-calcium (Ba/Ca) ratios, while especially sensitive to temperature in laboratory precipitation experiments, have not been explored as a coral SST proxy because seasonal Ba input from rivers overwhelms the SST signal in the coral skeleton. In this study, we investigated the Ba/Ca-SST relationship in corals from the Red Sea where Ba from river runoff is absent. Ba/Ca and Sr/Ca were measured in three *Porites lutea* coral cores, showing distinct seasonal cycles primarily influenced by SST, with infrequent spikes in Ba/Ca due to Ba deposition during dust storms. After removing the Ba/Ca peaks from dust storms, the resulting Ba/Ca time series show strong and significant correlations to SST, similar to Sr/Ca. Comparing Ba/Ca directly to Sr/Ca for each coral results in strong correlations that agree closely with experimental data. Our findings reveal the quantitative Ba/Ca-SST relationships in corals, and suggest that coral Ba/Ca can be used as a reliable temperature proxy in areas without river runoff.

PRELUDE TO BLEEDING KANSAS – GOVERNOR ANDREW H. REEDER

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In the late 1850s, Kansas underwent a civil war to establish its laws on slavery. “Bleeding Kansas,” to many historians of the subject, was a “dress rehearsal” for the American Civil War less than a decade later. The conflict itself is well studied, but the political maneuvering leading up to Bleeding Kansas itself is often overlooked. In the years prior, Kansas Governor Andrew Reeder worked to establish an antislavery stronghold and territorial capital on the frontier: a town called Pawnee. Mass electoral fraud in the first legislative election led to an overwhelmingly proslavery legislature that assembled in Pawnee for less than a week, clashed with the citizens there, and overrode the Governor’s veto to relocate the capital much closer to the border with proslavery Missouri, setting the stage for the war that followed. To Reeder’s dismay, Pawnee was soon demolished and the inhabitants forcibly relocated by Secretary of War and future president of the Confederate States of America, Jefferson Davis. This project documents Reeder’s motives in creating Pawnee and the backroom struggle that followed, ending with Reeder’s removal from the governorship and flight from Kansas in disguise in 1856. Focus here is on Reeder’s fascinating ideological transition from Stephen Douglas Democrat to forceful abolitionist.

WEALTH INEQUALITY AND DEMOCRATIC LEGITIMACY

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More than just economic jurisprudence predicated on the right to free speech, *Citizens United v. F.E.C.* (2010) has vast impacts on the individual lives of Americans. This specific case has influential ramifications, but it is not the authorization of corporate money to infiltrate politics it was feared to be. Corporate spending has remained relatively unchanged since 2010. However, states, where political expenditure laws were impacted, saw a doubling of the median range of campaign expenditures by individuals not connected to a particular candidate. *Citizens United* is not the first of its kind, but the mere face of a long line of Supreme Court decisions returning power to the wealthy. It is the most salient example of neoliberal jurisprudence redefining democracy as a free market of political goods. The Court deems that *Citizens United* will not cause the public to “lose faith in democracy.” However, “[w]hat matters is not whether or not this is legitimate in terms of law, but what its effects are and whether they are negative.”

Political philosophy has a unique place in a discussion based in economics. Intuitive knowledge can have profound insights into the economic issues of today, “especially about the deep structure of inequality, the way it is justified, and its impact on individual lives.” *Citizens United* is the invisible hand at play, but not in the way Adam Smith imagined it in *Wealth of Nations*. Rather than the hidden forces of individuals’ agency moderating the market, *Citizens United* allows for wealth individuals to tip the scales in their favor. Wealth has undue control over democracy. It is the state giving power to the wealthy under the guise of free speech. Those with disposable income to spend on political expenditures can promote politicians that align with their values or will at the very least protect their interests while in office.

Citizens United blurs the line between wealth and speech, and in doing so, money gains legitimacy as a form of political expression. Economic power is already fungible, but through rulings that enhance the ability of the wealthy to influence politics, economic power becomes political power. Karl Marx outlines wealth’s ability to effect areas outside of economics as “Money... cannot express the magnitude of its value except relatively in other commodities.” Political expenditures are money expressing its value as speech and political capital. All these advancements (or regressions) have been no accident but the result of a much larger transition into neoliberalism. Neoliberalism is the political philosophy based on economic principles of the free market. The majority opinion of the case claims unlimited independent expenditures do not increase real or perceived corruption in politics. *Citizens United* is the mechanization of neoliberal principles into campaign financing. Although the Court posits that unlimited independent expenditures are not *quid pro quo* corruption, it allows for those with access to wealth to have a greater access to politics and by extension our democracy.

PARENTAL EFFECTS OF DIET IN FALL WEBWORM

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The environment or experiences of a parent generation can impact the fitness of the next generation, a phenomenon known as parental effects. Specialists are widely the focus of study of parental effects, and much less is known about whether parental effects are important in generalists. We investigated if the fitness of the offspring of generalist fall webworm (*Hyphantria cunea*, hereafter FW) was dependent on the host plant on which the parental generation was reared. We used four different host plants to rear FW larvae, two of which were high-quality hosts (chokecherry and black willow) and two were low-quality hosts (narrowleaf cottonwood and thin-leaf alder). We mated FW male and female moths that had both been reared on the same host plant as larvae (e.g. chokecherry) and created at least 9 maternal lines per host plant species. The resultant egg clusters were divided into four, so that a portion of each egg cluster was reared on one of the four host plants. Thus, we have larvae from each maternal line that are being reared on the parental host as well as 3 unfamiliar hosts; we are currently rearing them in the lab to pupation. To measure fitness, we will weigh the pupae and compare the data across the host plant groups. This project will help us understand whether parental effects in FW are present and if FW fitness in an environment can become anticipatory if we know the environment of the parental generation.

CARBON SEQUESTRATION IN PEATLANDS: USING ENVIRONMENTAL PROXIES TO UNDERSTAND THE IMPACT OF A CHANGING CLIMATE ON GLOBAL CARBON STORAGE

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Peatlands are a type of terrestrial wetland ecosystem in which consistently water-logged conditions prevent decomposition, allowing for sequestered carbon in plant matter to remain stored in the soil. Because of this, peatlands have great carbon sequestration potential, storing more carbon in the soil than all other vegetation types in the world combined. By inhibiting decomposition, the composition of water-rich peat soil remains representative of the environmental conditions during the period in which the peat was formed. The collected peat samples can then be utilized as environmental proxies to determine historical temperature, moisture, and carbon content, and extrapolated to predict the future capacity of carbon sequestration in the context of a changing climate.

The peat samples in this research were collected during the fall of 2022 in the Echo Lake Fen of Grand Mesa, Colorado and analyzed using humification analysis. This process measures the organic content of the peat, which can then be compared to the known historical climatic conditions during each 10-year period of peat accumulation. Results suggest that warmer climates lower the water table of a peatland and expose plant matter to oxygen, allowing plants to decay and release carbon into the atmosphere. Understanding that carbon, as a greenhouse gas, exacerbates already rising global temperatures and increases the rate of plant decomposition is important to predicting how the loss of peatlands would impact future climate conditions. Peat soils contain more than 600 gigatons of carbon worldwide which represents up to 44% of all soil carbon, making it essential that efforts to preserve and restore peatlands are prioritized in order to minimize the amount of carbon in the atmosphere.

THE EFFECT OF CONTROLLABILITY ON STIGMA TOWARD MENTAL ILLNESS

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90% of US adults with a mental illness report that stigma negatively impacts their lives. Within mental illness stigma, controllability could influence stigma such that neurobiological explanations (low controllability) were associated with greater desire for social distance but not reduced blame. Additionally, the language used to describe a condition could inform stigma of mental illness; identity-first, relative to person-first, language is argued to propagate stigma. The current work investigates the independent and interactive effects of controllability and language on dimensions of stigma toward people with mental illness.

HONEYBEE RESEARCH AND STUDENT PERCEPTIONS OF SCIENCE

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European honey bees (*Apis mellifera*) are critically important because they provide pollination services to support the agricultural industry. Enhancing our understanding of honey bee foraging behavior and how bees choose which plants to visit once they arrive at a resource patch will help us to better understand pollination services. Recently honeybees have become a model system for engaging both the general public and undergraduate university students through community science and Course-Based Undergraduate Research Experiences (CUREs) to help change perceptions and attitudes toward pollinators. Information identifying if bee activity on neighboring flowers impacts the number of bees that visit a focal flower was collected with the help of STEM and non-STEM major students in a previous related study. The students involved in the experiment were also assessed in pre- and post-surveys. Both STEM and non-STEM students showed an improved attitude toward pollination processes and the importance of honey bees. These results provide important insight into how the commonly known honey bee can be an inlet for people to become interested in science.

THE EFFECTS OF RED DRAGON FRUIT BETACYANIN EXTRACT ON THE MOTOR FUNCTION AND HEALTH OF NEUROMUSCULAR JUNCTIONS IN THE G93A MUTANT HSOD1 MOUSE MODEL OF ALS

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Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease characterized by oxidative stress, neuroinflammation, and axonopathy leading to the loss of upper and lower muscular neurons. The G93A hSOD1 ALS mouse model, used in this study, has a point mutation in the SOD1 gene causing an overexpression of superoxide dismutase. This animal model experiences skeletal muscular atrophy, muscle weakness and weight loss beginning at the onset of the disease (~90 days old) until they reach end stage (~120 days old). This is due in part to the deterioration of neuromuscular junctions, which are synaptic connections between the terminal end of the motor nerve and the muscle. Betacyanin, a nutraceutical compound found in red dragon fruit (DFE), has been shown to have powerful antioxidant and anti-inflammatory properties, making it a potential therapeutic treatment for ALS. This study tested the effect of betacyanin on motor function and the neuromuscular junctions in the gastrocnemii muscles of the G93A mutant hSOD1 ALS mouse model. In this study, G93A hSOD1 mutant mice were treated orally with 5% (v/v) DFE in drinking water ad libitum from disease onset until end-stage. In each group, (consisting of three littermates: one wild type, one untreated mutant and one treated mutant), the progression of the disease was monitored by measuring the body weight and conducting grip strength and rotarod tests. Then histopathological analyses were performed to determine the effect of DFE on the neuromuscular junctions in the gastrocnemii muscles. Overall, the treated mutants have shown reduced deterioration of neuromuscular junctions in the gastrocnemius muscle, delayed wet weight loss of the gastrocnemius muscle and improved motor function compared to the untreated control ALS littermate. These findings indicate that DFE slowed the progression of ALS and shows potential as a therapeutic treatment for patients with ALS.

IN VIVO SCREENING OF THERAPEUTIC SMALL MOLECULES AGAINST PARKINSON'S DISEASE IN C. ELEGANS MODELS

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We have developed small therapeutic molecules in vitro to identify potential cure for α -Synuclein (α S) aggregation—a process central to Parkinson's disease (PD) in *Caenorhabditis elegans* (*C. elegans*). The goal of the project is to test the therapeutic molecules in vivo. The *C. elegans* will go through paralysis assay for 13 days and Confocal Imaging to support if the therapeutic molecule is a sufficient cure for PD. The pathological hallmark of PD is the abnormal aggregation and accumulation of neuronal proteins α S. These proteins assemble into plaques in PD brains. Once the protein adopts plaque conformation, it becomes toxic, and it can damage or deplete dopaminergic neurons. Dopaminergic neuronal death causes the onset of PD symptoms. Our lab has designed α S inhibitors as potential therapeutics which was tested on *C. elegans*. *C. elegans* are the perfect model organisms for this project as they mimic 60% of the human genome. Our findings showed that some therapeutics molecules decreased α S aggregation.

COMPUTER-ASSISTED TOTAL KNEE ARTHROPLASTY ACCURACY INFLUENCED BY ANATOMIC LANDMARK IDENTIFICATION

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Nearly 1 million knee replacement surgeries are performed in the United States of America yearly. Robotic systems designed for knee arthroplasty have demonstrated comparable accuracy to conventional methodologies lacking computer-assisted technology. Robot-surgical systems can be image-free or image-based. The two types yield similar surgical outcomes; however, image-based systems need potentially expensive medical imaging. Image-free robotic systems perform resections in a coordinate system formed by surgeon-probed anatomical landmarks across the femur and tibia. Resection accuracy is essential for improving the fitting of a replacement knee, which can yield greater patient satisfaction and implant longevity. This study aimed to quantify the influence of anatomical landmark identification on a robot's ability to define the coordinate system in which bone resections are executed. For the study, total knee arthroplasty was performed on a cohort of 40 cadaveric specimens using an image-free surgical robot. Data collected during the surgeries included the positions of anatomical landmarks necessary for defining a coordinate system. The difference between the landmark positions recorded by the surgical system and the ground truth positions was computed for each specimen. The standard deviation of the data was then determined, and error was randomly applied to each ground truth landmark through a Monte Carlo simulation. New coordinate systems were defined using the simulated data and overlaid with the ground truth coordinate system to quantify alignment error. Coordinate system error was then plotted against landmark error. Different landmarks influenced different axes of a robot's coordinate system. However, two landmarks on the bottom part of the femur induced the most error (greater than one degree) in the coordinate system per mm of landmark position error. The study's results can help develop novel surgeon training techniques and probing tools to improve the accuracy of image-free robotic surgical systems used in knee replacement surgery.

FRAME THEORY AND ITS APPLICATIONS

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Since its introduction in the early 1950's, Hilbert space frame theory has become an active area of research due to its applications in engineering and physics, including in speech recognition, optical imaging, and X-ray crystallography. Frames, like orthonormal bases, give a continuous, linear, and stable reconstruction formula for vectors in a Hilbert space. However, frames allow for redundancy, and this makes frames much more adaptable for theory and applications. Phase retrieval is one of the applications of frame theory in which only the intensity of each linear measurement of a signal is available and the phase information is lost. In 2006, Balan, Casazza, and Edidin introduced a more powerful notion of phase retrieval using the magnitude of frame coefficients. Closely related to the subject of phase retrieval is weak phase retrieval. Weakening the conditions of phase retrieval, in which we have fewer measurements, still satisfies most of the properties of phase retrieval. In other words it is not "weak" at all. In this talk, we give an overview of phase retrieval and weak phase retrieval. In addition, a review of current phase retrieval algorithms will be discussed; however, an algorithm for weak phase retrieval has yet to be established.

CONCUSSION ASSOCIATED BIOMARKERS

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One common symptom of concussions is depression that follows impact. Since serotonin is related to depression, this study looks at the precursor of serotonin, tryptophan. The purpose of this study is to be able to identify concussion associated blood biomarkers, specifically the role of tryptophan in concussions. Blood samples from DU's Athletes will be used, specifically their plasma from before, during and after concussions. The data processing uses the plasma from the athlete's blood. In brief, the sample is filtered, and large molecules (proteins) eliminated. Next, Fluorescein Isothiocyanate (FITC) is added to the filtered plasma (for 24 hours in the dark) to label the free amine groups (from the amino acids, including tryptophan) Then samples are run through the Capillary Zone Electrophoresis System (CZE) and the signal (peaks, corresponding the amino acids, specifically tryptophan). Tryptophan will be identified by spiking the samples with a standard solution of tryptophan (at a known concentration). This allows tryptophan to be easily identified. After the correct peak has been identified as tryptophan the concentration is then found by finding the area under the peak. This process is repeated with plasma samples from before, during and after concussion to determine if tryptophan has decreased. The expected results are that there will be an elevation in the tryptophan curve, biggest after the 24-hour mark, then still slightly elevated at the post-concussion point as well. This project could have implications to be able to help explain why depression occurs after concussions, as well as help explore possible treatments to deal with that depression.

THE MINDANAO PLAN: A STRUGGLE FOR RESCUE AND LIBERATION IN THE PHILIPPINES, 1938-1941

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In July 1938, a conference was convened to address the ongoing and ever increasing Jewish refugee crisis that would later be dubbed the Evian Conference. This conference would fail in its goals to address the ever increasingly stateless Jews. Not long after the conference's failure an island archipelago, and a United States colony no less, did what the other "democracies" of the world would not and raised their hand to welcome Jewish refugees. The proposal would later be dubbed The Mindanao Plan. This plan had many official and unofficial iterations. At its heart it was a plan to resettle 30,000 Jewish refugees to the Philippine Island of Mindanao. This plan shows points of contact that demonstrate the colonial dance between the United States and the Philippines. This work argues that the structures imposed under United States colonialization were instrumental to the attempt and failure of the Mindanao Plan in the Philippines. This dance had several results. It engaged in a reframing of Jewish refugees as the "good" kind of immigrant deserving salvation in the Philippines through an intersection of the understanding of race and class in the United States and the Philippines respectively. As the dance continued, the Philippines saw accepting Jewish refugees as an opportunity to use them in their realpolitik to prove their worthiness for independence to their colonial masters, whereas the United States sought to use Jews as pawns in their evolving neo-imperial ambitions after the Philippines' independence. The final measure was a dance of death, as the United States' xenophobic anxieties and the obstruction manifesting from them ran out the clock on the Mindanao Plan, thus, condemning it to history's "what-ifs."

CELLO: EXTENDING THE LIMITATIONS

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The goal of this project is to explore new horizons of classical, contemporary music composition and the live performance of said horizons. While the instrument, "violoncello", most commonly referred to as "cello", is dominantly associated with traditional, acoustic classical music repertoire, this project aims to define that the cello is an instrument capable of performing all styles of music despite any preconceived limitations.

As acoustic guitar has its relative, the electric guitar, the cello also has its alternative relative. Sketches of the electric cello were first conceived in the 1930s with the intentions of making the instrument itself more adaptable, more competitive with the sound and volume of instruments like the electric guitar, and more affordable, to name a few inspirations. Despite how much success electric and/or hybrid instruments may have had making the cello more adaptable in numerous scenarios, the contemporary classical music scene hasn't seen much progression in the integration of electric cello with contemporary composition and performance. The primary purpose of this project is to create a new piece of music for solo electric cello and live electronics, with the intentions of breaking the boundaries between genres of music, expanding the repertoire for this instrumentation, and discovering what new compositional techniques and devices can be employed to make the piece accessible to different audiences and performers alike. This project strives to answer the questions: What limit can a cello and its pairing with electronics be taken to; What new compositional devices and techniques can one employ or create to make this piece efficient and logical; How can one take this piece to the concert stage, or another venue, to give a successful and meaningful performance.

ASSESSING RACIALIZED MENTAL REPRESENTATIONS OF CRACK AND POWDER COCAINE USERS

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During the crack epidemic, targeted laws and media representation sent messaging that those addicted to crack were Black criminals (Alexander, 2020). In contrast, the growing prevalence of powder cocaine generated productive responses (e.g., emphasizing treatment; Hansen, & Netherland, 2016), which may be because powder cocaine being associated with Whiteness. The current work examines whether racialized mental representations (MRs) of individuals experiencing addiction to crack or powder cocaine predicts bias in recommended punishments.

In Phase 1, 120 participants completed reverse correlation tasks (see Brown-Iannuzzi, 2017 for detailed methodology) envisioning individuals experiencing addiction to crack and powder cocaine. In Phase 2, in three subphases with slightly varying procedures, separate samples of participants viewed composite MRs of each target group and rated them on a variety of social characteristics, notably Afrocentricity and Eurocentricity. Evaluators then rendered punishment judgments (fines, prison time, community service).

Paired samples t-tests were conducted to compare evaluations of MRs by phase 2 evaluators. The crack, relative to powder, cocaine MR was judged as significantly more Afrocentric and less Eurocentric in all three subphases.

The crack cocaine MR was recommended significantly harsher punishment judgments in phase 2a. The powder MR was recommended significantly harsher punishment judgments in phase 2b. There were no significant punishment judgment differences in phase 2c.

This work suggests that people hold distinct and racialized mental representations of people who use different drugs, and which may influence punishment expectations/judgments. Despite crack and powder cocaine having no pharmacological differences, federal crime penalties punish crack much more harshly than powder cocaine (Lynch, 2021). The findings of this study provide some insight in the creation, preservation, and consequences of disparities in drug laws and their enforcement.

COPULATION DURATION IN A PROMISCUOUS LEAF BEETLE

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Hybrid zones provide an excellent system to study the evolution of reproductive barriers, as they allow for the close observation of species interactions. An understudied aspect of sexual interactions in hybrid zones is the effect of heterospecific mating on copulation duration. In this study, I looked at the outcomes of heterospecific mating frequency on copulation duration and female lifespan of the beetle *Chrysochus cobaltinus*, which forms a hybrid zone with the closely related *C. auratus* in south-central Washington State. I found that heterospecific matings had a significantly longer copulation duration than conspecific matings and that conspecific matings preceded by heterospecific matings were significantly longer than conspecific matings preceded by other conspecific matings. The overall frequency of heterospecific matings, number of matings, total time mated, and the identity of the males, had no significant effects on the female's lifespan. These findings invite further research on male-female interactions in hybrid zones, as they suggest that male preference could possibly be a significant factor in copulation duration in these beetles.

EDITOR'S NOTES

These abstracts have not been peer-reviewed.

Distant Memory by Nnenna Okwuegbu
Colored Pencil



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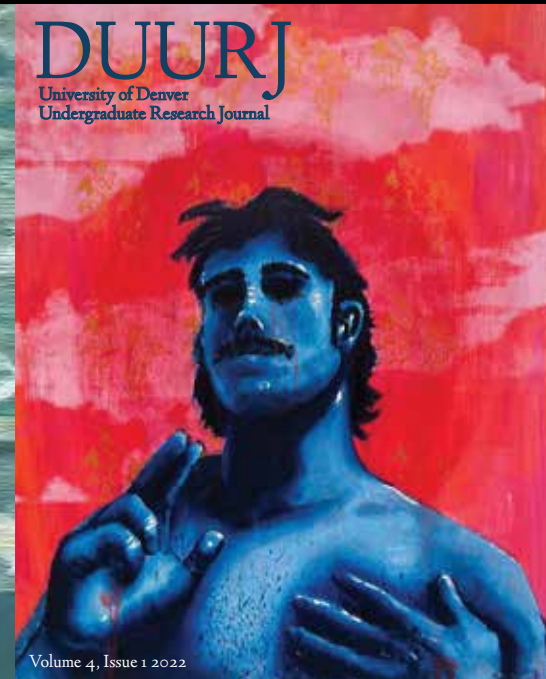
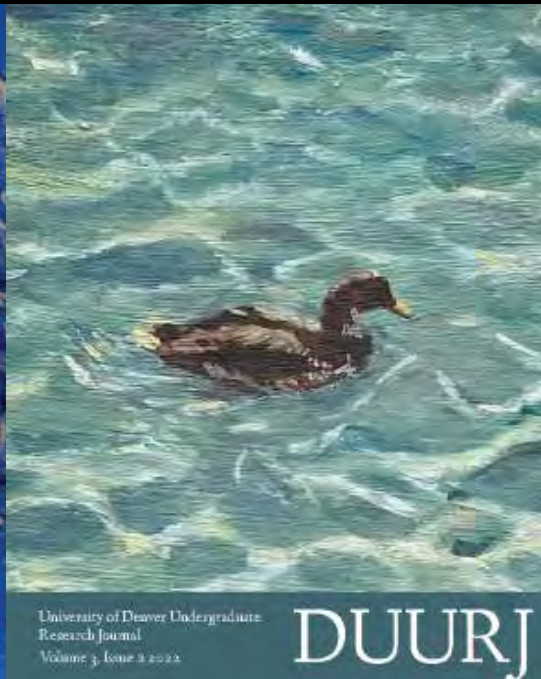
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