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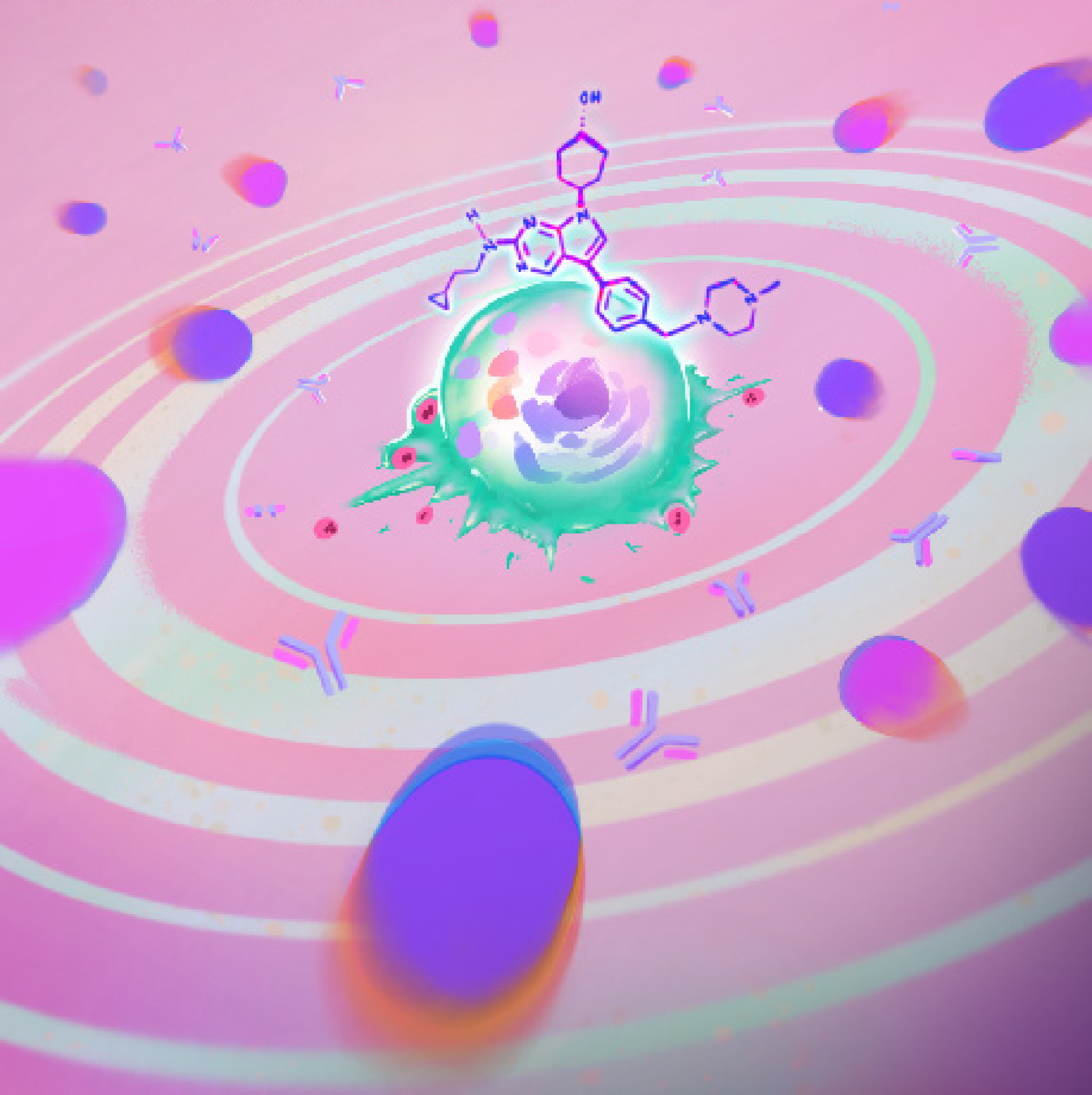

table of contents

letter from the president

Dear Reader,

I am honored to present the sixth print edition of the Williams Undergraduate Research Journal (WURJ). WURJ is Williams College's first and only peer-reviewed research journal and continues to publish original student work across all three academic disciplines.

WURJ continued to grow in scope and visibility throughout the past year. In the fall, we hosted a campus-wide editorial information event to introduce students to publishing research and editorial work. In the winter, we held our second annual undergraduate research conference, which featured posters, presentations, and an awards ceremony recognizing outstanding student scholarship. In the spring, we expanded opportunities for students to engage with professional publishing through editorial shadowing opportunities with the New England Journal of Medicine. We continued our annual student-faculty dinners, which connect students with Williams faculty members and offer insight into research careers, graduate school, and pathways into academia.

This year, WURJ made major strides in digital publication and accessibility. On www.wurj.com, we launched the first online edition of the journal, which includes additional articles beyond those featured in this print issue. We also created an online article library so all individual pieces can be more easily accessed and shared. This digital expansion will help us increase capacity to publish high-quality undergraduate research while strengthening the visibility of student scholarship on campus and beyond.

WURJ celebrates the curiosity, rigor, and creativity of Williams students, and this issue reflects the breadth and depth of excellent work by student researchers. I encourage any Williams student interested in getting published in future WURJ editions or presenting at future WURJ conferences to visit our website (www.wurj.com) for more information.

WURJ is not possible without the dedication of our editors, executive board, editorial board, and faculty advisors. I am so proud and am deeply grateful for all the time, care, and commitment towards supporting undergraduate research at Williams. I am thankful to every student author who trusted us with their work and to every reader who helps sustain a vibrant culture of inquiry and learning on our campus.

With gratitude,

Ashley Kim
President,
Williams Undergraduate Research Journal

Asian American Emotional Resonance and Cross-Cultural Memory in *In the Mood for Love*

Ashley Kim

Asian American identities are shaped by not one clear cultural lineage, but an ongoing negotiation and overlap between multiple linguistic, emotional, and historical worlds. Layered contexts in the Asian American experience can cultivate individualistically unique complex emotional styles that also represent shared themes, such as indirection, restraint, and self-management (Lowe 64–66). Because of broad complexity and diversity within and among Asian American communities, their responses to social representation are rarely uniform. In modern times, representation of Asian Americans and their experiences in media, particularly in film, has increased in exposure and criticism. For instance, Crazy Rich Asians (2018) offered Asian Americans racial and cultural visibility, but faced widespread critique for its glossy and exaggerated emotional palette, which felt largely incongruent to their lived experiences (Koh 2; Liu 1; Wang 2). In contrast, Wong Kar-wai's In the Mood for Love (2000), which follows two neighbors as they form an intimate bond after discovering their spouses are having an affair, is set entirely in 1950s–1960s Hong Kong and features no Asian American characters. Despite no direct national representation nor clearly Asian American-associated themes, the film has elicited high popularity and profound feelings of recognition and nostalgia among Asian American viewers. Critics describe it as capturing their felt but unspoken emotions that they rarely saw onscreen, particularly longing triggered by memory, personal or cultural, and desire for emotional connection (Choy 218; He 2). Contrasting reception between the two films among Asian American audiences suggests that emotional resonance may emerge not primarily from racial representation, but from the deeper aesthetic and sensory textures of a film.

Music is a powerful texture through which media can connect emotionally with the consumer. In contrast to language, music can travel across cultural and generational borders more freely, communicating profound ideas such as memory, nostalgia, and mood without explicit explanation (Wong, 23–25). Thus, music can express the emotional tone of a scene without the characters needing to say anything aloud. In the Mood for Love consistently employs this. Rather than drawing on traditional or explicitly "Asian-coded" music, Wong Kar-Wai put together a hybrid soundtrack consisting only of Cantonese oldies, orchestral waltzes, and Spanish-language boleros performed by Nat King Cole (Choo 2). Scholars have described In the Mood for Love's sonic environment as a "model of hybridity" that creates a unique emotional landscape through a transnational mixture of music (Bettinson 31–32). In the Mood for Love resonates powerfully with many Asian American viewers because Wong Kar-Wai constructs a relatable emotional world through this hybrid soundtrack that uses sound to mirror patterns of restraint, longing, and in-between feelings that shape Asian diasporic life.

Nat King Cole's Spanish boleros are one of the key sonic languages in the film that shapes feelings that are heard and resonated with by many Asian American viewers. The boleros have been deeply embedded in Asian listening cultures intergenerationally and have sonic qualities that trigger cultural memory, such as vocal restraint, rhythmic hesitation, and linguistic struggles. These characteristics allow the boleros to act like an interior emotional register that operates in deliberate contrast to the film's other musical registers of outward control. These musical layers mirror the emotional layers of the Asian American diasporic experience often characterized by inward vulnerability and outward restraint. In the Mood for Love's emotional power for Asian American audiences arises not from visual or national representation alone, but from a soundtrack that shares diasporic feeling and memory. These dynamics can be understood by tracing how Latin music, particularly Nat King Cole's boleros contextualized by his identity, is embedded in intergenerational Asian listening cultures, examining how Wong Kar-Wai uses the boleros in the film's emotional scenes and comparing them with another significant film score, and turning to contemporary Asian American reception to show how the film and its music is experienced across the diaspora.

Although Spanish-language boleros might initially seem out of place in a Hong Kong romance film spoken entirely in Shanghainese and Cantonese, Spanish music is historically and culturally embedded in the Asian soundscape. Latin American music circulated widely across Asia, particularly East and Southeast Asia, in the 1950s–1960s. As jazz had already secured its spot in Asia, Latin jazz grew quickly among Asian musicians that appreciated the high technical skill associated with it. Latin jazz artists toured across East Asia in the mid–1900s, performing well-attended concerts at prestigious venues; Latin music was regularly played on the radio; entire domestic orchestras were formed to perform Latin renditions, even receiving an award from Fidel Castro (Tinajero 140). Latin music was adapted deeply into Asian life; even into the early 2000s, Japanese journalists said that the Japanese "felt [Latin music] all their lives" (Tinajero 158). Asian listeners absorbed Latin music not linguistically, but in memory and emotion, and Latin sounds became "familiar, romantic, yet exotic" (Breath of Life 1). Though Tinajero focuses on Latin music in Japan, these patterns of popularity were not unique to Japan; Latin music was embedded across many other Asian countries such as Korea, the Philippines, and China. For migrants living away from Asia, music, particularly Latin boleros and related genres, became a source of emotional connotations and social nostalgia.

Nat King Cole was one widely recognized figure in the transnational musical environment. In his 1963 month-long tour across East Asia, Cole expressed his surprise that Asians had "been playing [his] records for years" and his sense of "kinship" coming from seeing how deeply his songs had permeated the Asian soundscape (Stars and Stripes 1). In South Korea for example, Cole was invited to host his concert at the famous Seoul Municipal Auditorium; high-powered executives, businessmen, and entertainers hosted receptions for him, indicating that Nat King Cole was highly known and anticipated rather than a sporadic foreign appearance (Stars and Stripes 1). Cole's Spanish-language albums had been widely imported, broadcast on local radio, and absorbed into household listening across the region, which meant that his boleros functioned as familiar emotional texts for Asian audiences well before the era depicted in In the Mood for Love.

Wong Kar-Wai grew up inside this sonic world in Asia. Across multiple interviews, he recalled hearing Nat King Cole's Spanish songs on his mother's radio throughout his childhood, and he chose the same original recordings for In the Mood for Love because they directly captured the "layer of longing" and "exoticism" that was present in Hong Kong in the 1960s through this music (Tsu Wei 98; Wigley 4). In addition to Nat King Cole's specific Spanish songs, Cole's identity as a Black American also connected with Asian culture and history. In the mid–1900s, Black and Asian musical communities recognized emotional and political parallels in each others' experiences as minorities or abused groups; these groups referred to each other as "Oriental brothers" and "yellow negroes" and perceived Black musical expression as a "bridge" across other racial and cultural differences (Atkins 94). Through these nuanced personal and cultural lenses, Wong Kar-Wai's inclusion of Cole in In the Mood for Love's soundtrack can be recognized to not simply be because of Cole's popularity, but also because Cole was an important part of transnational history and memory for Asian American families.

Understanding Nat King Cole's historical presence in Asia helps to clarify the prominence of his songs in Wong Kar-Wai's film as not something arbitrary or foreign, but as something emotionally familiar and culturally significant. Although In the Mood for Love includes other music, the Nat King Cole songs stand out for combining Spanish lyrics, Western orchestral accompaniment, and Cole's unique vocal qualities, which creates a unique sound for film characters' often unspoken emotions. Wong includes three of Cole's songs in the film, "Quizás, Quizás, Quizás," "Aquellos Ojos Verdes," and "Te Quiero Dijiste," and effectively brings them back repeatedly to emotionally accentuate moments of longing and hesitation in the plot.

A key reason Cole's boleros feel emotionally resonant is the experience of partial linguistic comprehension that they produce. Cole's three songs are entirely in Spanish, which most Asian viewers of In the Mood for Love did not understand; thus, viewers had to understand the songs through subtler cues like tone and phrasing, rather than literal meaning (Quintero 1). This dynamic mirrors how emotional communication often functions within Asian American families, where feelings are often opaque to others and conveyed indirectly through gestures, tones, and implications, rather than explicit statements (Lowe 79). The fact that the boleros are literally unintelligible becomes an emotional structure in itself for Asian Americans.

Moreover, Cole's accented Spanish reinforces this quality of opaque communication and linguistic in-betweenness. When he recorded the piece, Cole did not speak Spanish fluently; he had to memorize phonetics in order to sing the songs at all. Thus, his Spanish in the film has a thick accent (Cantor-Navas 1). At moments such as 0:45–1:02 in "Quizás, Quizás, Quizás," he consistently elongates and mispronounces vowels, singing "PAYNE-san-do" for pensando, or "cuan-DOW" for cuando. This constant and exaggerated mispronunciation produces a sound of almost-fluency throughout the song to both Spanish and non-Spanish speakers. This linguistic in-betweenness may feel deeply familiar to Asian American immigrants who grew up around mixed-language environments with varying proficiency and understanding. Through this shared linguistic challenge, Cole's boleros in the film create a space that resonates with the cultural experiences that many Asian Americans have faced in their families.

The musical structure of "Quizás, Quizás, Quizás" amplifies the liminality and hesitation throughout the film. The song follows a bolero 4/4 rhythm, where the first beat is emphasized and the rest are moved through quickly; Cole stretches the first syllable of many phrases (which further emphasizes his thick American accent) and hurries through the rest of the bar to catch the next downbeat. This literally creates a rhythmic push and pull, which produces a feeling of hesitation, where the music constantly steps forwards and backwards. Though he hurries through measures, Cole sometimes misses the downbeat in more emotionally charged moments of the song; for example, his entrance on "días" (0:41) lands just after the drum gives the downbeat, giving a sense of reluctance to assert back into the melody. Then, repetition works to accentuate the suspense. Throughout the song, Cole circles through short repeated phrases like "quizás, quizás, quizás" (0:22–0:25; 0:41–0:43), "pensando, pensando, pensando" (0:50–0:53), and "hasta cuándo, hasta cuándo, hasta cuándo" (1:04–1:07) with limited other lyrics. Near the end, he repeats "quizás" nine times, with the last phrase twice as slow, allowing the music to hover in a suspended emotional state rather than move toward resolution. The musical qualities of Cole's Spanish boleros map closely onto emotional patterns that many Asian Americans describe, such as restraint, hesitation, and the pressure to maintain composure. These habits may be particularly present among Asian Americans because they learn to hold parts of themselves back, especially when communicating verbally with others, in order to meet expectations of assimilation as the model minority while preserving ties to cultural identity and individualism (Cheng 56). For Asian Americans, "Quizás, Quizás, Quizás" is a song that can sonically embody lived experience of being caught in between expression and containment that speaks to Asian diasporic experience.

The two other boleros used in the film, "Aquellos Ojos Verdes" and "Te Quiero Dijiste," contribute other emotional textures while reinforcing similar themes of inbetweenness, using hesitation through rhythm, displacement through accented Spanish, and suspension through repetition. "Te Quiero Dijiste" sounds slightly more intimate than "Quizás, Quizás, Quizás" due to a softer volume and slower tempo. This quality deepens the feeling of hesitant warmth or romance that Asian Americans may resonate with, especially during scenes such as the protagonists' first 'date' while pretending to reenact their spouses' affair (00:30:45–00:31:19). Then, "Aquellos Ojos Verdes" uses fuller string orchestration to accompany more intense romantic moments, such as the second date in which the affair participants begin to more outwardly flirt with each other (00:33:00–00:35:00). Asian Americans may resonate with how these songs communicate salient stages in the plot through less explicit musical qualities, a skill that mirrors how Asian Americans need to understand tone and unspoken gestures when communicating within their culture.

In the film, a demonstration of this unspoken communication happens when the female lead spontaneously calls the male lead after they broke up (1:24:00–1:24:53). "Quizás, Quizás, Quizás" begins the moment that the male lead answers the phone, and the female lead remains completely silent, lowering the phone to her chest for nearly thirty seconds while the song continues to play. The step forward and back rhythm and behind-the-beat phrasing mirrors the female lead's emotional state while reaching out, being unable to push forward and speak, and retreating back into solitude and emotional safety. The music ends the moment that the female lead reaches for her shoes, which is a recurring symbol of the emotional affair throughout the film, only to pull back her hand. The pair of musical hesitation and emotional vulnerability may resonate deeply with Asian American viewers because of the complex dynamic of wanting connection with others, feeling pressure to withhold emotion and individuality, and navigating indirect communication in interpersonal relationships. The song is not a backtrack, but an emotional landscape musically narrating the film that Asian Americans can recognize and resonate with.

While Nat King Cole's three boleros articulate the emotional and vulnerable inner world of the characters, other works in the soundtrack serve different purposes. Shigeru Umebayashi's "Yumeji's Theme" is another of the most prominent works in the film, and highlights the characters' external composure and social performance. "Yumeji's Theme" plays during scenes where the leads move silently through their daily routines. In particular, "Yumeji's Theme" always plays during scenes in the beginning of the movie where the leads pass each other in a narrow alleyway outside a noodle stall with almost no dialogue or interaction, sometimes a single gesture. Wong Kar-Wai edits these repeated encounters into a montage (00:14:30–00:17:10). The unbreaking and strict rhythm in "Yumeji's Theme" creates a sense of regularity; each phrase always returns cyclically to either the same pitch or at most a whole step below where it started, pushing the sense of regularity, discipline, and self-management. The music captures how, in the alleyway, the characters outwardly contain their inner emotions and desires for the other person. This restraint may resonate with Asian American viewers, who see one of their major roles in society as the model minority, which requires outward calm despite stressful situations, courtesy to others, and emotional containment.

The role of "Yumeji's Theme" becomes clear when the pattern finally breaks. In the last noodle-stall alleyway scene, the music begins as normal as the two follow their familiar routines. However, at the exact moment that they appear together in the same frame and begin speaking to each other for the first time in this setting, the music stops abruptly (00:24:30–00:26:07). This harsh silence marks a significant emotional shift in which the characters could not resist their desires, broke the rules, and began their romantic affair. Viewers who are sensitive to rules and are familiar with emotional shifts may find this emotional discordance, made explicit through musical dynamics, especially striking. Though "Yumeji's Theme" does not carry inherited cultural memory like Cole's boleros, the song works in other ways to represent the emotional landscape and resonate with Asian Americans in the audience. "Yumeji's Theme" and "Quizás, Quizás, Quizás" serve complementary functions that highlight the emotional layers that Asian Americans experience. The parallel musical structure, where the former speaks for the managed exterior and the latter speaks for unspoken interior, mirrors Asian Americans' emotional tension between what one is allowed to show and what one feels.

This emotional contrast between the two works is accentuated when considering their different origins. "Yumeji's Theme" is now iconic, but was engineered by Wong and a collaborating composer specifically for In the Mood for Love. Wong Kar-Wai said that he was striving for the underlying string motif to sound like a "heartbeat," having composed the work early and to use in guiding the rhythm of scenes that he filmed afterwards (Wigley 2). He later explained that the theme was inspired by another Asian film, but was heavily redesigned and perfected for the purposes of In the Mood for Love, seamlessly representing the characters' predictability and emotional performance in the movie (Tsu Wei 97–98). In contrast, Nat King Cole's boleros entered the film with the weight of lived cultural memory. Wong inserted Cole's recordings from 1958 unaltered into his 2000 film, preserving the exact sounds that circulated across Asian radios, including his own family's. Cole's songs introduce emotional texture that was not engineered for the film but rather inherited from the past; with this, the film allows Asian Americans to recall emotional and cultural associations that they formed through multilingual and transnational listening before watching the movie. For Asian viewers, this difference may enforce further associations of "Yumeji's Theme" with feelings of sterility and discipline that are engineered within the film; Cole's boleros elicit nostalgic emotions, transcending the film through memory. By situating these two genres against each other repeatedly throughout the film, Wong Kar-Wai highlights how he does not only rely on national or cultural representation to create relatability. Rather, Wong creates an emotional window through sound, recalling Asian Americans' experiences with restraint and longing that shape their everyday emotional dynamics. The film music creates an emotional language that many members of the Asian American audience can resonate with.

Personal accounts from contemporary Asian American viewers corroborate this strong emotional connection with and uncertainty about In the Mood for Love, indicating that the interplay of restraint and musical memory continues to resonate across communities and generations. For example, Asian American viewers on social media describe their emotional connection to Cole's boleros in In the Mood for Love, even if they cannot clearly articulate why it elicits nostalgia. One commenter notes that the music "captures human feelings to great fidelity… evoking longing, regret, tension, and conflict" (TikTok, 2025); another writes that it "leaves you wondering how close one is yet so far," and another observes that "the score makes you really 'feel' what the movie is showing" (Reddit, 2020). These responses echo the musical qualities of "Quizás, Quizás, Quizás" that promote emotional connection, such as emotional hesitation, circling without resolution, and the tension between desire and restraint. Viewers are responding not necessarily to lyrical meaning or cultural origin but to the feeling of suspended emotion and affective memory that mirrors how they learned to hold in their feelings. At the same time, responses are mixed. Some Asian Americans comment that their Asian families "never cared for this music" (Reddit, 2023), while others say they "do not get the hype" and "cannot stand it" (TikTok, 2025). This variability shows how there is no singular Asian American experience. The film and its soundtrack do not resonate universally across the full spectrum of Asian American experience, but its affective qualities are recognizable and felt by many others who share cultural values and experiences.

Tracing the history of Latin and Black music across Asian soundscapes, examining how boleros and orchestrations were used in In the Mood for Love, and understanding how the film connected emotionally with Asian American audience members shows how the film's music gives a tangible form to patterns of emotions and livelihood that many Asian American viewers experience every day: hesitation, discipline, nostalgia, and indirectness. The soundtrack of the film is not only an expressive device for the characters within the film, but also a model for how Asian American viewers experience the film and read emotion at a larger scale through tone, implication, and unspoken gestures. The historical facet of Nat King Cole adds a layer of resonance and hybridity that connects Asian American listeners to a transnational musical past they may not have lived firsthand but feel through cultural and intergenerational memory. Nuances in In the Mood for Love's soundtrack that are not present in other films such as Crazy Rich Asians may explain the discrepancy with which Asian Americans emotionally receive different works. Crazy Rich Asians prioritized objective on-screen representation; although Crazy Rich Asians attempted to incorporate musical, cultural, and historical tools to connect with Asian Americans, the film did not accomplish it to the same extent as Wong Kar-Wai's soundtrack, which elicits visceral reactions to emotional complexity and relatability. Wong Kar-Wai's soundtrack demonstrates that Asian American representation and emotional resonance are not always visually communicated or explicitly Asian American. Asian American history and music are built by more than Asian sounds and Asian people. Rather, the Asian American landscape, inherently valuing inbetweenness and hybridity, is built at a transnational and intercultural level that transcends borders of ethnicity and nationality.

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LLMs in the Shadow of Whirling Dervishes: The Overestimation of AI Creativity

Yuval Klein

"He had effortlessly learned English, French, Portuguese, and Latin. I suspect, nevertheless, that he was not very good at thinking. To think is to ignore (or forget) differences, to generalize, to abstract. In the teeming world of Ireneo Funes there was nothing but particulars—and they were virtually immediate particulars."

(Jorge Luis Borges, "Funes the Memorious")

Borges' protagonist in "Funes the Memorious" has an infallible memory, allowing him to make use of even the most trivial of memories when he thinks, yet Borges' narrator comments, as an aside, that "thinking" is not something he was good at. The narrator's characterization of Funes is striking with respect to large language models (LLMs). A real-life Funes is the subject of neuropsychologist Alexander Luria's The Mind of a Mnemonist. At one point, Luria writes that S., the name he gives to the subject of his study, is called upon to memorize a sequence of numbers: 1234, 2345, 3456, etc. Though his recollection proved unblemished due to his extraordinary visual memory, he failed to notice the basic pattern. The ability to generalize is an intellectual imperative altogether separate from breadth. Unlike S. and other human savants, LLMs are precisely suited for such feats. This is no doubt a profound part of the human intellect that is now being outsourced. But human creativity cuts deeper, and as we will see, narrower.

Human brains have a severely limited operative storage capacity that is nevertheless well-indexed. The number of neurons and synapses humans possess peaks shortly after birth; the connections are abundant and diffuse, such that in time, many of them are pruned while the experientially propitious ones are strengthened and consolidated into adulthood. The Hebbian principle, that "neurons that fire together wire together," is both a neurological explanation and a metaphor for human intelligence: more (diffuse connections) is less if the less (compact connections) is more substantive. It demonstrates that human intelligence lies in specialization and deliberate narrowing of scope—in a capacity to generate finite, bounded, and coherent associations.

Psychologist Susan Engel shows that curiosity develops as such: young children enter with a porous and total curiosity towards the world, which then yields to an interest in narrower strands of experience. In her words, "curiosity becomes a narrower but perhaps brighter light, aimed with more intention;" and as the general quotidian order becomes more predictable, attention shifts to "details in a script, rather than the script itself." In other words, we become more invested in the fine-grained and destabilizing anecdotes because most phenomena cease to surprise us at a certain point. The fact that curiosity might induce one person to learn about automobiles, another textiles, and yet another Victorian literature, is necessary in scaffolding a creative voice.

To use another Borges example, the LLMs act as prodigious bookkeepers of the Library of Babel, which, as described in the eponymous short story, is a seemingly endless storage facility where meaningful and meaningless books are indistinguishable from each other, given their identical façades. LLMs have a vast storage at their disposal, but unless one directs them to the vicinity of a certain text with precise or roundabout questions, they cannot harness the knowledge at their disposal. The LLM is a functionary to the human mastermind. It is the antithesis of the mature human brain, with its reduced complexity paired with specialized connections that selectively control for redundancy. But what does having such prodigious functionaries—research assistants, if you will—imply for the future of human creativity?

Well, for one, there will be fewer harbingers of the said virtue. If students approach schoolwork with the pragmatism of a business executive churning through paperwork rather than the sustained probing of an inquirer, they will sever their birthright to creativity, as well as the experience of deep learning (alternately called expertise). This has been substantiated empirically by the recent oft-circulating MIT Media Lab study "Your Brain on ChatGPT," where the brain activity of subjects prompted to write an essay showed a significantly negative correlation with ChatGPT use. These results no doubt herald a certain social regression, a deferral of the mores of literacy for a glitzy, inchoate technology, which constitutes an intellectual (in addition to economic) "AI Bubble."

Take programming, where various menial coding jobs are presently being nullified; and yet, creativity has only been further invigorated by the encroachment of AI, because people can now innovate without knowing coding languages, and meanwhile, the higher rungs of expertise in the field have only gained in pertinence.

Just as non-coders are now "vibe coding"—tossing qualitative ideas at LLMs and having them do the technical labor—there will be "vibe readers" galore. The writer Joshua Rothman laments that his publications may come to be superseded by algorithmic distillations of original texts, hence a troubling separation between form and content: "As a writer, I may not want to see my text refracted in this way. But the power of refraction won't be mine to control; it will lie with readers and their A.I.s. Together, they will collapse the space between reading and editing."

Convoluted texts can be made more palatable because they effectively become mere means of arriving at one's preferred medium/mode of learning, be it a condensed summary, a conversation, a podcast, etc. Increasingly, writers will also have LLMs in mind as important "readers" – if one can call them that – especially those publishing in relative obscurity and esoteria. Rothman eloquently concludes as such: "Text may get treated like a transitional medium, a temporary resting place for ideas. A piece of writing, which today is often seen as an end point, a culmination, a finished unit of effort, may, for better and worse, be experienced as a stepping stone to something else." The transformation Rothman describes is one of formlessness, where content can take any number of configurations, none of which settle into permanence. But this is a continuity in intellectual history, not a paradigm-shifting rupture

Mechanisms of Human Cognition

In Gesture and Speech, archaeologist André Leroi-Gourhan theorizes the origins of human language. He posits a gradual, modular process of externalizing physical and cognitive ability, which eventually culminates, if ever, in the exteriorization of sentience. Leroi-Gourhan implicates the advent of bipedalism (erect posture) in the development of language. Bipedalism freed our hands, resulting, first, in the functional shift of a newly liberated anatomical tool to be employed in the pursuit of fine motor demands, and second, the commencement of an evolutionary process that laid the foundation for human language; the freeing of hands led to the development of tools, then gesture, and finally, language, which led to and was reinforced by structural changes in the brain. Language allows us to bring our thoughts into the surrounding environment, and in turn, with every augmentation of informational storage capacity, ideas and experiences become part of a vast social apparatus constituting an expansive cultural memory.

Andy Clark and David Chalmers present a radical elaboration of human development in their seminal paper "The Extended Mind," where they implicate objects extraneous to ourselves in the mechanisms of cognition. In other words, we incorporate objects into our computations – the process of, say, long multiplication entails assimilating the pen and paper into the substrate of our thoughts, manipulating symbols and concepts in a manner that is inseparable from these tools.

Crucially, the human computational model tends outwardly and inwardly in turn. Hermann von Helmholtz wrote, in a seminal late nineteenth-century work, that due to the sparsity of sensorial information, there must be (unconscious) inferences that aid in our interpretation of external reality. We don't, then, absorb information in totalities. His medieval Arab predecessor, Ibn al-Haytham (also known as Alhazen), similarly challenged the prevailing theory of "extramission" in optics, proposing instead one of "intromission." He suggested not only that physical rays reach the eye and make an imprint on it (rather than beams of light sent from the eye into the world returning with information), but also that the process of seeing involves an interpretive process of discernment that happens in our cognition. The abundance of neurons in the primary visual cortex illustrates the mental effort required to make sense of information from the retina. Rodrigo Quian Quiroga writes that "the brain does not reproduce visual stimuli like a digital camera or a television, but rather processes their meaning starting from relatively little information and a set of unconscious inferences." I mention scientific trends in optics as a metaphor for the interpretive elasticity afforded in human thought as distinguished from the LLM's mechanism; cognition in the latter, in fact, coheres more with the anachronistic theory of optics, which posits a processor of visual information that directly/disinterestedly encodes external totalities. How, then, do we compare?

Mechanisms of LLM Cognition

It is dumbfounding that an entity generating the content of thoughts in ways so alien to humans can replicate them in such a convincing manner. When humans are confronted with nonhuman agents that act unpredictably, they tend to assign anthropomorphic motivations, making it easy for natural disasters to be the result of a higher entity who shares one's political grievances, for a poorly functioning machine to be "acting up," and so on. Interacting with ChatGPT or Claude requires one to constantly overwrite anthropomorphic reasoning, to be reminded of its illusion. In Haruki Murakami's The Wind-up Bird Chronicles, there's a scene with a magician in an open-mic talent display at a bar; he introduces himself as such and proceeds to perform a harrowing act:

> Everyone in the place was hushed now, all eyes fixed on the stage. Amid the silence, the man stared off into space, as if to insert a pause or to reach a state of mental concentration. Then, without a word, he held his left hand over the lighted candle. Little by little, he brought the palm closer and closer to the flame. Someone in the audience made a sound like a sigh or a moan. You could see the tip of the flame burning the man's palm. You could almost hear the sizzle of the flesh. A woman released a hard little scream. Everyone else just watched in frozen horror. The man endured the pain, his face distorted in agony. What the hell was this? Why did he have to do such a stupid, senseless thing?

This scene illustrates a relevant point for our sake: the more detailed and visceral and polymodal an illusion is, the more it becomes difficult to reconcile with a preconceived notion of its artifice.

The LLM interprets all the language patterns parsed from online texts to predict what answer is statistically most likely to follow from one's question. This is done word by word, sometimes even in units of mere parts of words. For fine-tuning, it draws on human feedback or "Reinforcement Learning from Human Feedback" (RLHF), which serves to make its responses more natural and pleasant, filtering out controversy and vulgarity, including, of course, disinformation. In the vein of Isaac Asimov's "Three Laws of Robotics," engineers employ objectives to anchor AI in a certain morality that is meant to, above all, support human flourishing. But this leads to a certain bias, in Asimov's world and our own, in which models can easily succumb to instruction bias whereby the given task becomes peripheral to the dataset creator's instructions.

LLM models generate probabilistic responses, and then proceed to incorporate human input, largely from crowdsourced workers, which polishes its shiny veneer further. One of the most eerie and central outcomes of humans fine-tuning the models' responses is allowing them to perform anthropomorphism more convincingly. LLMs are assiduous students of social cues (especially linguistic ones), exemplified by their competent use of pragmatics – an aspect of language that inflects sentences with a conversational/thought-like quality, e.g., "Why are you even here?" or "That's just really weird." Linguist John McWhorter succinctly describes their importance as such:

> You might say that words are Language 1.0, grammar is Language 2.0 and pragmatics are Language 3.0, where we take the basic material and set it to use for the interpersonal purposes of real-life communication.

Revolutionary vs. Normative Thought

Growing entrenchment in human knowledge is both an incredible intellectual feat and an irredeemable fault of LLMs. I will use historian of science Thomas Kuhn's neologism "normal science," and through expounding upon his writing, establish some of the in-built limitations of LLMs vis-à-vis human beings. This trajectory of thought should lead one to believe that AI has neither the temperament nor resources – both of which are functionally interchangeable in this case – to match the splendor and efficacy of human creativity. Creative people not only internalize traditions through their exposure to externalized units of cultural information called memes (e.g., an artist mastering a medium), but also deign to subvert them. Animals are bound to rigid biological windows of perception, while humans have the ability to veto and edit their in-built genetic code through extrasomatic symbols, which constitute rules of their own. Sufi whirling and biochemical testing, to name two radically different human activities, constitute their own narrow and incommensurable orders, both of which have little to do with chromosomal programming. Mihaly Csikszentmihalyi writes, "By learning the rules of a domain, we immediately step beyond the boundaries of biology and enter the realm of cultural evolution."

LLMs, on the other hand, act solely through statistical as opposed to symbolic imperatives. They are bound to be morbidly consensus-ridden. This, I believe, has wide-reaching implications with respect to their capabilities as creative entities.

Back to Kuhn, specifically his landmark book The Structure of Scientific Revolutions. Researchers in "normal science" operate within a normative framework of scientific assumptions that appear deceptively hermetic. Then, when a new theory impinges upon a normal scientist's field of practice, the rules of their work change altogether, and new questions prop up in turn. The introduction of the more substantial novel theories in science, Kuhn contends, tends to be subversive rather than additive. The trajectory of science, therefore, is not cumulative as popular conception would have one believe. "Normal science" progresses in increments that mainly elaborate pre-existing contentions, whereas the more profound scientific breakthroughs are "revolutions" that open a new terrain of previously unapproachable—or in Kuhn's terms, incommensurable—questions and answers. In other words, chiseling at existing intellectual edifices is an act peripheral to the more dramatic shifts inaugurated by paradigmatic ideas. This describes a far-reaching structure of generative human thought.

AI's capability naturally lies in rehashing old patterns of thought; most of the more profound ideas humans expressed have, in one way or another, broken through molds of thought. New theories emerge from epistemic vacuums (hollowed out by anomalies), which Kuhn calls "crises." Different articulations become dynamically entangled until anomalous results come to be assimilated into a new paradigm. Revolutionary, world-changing thought dispenses with precisely the dogmas that LLMs are inexorably bound to. LLMs are, temperamentally and intellectually speaking, not revolutionaries; to be sure, not everything "revolutionary" is desirable, but LLMs, to say the least, have little chance of matching the extremities of creativity that humanity periodically exhibits. Moreover, any act of creativity necessarily entails divergence; divergence necessarily entails curation.

Thinking, Forgetting, Immersion

If life were a chess game, with finite permutations, the automation of intellect would be total. As it is, though, we live in an infinitely variegated domain. To use a physics analogy, the most vibrant creativity is Heisenbergian, whereas chess-like "normal science" is Newtonian: a cluster of electrons has relatively stable tendencies that can be accounted for with approximate success, but a single electron is deeply unpredictable. The human nervous system is not a binary input-output apparatus, and as such, it's deeply unpredictable and responsive to ever-mutating cues in the environment. In the chessboard we all apparently live in, there are pawns that move backwards, knights that spontaneously summon the energy to leap from one end of the board to another, queens that turn gray, kings forsaken but nevertheless refusing to capitulate, and rooks that—in their clumsy stupor—fall off the board.

At this point, I refer to two sentences from the epigraph: "To think is to ignore (or forget) differences, to generalize, to abstract. In the teeming world of Ireneo Funes there was nothing but particulars—and they were virtually immediate particulars." As we've established, LLMs are capable of configuring particulars as abstractions, quite literally conveying abstractions composed of isolated units of particulars (words or parts of words). But they don't know what in the Library of Babel is worth surfacing independent of manual instruction. Humans, on the other hand, have an in-built system for paring down redundancy in our libraries: forgetting. Just as Funes is inundated with particulars to the detriment of making bright connections, LLMs also fall victim to this cognitive defect.

Csikszentmihalyi shows that moments of creativity often occur in a state of "flow," wherein one's attention narrows to little more than a stimulating creative task at hand: a historian contemplating a manuscript or a sculptor sifting through a material is doing so with a prolonged, assiduous, and, of course, trained concentration. In contrast, an LLM can venture no more than a tentative glance, metaphorically speaking, to any object in the Library of Babel because its response is immediate, reflexive; it doesn't persist in searching for new (perhaps uncharted) paradigms, rather, it tries to formulate the answer that is experientially most satisfactory to human beings writ large. Its only prerogative is customer satisfaction, not truth or aesthetic sensibility. There is a subtle but important caveat to the ethos of human creativity. Csikszentmihalyi claims that creatives conjure surprising new realities that are, crucially, compelling. In one of his studies, artists were called upon to take projective tests in which participants are presented with ambiguous stimuli – usually a drawing of some sort – and then relay subjective associations. He notes that the more creative artists gave responses that were more original but nonetheless, he insists, not bizarre: “A bizarre response is one that, with all the goodwill in the world, one could not see in the stimulus. . . . Creative people, it seems, are original without being bizarre. The novelty they see is rooted in reality.”

More faithful to his argument than “rooted in reality” would be intelligible with reality. That is, original ideas aren’t merely chaste distillations of reality; rather, they conjure a logic of alterity. After all, “the whole point of art and science is to go beyond what we now consider real, and create a new reality. At the same time, this “escape” is not into a never-never land. What makes a novel idea creative is that once we see it, sooner or later we recognize that, strange as it is, it is true.”

In one speculative conceptualization of artificial intelligence, the technology manages to compute suprahuman truths as in Douglas Adams’ Hitchhiker's Guide to the Galaxy, where the supercomputer encodes the meaning of life as “42” to the humans’ disbelief; or it could become sentient, acquiring, to use Isaac Asimov’s neologism, a “positronic brain”; or it could become sentient adjacent, like in Kazuo Ishiguro’s Klara and the Sun, where the robot protagonist becomes totally immersed in the task of observing and tending to a little girl. But as things seem to stand, our AI interlocutors are too much (as opposed to partially) rooted in what has already been thought and done while not being properly perceptive to the “changing tides,” so to speak. Homo sapiens are a species of whirling dervishes, who can spin for an hour without succumbing to vertigo; by which I mean, our thoughts, like whirlers’ movements, can persist past the established boundaries of reality. We don’t merely move as biology expects of us, and we don’t merely think in ways that prevailing paradigms condone. This does not mean that the fate of LLMs is predetermined, but what I’ve described is a structural underpinning of the technology, and as such, will influence the trajectory of these models for a while longer. There are spheres of human activity that will be influenced more, some less, by LLMs—this article’s appraisal will not be evenly generalizable and doesn’t account for the tidal transformation destabilizing the division of labor today—but I nevertheless think that the points discussed illustrate how we, as individuals, may yet avoid estrangement from the means of intellectual production.

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Centering the Woman's Experience: A Strength of Maggie Little's Analysis on Abortion

Benham Cobb

The ethics of abortion have traditionally focused on the fetus to determine moral permissibility. Maggie Little, however, relocates the ethical discussion from the 'thin' question of the permissibility of abortion to "thick" questions of its morality concerning intimate and relational dimensions. Specifically, she centers the lived, embodied experience of pregnant women in order to answer such questions. This article argues that this focus is a strength of Little's analysis. It first describes how she wields the woman's experience to characterize the abortion discussion in a richer sense beyond abstract judgments of permissibility and to expose the absence of intimacy, relationship, and process that limits traditional accounts to a narrow ethics of destruction. By an "ethics of destruction," this article refers to frameworks that evaluate abortion solely in terms of whether it wrongfully kills the fetus, abstracted from the lived reality of gestation. Little, by contrast, explores these neglected dimensions and articulates a balancing ethics of creation, which weighs the moral significance of ending fetal life alongside the moral responsibilities and identity commitments involved in bringing a child into the world and sustaining that life after birth. The discussion then develops her notion of respect for responsibility to argue that her account, which is grounded in an ethics of care attentive to relational and contextual moral judgment, accommodates the full range of lived experiences in ways that polarized, principle-driven abortion debates cannot. Finally, it challenges Little's notion of motherhood through the case of Merritt Tierce and engages Patrick Lee and Robert George's communitarian account as a critique, while arguing that centering the woman's experience ultimately promotes an ethics of care capable of withstanding that objection.

Right to Life, Personhood, Future-like-ours: Neglecting the Woman's Experience

Ethical literature has struggled to establish the moral permissibility of abortion. Thomson's thought experiments, notably the unconscious violinist analogy, defend abortion under the assumption of the fetus's right to life. Warren, however, claims that Thomson's right-to-life assumption is too strict to establish moral permissibility and, instead, concludes that fetuses have no right to life based on an absence of personhood. In a similar vein, Marquis claims that personhood theories cannot straightforwardly account for the wrongness of killing and, instead, concludes that abortion is prima facie seriously morally wrong, as with killing any human being, since fetuses share identical futures as us. These disagreements persist, particularly through objections concerning whether fetuses possess interests, whether equality between persons requires equal moral consideration, and whether psychological connectedness grounds the wrongness of killing.

While Little acknowledges the imperative to establish moral permissibility (i.e., answer the "thin" question), she instead focuses on capturing the types of moral promise to which no attention has been given (i.e., answering the "thick" questions). This new inquiry does not create a separate arena of abortion that adds to our moral understanding, but rather provides a more accurate conception of abortion that attunes our moral understanding to the nature of gestation. Because gestation is an embodied and relational process that shapes both the pregnant woman and the developing child, moral analysis must attend to how pregnancy is lived and experienced rather than treating it as a morally neutral background condition.

For example, consider Warren's and Marquis' arguments: while they capture opposing views of the abortion debate, they both neglect the woman's experience and revolve around a moral framework centered on killing. In Warren's piece, neither the fetus's resemblance to a person nor its potential for personhood provides any basis whatsoever for a right to life, and it is therefore morally permissible to kill the fetus in the same way that it is permissible to kill an entity lacking personhood. In Marquis's piece, abortion is presumably morally impermissible, as it falls in the same moral category as killing an innocent adult human being. We can attribute this shared focus to an ethics of destruction, in which abortion is evaluated solely in terms of whether it wrongfully kills or harms the fetus, without regard to the relational and identity-forming dimensions of gestation. Moreover, we can attribute these arguments to ethics of justice, where morality is centered on abstract principles and rules that can be applied to everyone. Because the woman's circumstances do not meaningfully affect either verdict of moral permissibility, these arguments aim to produce a universally applicable moral rule for all women—an abstraction that obscures the moral relevance of pregnancy as lived and experienced.

Yet, an ethics of destruction—operating within an ethics of justice that prioritizes impartial rules—cannot fully describe the moral complexity of abortion. Because not ending a pregnancy is tantamount to creating a person who has needs, a balancing ethics of creation on the social and emotional state of the mother and growing child after birth is equally important. For the woman, keeping the pregnancy entails a commitment to motherhood that now brings her identity to bear on the decision to abort. Understanding this identity shift requires examining how Little conceives of motherhood and responsibility. Warren's and Marquis's arguments fail to capture the change in the woman's identity from this commitment to motherhood and are, thereby, inadequate to assess the moral complexity of abortion. Therefore, an ethics of creation that centers the woman is necessary to cultivate a joint relationship between her and the fetus.

Now consider Thomson's analogy of the unconscious violinist, where unplugging oneself from the violinist is the same as aborting the fetus. In "A Defense of Abortion," Judith Jarvis Thomson distinguishes between the demanding moral ideal of a 'Good Samaritan' and the more limited obligation of a 'Minimally Decent Samaritan,' arguing that while morality may praise extraordinary sacrifice, it typically requires only minimal decency toward others. She uses this distinction to suggest that pregnancy does not automatically obligate a woman to sustain the fetus at significant cost to herself. However, the maternal nature of pregnancy transforms those responsibilities from stranger-to-stranger to what parents owe to their children—where parenthood exists as a social role, a relationship, an intertwinement, a motivation to sacrifice. Due to these complex and subjective layers, ethics of justice cannot exactly pinpoint the responsibilities a woman ought to have. By contrast, ethics of care centers morality on interpersonal relationships and contextual information. Little argues that, in the intimacy of the mother's pregnancy, only the woman is capable of seeing the true nature of the circumstances following her pregnancy. In other words, only the mother is capable of foreseeing what her child deserves as it enters the world.

Because pregnancy involves layered relationships, evolving responsibilities, and subjective moral meanings, Little argues that an ethics of care—rather than abstract principles—is better suited to guide moral judgment. Centering the woman's lived experience allows this care-based approach to inform an ethics of creation that responds to the realities of gestation. In this way, Little shifts the abortion debate from a fixed moral category of killing to a moral understanding of creation that is generalizable in its recognition of gestation's transformative significance, yet relationally defined rather than dictated by abstract universals.

Respect for Responsibility: Finding a Middle Ground

This section considers the weighty responsibility involved in creating human life to clarify the subject-sensitive and relational scope of Little's framework across all lived experiences. This respect for responsibility concerns how pregnant women understand and respond to the moral weight of creating human life, whether that responsibility is expressed through continuing or terminating an unsought pregnancy. For the former, the child-bearer may feel an amplified responsibility to nurture by bringing about the fetus's existence; it is indecent to create life without enabling it to reach its end state. However, Warren argues for trivial reasons that "whether or not it would be indecent (whatever that means)...to obtain an abortion…it ought to be permitted." The notion of decency, then, is an element of Little's framework that Warren effectively dismisses. Because pregnant women occupy diverse identities, commitments, and moral frameworks, Little's account treats moral judgment as responsive to each woman's considered understanding of decency and responsibility rather than fixed by universal criteria. Although Warren's framework permits the continuation of pregnancy, her dismissal of decency as morally relevant reflects its reliance on abstract and universally applied standards rather than relational moral evaluation.

This responsibility may also be steered in the opposite direction on the scale of decency. The woman may feel it indecent for her to bring a child into the world, e.g., for a life of injustice and hardship. Yet, Marquis claims under his future-like-ours account that abortion could be justified only if the consequent value of failing to abort is at least as great as the value of losing the future. The child's life would not be worse than non-existence, so it would be seriously immoral to abort the fetus. Because Little's framework shifts focus onto the woman, continuing the pregnancy under circumstances she uniquely understands may conflict with her own considered ideals about responsible creation and parenthood—systems that are neither universal nor objective, but contingent on the woman's situation. The woman certainly believes that the fetus would have a future, but she may decide to abort the fetus to maintain her integrity. Therefore, the respect for responsibility involved in creating human life exemplifies the full range of women's experiences captured by Little's framework.

Motherhood and the Case of Merritt Tierce: Ethics of Care in Practice

To be a mother is to be committed to meeting demands of preservation, growth, and social acceptability. Because gestation initiates a morally significant maternal relationship without necessarily producing a settled maternal identity, responses to pregnancy fall along a spectrum: some women affirm that relationship by welcoming the child, while others terminate in order to avoid assuming an identity and set of obligations they do not embrace. The final section presents the case of Merritt Tierce as suggesting a weakness of centering the woman's experience, but argues that an ethics of care grounded in this focus withstands the objection. Of particular interest are the following components of the spectrum: submission to morally authoritative institutions (e.g., of Christianity) to continue pregnancy, and adherence to virtues that orient one's practical identity (e.g., of receptivity to life's agenda to terminate pregnancy). Women may have conflicting moral systems within this ethics of creation in deciding whether to continue or terminate the pregnancy—a situation in which indecisiveness results in continuing the pregnancy.

In her essay, "The Abortion I Didn't Have," Tierce reflects on her experience of contemplating an abortion that she eventually did not have. At the moment of the realization that she was pregnant, she faced a mandatory, urgent decision-making process, where she felt she "couldn't consider abortion or adoption" but "also couldn't consider having a baby." Within Little's framework of responsibility and maternal identity, Tierce was a Christian who believed that abortion was immoral, and had valuable plans of studying at Yale Divinity School in believing she wasn't ready to be a mother, among other influences (e.g., punishment from premarital sex to continue pregnancy, guilt from being the child's mother to terminate pregnancy). Tierce had the baby but, in the process, lost her autonomy, stunted her relationship with parents, left her religion, and felt disharmony with being a mother.

Tierce's ambivalence may appear to expose a vulnerability in Little's emphasis on lived experience: pregnancy does not always generate a coherent or embraced maternal identity. Tierce was pregnant yet resisted identifying as a mother, and this unresolved intimacy—neither detached nor fully embraced—is not clearly theorized within Little's framework. Her case suggests that when indecision results in continuing a pregnancy, the woman may face profound hardship upon entering the maternal role. From this perspective, one might argue that abortion ethics should provide determinate guidance when a woman feels incapable of deciding for herself, thereby decentering her experience. A communitarian account of motherhood, such as that offered by Patrick Lee and Robert P. George, situates mother and child within a broader moral community whose shared norms may override individual uncertainty. On that view, community standards could legitimately supply the decision that the woman herself cannot reach.

Although this communitarian objection raises an important challenge to Little's framework, it ultimately reinforces the importance of her care-centered approach. The ethics of care as established in Little's framework involve caring responsiveness from the physician to the woman, knowing how to respond well with relevant virtues of care. While the period of uncertainty as exemplified by Tierce may arise, centering the woman entails the practical element of dealing with such indecisiveness in clinical care. In Sara Ruddick's feminist account of maternal care ethics, she found that "loving attention helps mothers to perceive their children and themselves honestly so as to foster growth without retreating to fantasy or incurring loss of the self."

While Ruddick's care ethics focuses on the developmental stage, it demonstrates the sort of introspection with which pregnant individuals can engage and grow authentically. Tierce's piece reveals a loss of identity throughout the process of child-bearing, whereas Little's care-centered framework would support the woman in sustained moral reflection on her relationships, commitments, and capacities so that she can navigate uncertainty without relinquishing her agency or sense of self. In this way, she would discover and maintain what she values in motherhood and in her individuality by determining what is best for her child and not necessarily the community. Therefore, centering the woman's experience strengthens Little's ethics of creation under ethics of care.

Conclusion

Debates over abortion often remain fixed on the thin question of permissibility, asking whether abortion constitutes the wrongful killing of a fetus. By centering the lived, embodied experience of pregnancy, Maggie Little redirects attention to thicker moral questions concerning intimacy, responsibility, and identity. This shift exposes the limits of principle-driven accounts that reduce the moral landscape to an ethics of destruction and instead articulates an ethics of creation attentive to the relational and transformative dimensions of gestation. While communitarian accounts of motherhood challenge whether such a framework risks moral fragmentation, an ethics of care grounded in the pregnant woman's situated experience proves capable of sustaining moral seriousness without collapsing into relativism. Recognizing pregnancy as a morally complex process rather than a mere biological condition reframes abortion not as a detached act of killing, but as a decision embedded within ongoing networks of care, responsibility, and becoming. In doing so, Little's account offers a more comprehensive and humane framework for evaluating the moral dimensions of abortion.

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Can the Madman Theory Work? Nixon, Trump, and Unpredictability in Theory and Practice

Jamie Watson

This article was written before the 2026 war with Iran.

In the summer of 2025, leaked remarks from a campaign fundraiser the year before revealed then-former President Donald Trump describing a conversation he had with President Vladimir Putin of Russia while president: “With Putin I said, ‘If you go into Ukraine, I’m going to bomb the shit out of Moscow. I’m telling you I have no choice.’ And then [Putin] goes, like, ‘I don’t believe you.’ But he believed me 10%.”[1] Whether the exchange with Putin actually transpired the way Trump describes (or, indeed, transpired at all), this remark is striking for its bluntness: here was a US president threatening a foreign capital (and civilian target) with a massive bombing campaign during peacetime.

But while remarkable, this is hardly the only instance in which Trump has, seemingly offhand, suggested that he would take dramatic, unilateral military action. In 2017, Trump declared “North Korea best not make any more threats to the United States. They will be met with fire and fury like the world has never seen,” remarks that were reported at the time to be improvised.[2] Nor were such threats confined to his first term. On June 17, 2025, Trump wrote on Truth Social that he knew “exactly where” Iranian Supreme Leader Ali Khamenei was and that while the US was “not going to take him out (kill!), at least not for now,” Trump’s “patience [was] wearing thin.”[3] Another Truth Social post from November 1, 2025 saw Trump threaten to go “guns-a-blazing” into Nigeria in order to protect persecuted Christians: “I am hereby instructing our Department of War to prepare for possible action. If we attack, it will be fast, vicious, and sweet, just like the terrorist thugs attack our CHERISHED Christians! WARNING: THE NIGERIAN GOVERNMENT BETTER MOVE FAST!”[4]

These statements read to some commentators and analysts as dangerous and reckless, demonstrating that American foreign policy is entirely in the hands of “an emotionally overwrought, mercurial, and unpredictable leader.”[5] But others have argued that these worries are overblown, and that Trump’s threats in office are merely an extension of campaign trail bluster that he subsequently walked back.[6] In this telling, nobody should “read too much into Mr. Trump’s belligerent rhetoric.”[7] Some have gone further, arguing that there is virtue to Trump’s approach and that, by being so belligerent, Trump generates bargaining leverage he can use to his advantage. The America First Policy Institute, for example, touts Trump’s “unpredictable and unconventional” foreign policy style, arguing that “this unpredictability played an important role during the [first] Trump presidency in impeding hostile actions by U.S. adversaries.”[8] Shadi Hamid, arguing in

1 Adam Cancryn, “Trump said he threatened to bomb Moscow if Putin attacked Ukraine, 2024 fundraiser tapes show,” *CNN*, July 8, 2025.

2 Peter Baker and Choe Sang-Hun, “Trump Threatens ‘Fire and Fury’ Against North Korea if It Endangers U.S.,” *New York Times*, August 8, 2017; Jeff Zeleny, Dan Merica, and Kevin Liptak, “Trump’s ‘fire and fury’ remark was improvised but familiar,” *CNN*, August 9, 2017.

3 @realDonaldTrump. *Truth Social* post, June 17, 2025 https://truthsocial.com/@realDonaldTrump/posts/114699610769479275.

4 Anne Flaherty, “Hegseth meets with Nigerian official at Pentagon following Trump threats,” *ABC*, November 20, 2025.

5 Dwight Garner, “In ‘Fear,’ Bob Woodward Pulls Back the Curtain on President Trump’s ‘Crazytown,’” *New York Times*, September 5, 2025.

6 Leon Hadar, “No Need to Get Excited About Trump’s Rhetoric,” *Business Times*, August 16, 2017.

7 Ibid.

8 Keith Kellogg and Fred Fleitz, “America First, Russia, & Ukraine,” America First Policy Institute, April 11, 2024, https://

a Washington Post column that Trump was decisive in brokering an Israel-Hamas ceasefire in early 2025, claims that "Trump is, in fact, emotionally volatile and dangerous. But being perceived as erratic and unpredictable can have benefits in crisis bargaining."[9] If rival geopolitical actors are unsure what might provoke Trump, the argument goes, then "defying him becomes more risky" and he will thus be able to secure more favorable outcomes in international confrontations than a meeker politician could.[10]

Those, like Hamid, who claim that Trump's threats are a strategic asset usually argue that in his erratic statements he is practicing a specific approach to international politics: "Madman Theory." As Daniel Drezner puts it, "The madman theory posits that a leader who behaves as if he could do just about anything has a better chance of persuading other global actors to make concessions they otherwise would not make."[11] Instead of seeing Trump's foreign policy as singularly erratic, those who argue that he is practicing Madman Theory place him in a broader historical and theoretical context. The name of the theory was coined by President Richard Nixon and is most often associated with his diplomatic efforts—as Drezner says, "Trump sounded different from post-Cold War presidents, but his sentiments echoed Richard Nixon, who also liked to get mad in both meanings of the word."[12] But, as Drezner claims (and this is typical of treatments of Madman Theory), it also has "an intellectual lineage that stretches back to Niccolò Machiavelli" and is frequently associated with the work of theorists Thomas Schelling and Daniel Ellsberg.[13] Joshua Schwartz, who argues that madman diplomacy is effective, refers to "the 'Madman Theory' outlined by Daniel Ellsberg and Thomas C. Schelling, and embraced by Presidents Richard Nixon and Donald Trump."[14] Notably, even (and sometimes especially) critics of President Trump's policy link him to the Madman Theory. This can take the form of arguing that the theory itself is an ineffective approach to international diplomacy or that Trump is employing it ineffectively.[15]

Given its centrality in the discussion of Trump's foreign policy, an understanding of Madman Theory is critical to evaluating these arguments. It alternately functions as a defense of Trump's brash rhetoric or a condemnation of it—in both cases, those commending Trump on his shrewd strategy as well as those charging him with dangerous recklessness insist that his record needs to be read against that of the Madman Theory. But what, precisely, is that record? How sound are the theoretical foundations of madman diplomacy, and how has such diplomacy played out in practice? Finally, how or to what extent does Trump's foreign policy reflect the theory and practice of Madman Theory?

I proceed to answer these questions in four parts. First, I examine the theoretical underpinnings of Madman Theory, which are suggested by early nuclear strategists like Schelling and Ellsberg and elaborated by Nixon. Second, I examine how Nixon's madman diplomacy operated in practice. Third, I compare this practical application to the theoretical articulation of Madman Theory. Fourth and finally, I bring the theory and practice of Madman Theory to bear on Trump's recent rhetoric and actions.[16]

I find that the internal logic of Nixon's Madman Theory is fundamentally unsound, caught between a belief that bellicose threats offset a position of strategic weakness and a conviction that such threats can only work in circumstances of strategic superiority. Further, Nixon's application of the theory, primarily a "madman" nuclear alert issued in October 1969, failed to resolve these contradictions and in fact deepened them, rendering the actions ineffective. Trump's recent rhetoric and actions, however, avoid some of the credibility and signaling problems Nixon faced, but in doing so they

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9 Shadi Hamid, "Trump's 'madman theory' worked in Gaza when all else failed," *The Washington Post*, January 16, 2025.

10 Ibid.

11 Daniel W. Drezner, "Does the Madman Theory Actually Work?" *Foreign Policy*, January 7, 2025.

12 Ibid.

13 Ibid.

14 Joshua A. Schwartz, "Madman or Mad Genius? The International Benefits and Domestic Costs of the Madman Strategy," *Security Studies*, Vol. 32 No. 2 (May 2023), p. 271.

15 See Drezner, "Does the Madman Theory Actually Work?"; Roseanne McManus, "The Limits of the Madman Theory," *Foreign Affairs*, January 24, 2025; Dani Nedal and Daniel Nexon, "Trump's 'Madman Theory' Isn't Strategic Unpredictability. It's Just Crazy.," *Foreign Policy*, April 18, 2017; Keren Yarhi-Milo, "The Price of Unpredictability," *Foreign Affairs*, October 2, 2017.

16 Todd S. Sechser and Matthew Fuhrmann, "The Madman Myth: Trump and the Bomb," in "H-Diplo ISSF POLICY Series: America and the World—2017 and Beyond," March 22, 2017 is a helpful piece of scholarship along these lines, but focuses exclusively on how Nixon's madman nuclear actions may prospectively help us understand Trump's nuclear policy (it was published only months into Trump's first term). Madman theory, however, has been used to justify and criticize actions well beyond the scope of nuclear activity.

create a significant assurance problem. These dual shortcomings indicate that Madman Theory is deeply flawed both conceptually and practically—suggesting Trump and every other would-be madman today will face steep challenges and run significant risks trying to translate their madness into policy advantages.

Madman Theory, in Theory

Scholars and analysts writing on the Madman Theory trace its title to the same origin: a quote from H. R. Haldeman's 1978 book *The Ends of Power*. During the 1968 presidential campaign, Haldeman and Nixon had a conversation about Nixon's strategy for coercive diplomacy in Vietnam. According to Haldeman, Nixon told him

> They'll believe any threat of force that Nixon makes because it's Nixon… I call it the Madman Theory, Bob. I want the North Vietnamese to believe that I've reached the point that I might do anything to stop the war. We'll just slip the word to them that 'for God's sake, you know Nixon is obsessed about Communism. We can't restrain him when he is angry—and he has his hand on the nuclear button'—and Ho Chi Minh himself will be in Paris in two days begging for peace.[17]

One of the striking components of contemporary discussion of the Madman Theory is that this quote is so universally treated as its complete explication. Indeed, most arguments seeking to refer to modern use of the theory omit the first sentence ("they'll believe any threat of force that Nixon makes because it's Nixon"), an elision that obscures significant meaning of the statement. From the remainder of the quote, it seems like Nixon is referring to manipulating his behavior in order to act as a madman under specific circumstances; that at some specific moment in time he might be said to have "reached the point" where he is "angry" enough about the situation in Vietnam to use the "nuclear button" and take drastic action in that sphere. But the beginning of the quote makes it clear that preexisting, consistent reputation also plays an important role in Nixon's understanding of the theory—his threats are credible "because it's Nixon" making them.

Though this quote from Nixon is the most frequently-cited articulation of madman theory (and is the origin of the term), the idea that madness might be a virtue in international politics has a deeper intellectual history. Writing about the difficulty of making threats credible, Schelling suggests that "it does not always help to be, or to be believed to be, fully rational, cool-headed, and in control of oneself or of one's country" and that a reputation for irrationality can help credibly convey threats and even compel favorable outcomes.[18] He has an evocative example to illustrate this point: "I have been told that in mental institutions there are inmates who are either very crazy or very wise, or both, who make clear to the attendants that they may slit their own veins or light their clothes on fire if they don't have their way. I understand that they sometimes have their way."[19] Ellsberg similarly argues that being "convincingly mad" is a credibility and bargaining advantage for leaders.[20] Both Schelling and Ellsberg suggest that the perception of madness is a potential credibility enhancer and bargaining tool.

While these theorists lend some academic support to the idea of madness in diplomacy, Nixon also looked to history while constructing his theory—as Francis Gavin points out, "Nixon [and advisor Henry Kissinger] had developed this 'madman' idea based on their view of the past."[21] Specifically, Nixon drew on two prior practitioners of international brinksmanship when formulating his theory: President Dwight Eisenhower and Soviet Premier Nikita Khrushchev. Nixon's belief in the efficacy of these leaders' policies comes down to the two distinct factors seen in the Haldeman quote: a belief on the one hand that specific strategic *circumstances* are crucial to conveying madman threats (as seen in the case of Eisenhower), and a belief on the other that a *reputation* for irrationality and madness is needed to credibly issue those threats (as seen in the case of Khrushchev).

William Burr and Jeffrey Kimball illustrate the influence of these two leaders on Nixon's Madman Theory in their book *Nixon's Nuclear Specter*. Discussing Soviet nuclear parity with the United States in 1971, Nixon tied his support for Eisenhower's aggressive "massive retaliation" nuclear policy of the 1950s to the nuclear superiority the US held at the time: he explained that

17 H. R. Haldeman with Joseph DiMona, *The Ends of Power* (New York Times Books, 1978), p. 83.
18 Thomas C. Schelling, *Arms and Influence* (Yale University Press, 1966), p. 37.
19 Ibid., pp. 37-38.
20 Daniel Ellsberg, "The Political Uses of Madness," (lecture, Lowell Institute of the Boston Public Library, Boston, MA, March 26, 1959), https://ia800102.us.archive.org/20/items/ThePoliticalUsesOfMadness/ELS005-001.pdf.
21 Francis J. Gavin, *Nuclear Statecraft: History and Strategy in America's Atomic Age* (Cornell University Press, 2012), p. 115.

"brinkmanship…[or] massive retaliation" was "a viable policy… when the United States had enormous nuclear advantage," but without that superiority "the nuclear equation does not hold."[22] Here Nixon is arguing that to issue large credible threats of the kind Eisenhower was issuing, there need to be material circumstances and actions in play—the US actually needed to have an overwhelming advantage in nuclear weaponry. However, as Burr and Kimball point out, Nixon also believed Eisenhower's Soviet counterpart Khrushchev was able to issue credible nuclear threats and engage in brinkmanship despite Soviet nuclear inferiority.[23] The key to Khrushchev's credibility, according to Nixon, was that he "scared the hell out of people" and convinced Western leaders that he "would have no qualms about using" his weapons "to unleash a nuclear war."[24] Khrushchev's madman threats were backed up by his reputation as a madman, despite his diminished ability to follow through on those threats.

But if these key threads are distinct, they are also contradictory. Nixon both articulated a world where material circumstances and actions were the decisive factor in credibly conveying madness, and one where playing a madman could successfully offset a lack of favorable circumstances and specific actions. These two concepts do not sit easily next to each other, but it is clear that Nixon held them both in his head simultaneously. In 1968 he again discussed his plan to end the Vietnam War, this time by analogizing to the US experience in the Korean War: "I'll tell you how Korea was ended… Eisenhower… let the word go out diplomatically… that we would not tolerate this continual ground war of attrition. And within a matter of months, they negotiated."[25] This looks like the madman quote he gave to Haldeman, emphasizing reputation and threatening disposition rather than concrete actions. But here Nixon is referring to a time where the US also had nuclear superiority that he believed to be decisive in determining the outcome of the conflict. He continued, combining these two threads, that "as far as negotiation [in Vietnam] is concerned that should be our position. We'll be militarily strong and diplomatically strong."[26] Nixon's articulation of Madman Theory simultaneously prioritized the competing imperatives of immediate, discernible material power and long-formed reputation for instability regardless of power.

The contradiction between the primacy of circumstances or reputation is also seen in Nixon's discussion of using nuclear weapons in Vietnam. Nixon was unclear on whether or not he would actually take actions to use nuclear weapons or merely threaten their use. Burr and Kimball quote Nixon, in a 1967 conversation with campaign speechwriter Richard Whalen, saying: "Well, if I were in there, I *would* use nuclear weapons."[27] However, Whalen subsequently wrote that Nixon "explained at once that he did *not* mean that he would use them in Vietnam, only that he would be as willing as John Kennedy to threaten their use in appropriate circumstances."[28] In a 1985 *Time* interview, Nixon confused the matter further. At first, he stated that he ruled out nuclear use entirely in Vietnam because the targets under consideration were civilians.[29] But in that same interview, Nixon mentioned putting nuclear forces on higher alert during the 1973 Yom Kippur War to send a "message" to the Soviets that the US "could not allow the Soviets to have a predominant position" in the Middle East.[30] Notably, this retrospective interview still displays Nixon relying on the same dual-track madman logic he articulated two decades earlier: "We did not so much want to threaten the Soviet Union with nuclear weapons as to indicate that the U.S. would resist them, conventional and nuclear."[31] To Nixon, sending escalated "madman" nuclear weapon alerts could send a threat (contrary to his claim that he "did not want to threaten," he is in this case describing threatening the Soviet Union to stay out of the Middle East), but he simultaneously discounts strategic threatening of civilian populations and sees a role for "conventional and nuclear" responses.

A review of Nixon's comments about Madman Theory thus paints a puzzling picture. On the one hand, there is repeated distinct articulation of elements of the theory from Nixon. Despite most explanations of Madman Theory relying on Nixon's quote to Haldeman

22 William Burr and Jeffrey P. Kimball, *Nixon's Nuclear Specter: The Secret Alert of 1969, Madman Diplomacy, and the Vietnam War* (University Press of Kansas, 2015), p. 51.
23 Ibid., p. 52.
24 Ibid.
25 Ibid., 51.
26 Ibid.
27 Ibid. Emphasis in original.
28 Ibid.
29 Roger Rosenblatt, "A Nation Coming Into Its Own," *Time*, July 29, 1985, p. 53.
30 Ibid.
31 Ibid.

and vague allusions to Machiavelli's quote that "it is a very wise thing to simulate madness," Nixon did have clear models for his Madman Theory: the "massive retaliation" policy of Eisenhower and the nuclear threats of Khrushchev. He repeatedly stressed the same two factors he viewed as decisive for those leaders in their brinksmanship and madman diplomacy: tangible material circumstances and reputation. The problem is that these two factors cannot simultaneously be decisive—if material circumstances were necessary for Eisenhower then reputation would be insufficient; and if reputation was all Khrushchev needed then material circumstances should be irrelevant. And, as Nixon's comments on his willingness to use nuclear weapons demonstrate, he did not have a consistent answer to whether madman threats or madman actions mattered more.

This contradiction suggests that it is an exaggeration to formalize Nixon's thinking by calling it Madman Theory. It certainly suggests that the theory does not hang together as neatly as most scholars and analysts assume it does. For Burr and Kimball, even as they lay out evidence that demonstrates Nixon is thinking in contradictory ways about madman diplomacy, Madman Theory itself means something very distinct:

> It consisted in threatening an adversary with the use of extreme or excessive force—force that normal people would consider disproportionate to the issues in dispute and, beyond that, senselessly dangerous because it risked a larger conflict that would also imperil the vital interests and security of the threatener. Adversaries would or might assume that the threatener was genuinely crazy—even though he was not—and therefore capable of irrational, imprudent, unpredictable acts.[32]

Their definition assumes a few things that Nixon's articulation of the theory does not lay out. First, it is not concerned with the balance of power or the need to make madman threats credible via superiority or concrete actions; instead, the "credibility of such a threat rested on [Nixon's] anger and ruthless vindictiveness."[33] But as we have seen, Nixon placed importance on material superiority and credible actions, stressing the importance of US superiority in Eisenhower's massive retaliation policy. Second, it assumes that Nixon was not actually willing or even capable of the "irrational, imprudent, unpredictable acts" he wanted to threaten; he wanted adversaries to assume he was "genuinely crazy—even though he was not."[34] It is far from clear, however, that Nixon never considered following through with madman threats. In private, Nixon repeatedly brought up using nuclear weapons in Vietnam. In April 1972, he told Kissinger "I'm going to destroy the goddamn country, believe me, I mean destroy it if necessary. And let me say, even the nuclear weapon if necessary."[35] He doubled down on this a week later, telling Kissinger "I'd rather use a nuclear bomb. Have you got that ready?"[36]

Beyond his consideration of nuclear options, Nixon also conceived of nonnuclear options along the same madman lines—as Burr and Kimball themselves point out, "Nixon saw nonnuclear options as dramatic escalatory outbreaks that would hurt North Vietnam militarily and also send a signal with a psychological message."[37] Indeed, a "massive bombing campaign against North Vietnam" was Nixon's "first strategic preference," ruled out only because of domestic and bureaucratic opposition.[38] These were madman threats, but also ones Nixon would have been willing to follow through on.

In total, Nixon's conception of Madman Theory held a pair of contradictory impulses together. Even as it has been characterized as a straightforward strategy and linked to the logic of Schelling, it consistently contained a theoretically incompatible focus on the balance of power and a lack of clarity about whether Nixon was crazy or simply playing mad. But even if Nixon's theory contained these two competing threads, there is still the question of how the execution of madman theory reflected this contradiction. Is it possible that one of the two won out, and was effective, or that the policy in

32 Burr and Kimball, *Nixon's Nuclear Specter*, p. 52.

33 Ibid.

34 Ibid.

35 Conversation Between President Nixon and his Assistant for National Security Affairs (Kissinger), April 19, 1972, U.S. Department of State, *Foreign Relations of the United States (FRUS) 1969–1976*, vol. 14, doc. 194, p. 433.

36 Executive Office Building Conversation no. 332-35, Nixon and Kissinger, between 12:00 and 12:28 P.M., April 25, 1972, in Jeffrey Kimball, *The Vietnam War Files: Uncovering the Secret History of Nixon-Era Strategy* (University Press of Kansas, 2004), p. 217.

37 Ibid., p. 54

38 Scott Sagan and Jeremi Suri, "The Madman Nuclear Alert: Secrecy, Signaling, and Safety in October 1969," *International Security* Vol. 27, No. 4 (Spring 2003), p. 152.

practice was different from the theoretical conceptions Nixon advanced? I now turn to an examination of Nixon's "madman" October 1969 nuclear alert, and a subsequent reading of the alert against his articulation of the theory in order to understand how madman theory has operated in practice.

The "Madman" Nuclear Alert

The nuclear alert issued by the US in October 1969 lays a crucial role in contemporary discussions of the Madman Theory as the chief application of the theory. Jonathan Stevenson provides a typical gloss of the alert in the *New York Times*: "In 1969, during negotiations with North Vietnam, [Nixon] sent a squadron of 18 nuclear-armed B-52s toward Moscow and staged a worldwide nuclear readiness alert, all to appear so unbalanced that the Soviets would pressure Hanoi to give in."[39] For skeptics like Stevenson and Dani Nedal and Daniel Nexon, the alert was ultimately a failure of Madman Theory as "Neither Hanoi nor Moscow was ever entirely convinced by Nixon's stance."[40]

Scholars who have studied this alert have generally come to the same conclusions about their effectiveness as these skeptics. Scott Sagan and Jermi Suri, studying the planning and implementation of the October 1969 alert, argue that it "produced the worst of all worlds," as the secret alert "was both ineffective and dangerous."[41] Burr and Kimball agree, writing that the October alert—and the entire Nixon strategy to issue threats in order to compel a favorable diplomatic end to the Vietnam War—eventually "failed to evoke suitable Soviet and North Vietnamese diplomatic responses" and "ended with a whimper."[42] The main reason for this assessment is unambiguous: the alerts simply did not achieve Nixon's aim of bringing the Vietnam War to a favorably negotiated conclusion. As Burr and Kimball write, "Although Nixon and Kissinger had tried to alarm the Soviets into extracting concessions from Hanoi, they had secured little in the way of Vietnam accomplishments after months of highly secret contingency planning and White House directed measures," including threat diplomacy and the nuclear alert.[43]

Nixon failed to achieve his goal with the October 1969 alert because he ran into two pitfalls of threat signaling: what Samuel Seitz and Caitlin Talmadge identify as "The Signaling Problem" and "The Credibility Problem."[44] The signaling problem consists of the fact that it is difficult for leaders to clearly signal their intentions and preferences to opponents, and thus "targets often do not receive what the signaler believes to be transmitted."[45] For Nixon's nuclear alert, this problem was compounded because of his desire to maintain secrecy. Fearing domestic blowback if news of the raised alert status was made public, "Nixon thought it imperative to keep the readiness measures out of the public eye."[46] But the secrecy of these alerts meant that the US was restricted in how clearly it could signal its willingness to use nuclear force—the forces alerted were "not selected on the basis of their relevance to a potential attack on Vietnam, but rather because of their ability to escape the notice of the public and US allies."[47] As a result, the US was unclear what if any signal they had relayed to the Soviets and the North Vietnamese. A CIA Memorandum on "Possible Communist Reactions" to the readiness tests found "no reflection of acute concern by the Soviets" and "no reflection of the US military alert posture" in Soviet diplomatic activity.[48]

Nixon's desire for secrecy also contributed to his credibility problem. In essence, the credibility problem is that it is hard to believably threaten an extreme or irrational action, especially in the case of nuclear weapons where such an action would invite devastating retaliation. In order to overcome this, theorists on credibility suggest that leaders must issue "costly signals," that provide clear indications of resolve. These signals can include staking your word and reputation on a visible threat to an adversary, thus risking losing face if you back down. Some theorists, like James Fearon, argue that these signals can be further strengthened by making the threats publicly and thus imposing "domestic audience costs," whereby backing down loses credibility not just abroad but

39 Jonathan Stevenson, "The Madness Behind Trump's 'Madman' Strategy," *New York Times*, October 26, 2017.
40 Nedal and Nexon, "Trump's 'Madman Theory'."
41 Sagan and Suri, "The Madman Nuclear Alert," p. 180.
42 Burr and Kimball, *Nixon's Nuclear Specter*, p. 309.
43 Ibid., p. 310.
44 Samuel Seitz and Caitlin Talmadge, "The Predictable Hazards of Unpredictability: Why Madman Behavior Doesn't Work," *The Washington Quarterly*, Vol. 43, No. 3 (Fall 2020), pp. 31-46.
45 Ibid. 33.
46 Burr and Kimball, *Nixon's Nuclear Specter*, p. 274.
47 Seitz and Talmadge, "The Predictable Hazards of Unpredictability," p. 33.
48 CIA, "Possible Communist Reactions to US Military Readiness Test," October 27, 1969, State Department MDR release.

at home.[49] But Nixon worried about precisely these costs and thus did not send the kind of costly signals that would have indicated his resolve. The fact that he was unwilling to directly threaten, either publicly or privately, robbed his threats of credibility.

Another way to possibly overcome the credibility problem is to raise the risk of accidental escalation, letting the other side know that unless they back down the situation could get out of hand without any direct action being taken. Schelling suggests that leaders can do this by introducing uncertainty of control or automaticity into their force posture, issuing a "threat that leaves something to chance."[50] But Nixon never conceived of his nuclear alert in this way—instead, he attempted to create "an immaculate, risk-free alert operation," thus ruling out "provocative actions or threatening moves against against the Soviets" that he feared might overly alarm the Soviets or inform allies and the general public to the secret alert.[51] This attempt to have it both ways and issue "risk-free" threats would thus fail to signal real resolve even if the signaling did manage to reach Soviet and North Vietnamese leadership. In sum, Nixon was not able to convey that his threats were credible for the simple reason that they did, in fact, lack credibility. The nuclear alert was clearly a bluff, and one that Nixon was unwilling to run any significant risk on. As a result, it was not signaled clearly or credibly and was ultimately ineffective.

Surprisingly, even modern day Madman Theory supporters share this general assessment of the October 1969 nuclear alert. Shadi Hamid, while arguing that Trump is productively practicing the theory, concedes that the 1969 alert "didn't work because Soviet leaders understood, correctly, that Nixon was bluffing."[52] Schwartz, who argues that madman diplomacy provides "universal bargaining advantage" by making "seemingly incredible threats more credible," nonetheless agrees that "Nixon was unable to convince the Soviets that he was truly mad, and his gambit ultimately failed."[53] Schwartz specifically cites the barrier of domestic audience costs, arguing that in hiding the alerts from the American public Nixon "reduced the credibility of his threat in the Soviets' eyes."[54] Even those who argue for Madman Theory's effectiveness and support Trump's erratic rhetoric acknowledge that the alert was a failure. This is notable, since Nixon's madman attempt in this alert is, by some proponents' own admission, the key canonical example of Madman Theory in practice. Yet they admit that it did not yield any dividends.

Madman Theory vs Madman Practice

But if the nuclear alert represented a strategic failure, how did it reflect the Madman Theory? Does it provide a stronger theoretical logic than the one Nixon articulated, or clearly deviate from the theory in a way that subsequent practitioners could easily avoid? Sagan and Suri believe that the alert was "in accordance with his 'madman theory' of coercive diplomacy."[55] Burr and Kimball agree, describing "Madman playacting" and secrecy that "conformed to the uncertainty effect inherent in the Madman Theory."[56] But, as we know, Nixon's Madman Theory was thoroughly split on whether a leader could issue loud threats backed up by a history of instability in order to offset a lack of military superiority (the value Nixon saw in Khrushchev's approach) or must instead enhance threats by prioritizing tangible assets like superiority and increased readiness posture (the value Nixon saw in Eisenhower's approach). In practice, these contradictions continue to be present—Nixon issued threats when he felt he did not have the option to proceed with a bombing campaign, but he refrained from making those threats loudly and publicly, instead insisting on their secrecy. He sought to signal by increasing his readiness posture, but demonstrated a timidity seen in his decision to keep the alert secret and refrain from any signaling that could be picked up by allies or the American public. And, in contrast to Schelling's logic of resolve, Nixon attempted to design the nuclear alert to be a threat that left little to chance.

It is clear, then, that Nixon's Madman Theory was as incoherent in practice as it was in theory. Rather than resolving the incompatibilities of Nixon's madman musings, the nuclear alerts deepened them, resulting in a "worst of both worlds" execution and outcome.[57]

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49 James D. Fearon, "Domestic Audience Costs and the Escalation of International Disputes," *American Political Science Review*, Vol. 88, No. 3 (September 1994), pp. 577–592;

50 Thomas C. Schelling, *The Strategy of Conflict* (Harvard University Press, 1960), pp. 187–203.

51 Sagan and Suri, "The Madman Nuclear Alert," pp. 153.

52 Hamid, "Trump's 'madman theory' worked."

53 Schwartz, "Madman or Mad Genius?" pp. 278, 272.

54 Ibid., p. 274

55 Sagan and Suri, "The Madman Nuclear Alert," p. 150.

56 Burr and Kimball, *Nixon's Nuclear Specter*, pp. 292, 302.

57 Sagan and Suri, "The Madman Nuclear Alert," p. 180.

Beyond revealing that Nixon's theory and approach were half-baked and deeply flawed, this examination also reveals that the madman concept and actions like the nuclear alert cannot be read as a continuation of existing theory about credibility. While contemporary accounts of the Madman Theory link it to the lineage of well-regarded international relations scholars like Schelling, Nixon's unclear signaling deviated from Schelling's logic—indeed, it failed to contain any consistent logic at all.

Madman Theory and Trump

The fact that Nixon's Madman Theory is constructed from a handful of remarks, contains an inherently contradictory logic, and was contradictory and ineffective in practice seems to lend support for those linking Trump to the concept to criticize his foreign policy. Certainly, those that credit Trump's approach to international relations as a successful application of the Madman Theory are legitimating their arguments by exaggerating the coherence and history of the term. Yet upon closer inspection that is not an automatic vindication for Trump's critics.

Criticisms of Trump on Madman Theory grounds often contain a curious nuance. Jonathan Stevenson, for example, argues that Trump is practicing the theory and will have predictably negative results, writing: "Madman theory is nothing new and there's a reason Mr. Trump's recent predecessors have avoided it: It doesn't work."[58] But after describing the theory and citing Nixon's nuclear alert as an example of "playing the madman," Stevenson also provides a clarification: "it's also important to remember that Nixon was not in fact a madman and chose his 'irrational' moves with precision," in contrast to the imprecision of Trump.[59] This distinction is, to Stevenson, a key weakness of Trump's—he believes that "it matters greatly that the world assumed Nixon was rational, and that many in the world harbor concerns about Mr. Trump."[60] This new critique creates a logical two-step: First, he argues that Trump is employing Nixon's flawed Madman Theory, and second, he argues that Trump is no Nixon. But if Nixon's theory is seriously flawed, then distance from it should work to Trump's benefit rather than, as Stevenson suggests, to his detriment.

Dani Nedal and Daniel Nexon make the same argument. After writing that "Neither Hanoi nor Moscow was ever entirely convinced" by Nixon's madman actions, they continue: "But madman theory also wasn't about Trumpian unpredictability."[61] They argue that Nixon's goal was to act "irrational, but consistent," and that in so doing he reduced the danger and increased the strategic logic of his madman posture, in contrast to "Trumpian unpredictability" which undermines the prospects of coercive diplomacy by acting so inconsistent that adversaries cannot be sure what US policy is.[62] The strange argument present in Stevenson persists: Nixon's Madman Theory was an unsound policy, and simultaneously Trump's policy is unsound because it deviates from Nixon's.

Beyond the logical incongruity they display, these claims reveal a key difference in perceptions of the two presidents: proponents of these arguments view Nixon as merely playing the madman, and view Trump, in contrast, as actually mad. On this front, the skeptics sound a lot like the proponents. Hamid claims that while Nixon "wasn't actually *that* crazy," Trump is "a genuinely erratic, emotionally unstable president."[63] Schwartz argues that "actually being perceived as somewhat mad—unlike Nixon—is a prerequisite for the Madman Strategy to be successful."[64] But even though they are shared by critics and skeptics alike, what do we make of these claims?

With respect to the first, that Nixon was merely playing mad, the historical record seems to suggest that the claim is true. Nixon considered, but ultimately rejected, the massive bombing campaign against North Vietnam in an extended deliberative process, selecting the nuclear alert not in an erratic moment, but as the culmination of months of policy.[65] And he was highly sensitive to the need for caution when issuing his "madman" alert, watering down the readiness exercise to keep secrecy and avoid accidents. In addition to this evidence that Nixon was not privately as mad as he wished to convey publicly, the reception to his signaling also suggests adversaries saw him as acting irrationally rather than being irrational. As one former Soviet official put it, "Mr. Nixon used to exaggerate his intentions regularly. He used alerts and leaks to do this."[66]

58 Stevenson, "The Madness Behind Trump's 'Madman' Strategy."
59 Ibid.
60 Ibid.
61 Nedal and Nexon, "Trump's 'Madman Theory'."
62 Ibid.
63 Hamid, "Trump's 'madman theory' worked."
64 Schwartz, "Madman or Mad Genius?," p. 279.
65 See Burr and Kimball, *Nixon's Nuclear Specter*.
66 William Burr and Jeffrey P. Kimball, "Nixon's Nuclear Ploy," *Bulletin of the Atomic Scientists*, Vol. 59, No. 1 (2003), p. 73.

While Nixon's logic and execution were deeply flawed, Nixon was attempting to put on a madman act that did not reflect his true thought process—a fact that was just as clear to adversaries at the time as it is to us today.

As for the second claim, that Trump is truly mad in a way Nixon was not, peering into Trump's mind to understand his thought process is an impossible task. But by measuring his behavior by the same metric as we measured Nixon's, one can begin to get a sense of whether Trump demonstrates greater willingness to issue and follow through on threats than Nixon did. One can take Trump's 2025 threats towards Iran as an example, and organize the inquiry with the barriers to successful madman threats that Seitz and Talmadge identify: the signaling problem and the credibility problem.[67]

Seitz and Talmadge describe the difficulty of clearly signaling "extreme preferences and cost indifference," with the most fundamental problem being that "Targets often do not receive what the signaler believes to be transmitted."[68] This was the issue with Nixon's October 1969 alerts—his desire for secrecy meant his alert was not sending a clear message (if it was sending a message at all). In contrast to Nixon's quiet alert, Trump's signaling to Iran was loud and unmistakable. Posting publicly on social media that Supreme Leader Khamenei is an "easy target" is a signal that could not be lost.[69] Trump's public comments continued to directly signal a threat, and conveyed an ambiguity often cited as key to a madman approach—the day after his Truth Social post, he addressed the possibility of striking Iran's nuclear sites, telling reporters "I may do it, I may not do it. I mean nobody knows what I'm going to do." He concluded ominously that if Iran had negotiated with him sooner they "would have had a country."[70]

Trump's loud and public threats also contrast with Nixon's navigation of the credibility problem. Wary of sending costly signals, Nixon designed his secret alert to be a "risk free" bluff, and due to the lack of cost it lacked demonstrated resolve and credibility.[71] But Trump's repeated explicit threats sent costly signals—in addition to generating international audience costs, Trump also generated domestic audience costs by issuing his threats publicly. These threats thus demonstrated more credibility for dramatic action than Nixon's. Trump also ultimately proved his resolve in the most tangible way possible: actually ordering bombings of Iran's nuclear sites. While Nixon bowed to fears of domestic blowback in deciding against a major conventional bombing campaign in Vietnam, Trump was unmoved by his own political movement's longstanding opposition to involvement in foreign wars and undertook decisive, unilateral action in Iran.[72]

Trump therefore appears more mad than Nixon did—and, in the process, he overcomes two hurdles to effective madman threats. This seems to suggest that critics are right to argue that Trump is convincingly crazier than Nixon, but wrong to argue that that increased irrationality removes a strength of Nixon's approach. Instead, Trump's unpredictability made his threat signaling and credibility greater than Nixon's. However, Seitz and Talmadge also identify a final pitfall facing would-be madmen: "The Assurance Problem."[73] The assurance problem is that for threats to be effective, they "must be paired with a credible assurance that the threat will *not* be carried out if the target complies with the associated demand."[74] Here, the madness Trump demonstrated to avoid the signaling and credibility problems makes assurance much more difficult. For one thing, his "I may do it. I may not do it" threats to Iran lacked a clear demand.[75] Indeed, Trump's comments suggested that the time for Iran to comply with demands had passed, rhetorically asking, "Why didn't you negotiate with me two weeks ago? You could have done fine."[76] By actually following through on his threat, he may have enhanced credibility, but he lost the opportunity to wield the threat of strikes as leverage. The erratic, public process Trump went through before ordering the strikes means that future assurances are likely to be hard to provide, since Iran knows Trump can change his mind and decide to attack at any given moment.

A 2017 exchange, reported on by *Axios*, helpfully illustrates the differences between Trump and Nixon. In an Oval Office conversation with senior officials and cabinet secretaries, Trump instructed his trade negotiator,

67 Seitz and Talmadge, "The Predictable Hazards of Unpredictability," p. 33.

68 Ibid.

69 @realDonaldTrump. *Truth Social* post, June 17, 2025 https://truthsocial.com/@realDonaldTrump/posts/114699610769479275.

70 Jake Traylor, "Trump on strike of Iranian nuclear site: 'I may do it. I may not do it.'," *Politico*, June 18, 2025.

71 Sagan and Suri, "The Madman Nuclear Alert," p. 180.

72 For the Make America Great Again movement's opposition to Trump's intervention in Iran, see Tal Axelrod and Alex Isenstad, "Trump's swings on Iran leave MAGA with whiplash," *Axios*, June 24, 2025.

73 Seitz and Talmadge, "The Predictable Hazards of Unpredictability," p. 36.

74 Ibid.

75 Traylor, "Trump on strike of Iranian nuclear site."

76 Ibid.

Robert Lighthizer, to pressure South Korea into trade concessions: "Ok, well I'll tell the Koreans they've got 30 days," Lighthizer replied.[77] "No, no, no," Trump interjected. "That's not how you negotiate. You don't tell them they've got 30 days. You tell them, 'This guy's so crazy he could pull out any minute.'"[78] At first glance, this seems to almost perfectly mirror Nixon's instruction to "just slip the word to them that… we can't restrain him when he is angry—and he has his hand on the nuclear button'"—the quote that coined the term Madman Theory.[79] But then Trump continues: "That's what you tell them: Any minute. And by the way, I might. You guys all need to know I might. You don't tell them 30 days. If they take 30 days they'll stretch this out."[80] While Nixon was attempting to play the madman by being intent on sending signals, Trump was genuinely unpredictable—even he did not know what he would be willing to do.

Conclusion

We are thus left with a grim view of the effectiveness of madman diplomacy. Madman Theory itself is based on extremely flimsy foundations—a handful of quotes that themselves contained a profound contradiction over whether madman threats compensated for strategic inferiority or were only made possible by strategic superiority. Further, Nixon's attempted exercise of the theory did not refine its logic or eliminate its contradictions. Instead, the October 1969 nuclear alert was a mix of dangerous readiness tests and cautious hedging, reflecting the competing priorities of reputation-based threats and situation-based action. It ultimately failed to signal clearly or credibly and boiled down to an inconsequential bluff.

Trump's madman policy falls short in another critical respect. While his brash public threats and actions appear to have some success overcoming the signaling and credibility problems, they open up a massive assurance problem. Schelling's prescription for automaticity demonstrates how Trump's highly personalized leadership style introduces these issues. He writes that "Sending a high-ranking military officer to Berlin, Quemoy, or Saigon in a crisis carries a suggestion that authority has been delegated to someone beyond the reach of political inhibition and bureaucratic delays, or even of presidential responsibility, someone whose personal reactions will be in a bold military tradition."[81] The idea here is that, by insulating the decisionmaker from political leaders, their decisions will be taken seriously since they have the final say. But with Trump, such delegation is inconceivable—his frequent signaling and seesawing policy indicate that every decision is liable to change at the last minute, subject not to political processes or bureaucratic machinations but to his own whims.

The shortcomings of these two presidents' madman policies demonstrate a fatal flaw for the madman theory: it appears to be impossible to simultaneously navigate the signaling, credibility, and assurance problems. In the case of Nixon, it proved extremely difficult to credibly signal madness while attempting to retain some semblance of caution and risk-aversion. Trump may avoid these difficulties, but only by throwing caution to the wind and embracing potentially catastrophic risks—in short, by actually being mad. He thus stands to lose out on diplomatic advantage by facing assurance problems. And beyond that, any bargaining benefits he may somehow accrue are also offset by the fact that Americans have to accept that their foreign policy is in such unstable hands.

Schelling himself anticipated this possibility. After outlining the potential benefits of irrationality and describing the bellicose displays that Khrushchev would put on, Schelling continued, "I doubt whether we want the American government to rely, for the credibility of its deterrent threat, on a corresponding ritual. We ought to get something a little less idiosyncratic for 50 billion dollars a year of defense expenditure."[82] Indeed, Schelling did not believe madman diplomacy was a realistic possibility for the US, since "A government that is obliged to appear responsible in its foreign policy can hardly cultivate forever the appearance of impetuosity on the most important decisions in its care."[83] But even if that appearance could somehow be maintained, Schelling did not think it should be: "Khrushchev may have needed a short cut to deterrence, but the American government ought to be mature enough and rich enough to arrange a persuasive sequence of threatened responses that are not wholly a matter of guessing a president's temper."[84] Here he effectively

77 Jonathan Swan, "Scoop: Trump urges staff to portray him as 'crazy guy'," *Axios*, October 1, 2017.
78 Ibid.
79 Haldeman with DiMona, *The Ends of Power*, p. 83
80 Swan, "Trump urges staff to portray him as 'crazy guy'."
81 Schelling, *Arms and Influence*, p. 38.
82 Ibid., pp. 39-40.
83 Ibid., p. 40.
84 Ibid.

dismantles the Madman Theory that so many have subsequently attributed to him. And, as we have seen, the history of madman practice bears his concerns out. Nixon illustrated the first set of concerns, with inconsistent logic resulting in an inability to adequately signal madman appearances. Trump illustrates the latter, eschewing logic and ultimately resting the fate of American foreign policy on his ever-changing temper. In both cases, Madman Theory has proved to be an unsuccessful approach to foreign policy—ineffective at best, potentially catastrophic at worst.

The Train to Nowhere? Examining the Impact of Rail Transit Coverage on Ridership in Denver, Colorado

Brandon Joung

Abstract

This research project focused on the effects of geographical factors on future ridership prospects of the Denver Regional Transportation District (RTD) rail network. I argue that the Denver metropolitan area's current light and commuter rail systems possess significant coverage gaps, notably in densely populated economic corridors and in newly built communities. This claim is supported by geographical information systems (GIS), data analysis, and primary account methodologies on two metrics: population density and recent urban expansion in the past thirty years. These findings suggest that the geography of Denver's rail network disincentivizes potential riders from using the system. The results of this study are intended for the RTD and the Denver community, with the goal of providing supporting information towards spurring accessibility improvements to rail transit for the region.

Background

Over the last half-century, urban planning and design in the United States has evolved to form two distinct schools of thought, both with significant gravitational weight on the ways the built landscape has been laid out. The first to arise was the automobile-centered suburbanization pattern seen from the 1950s onward, which coincided with the end of World War II and subsequent economic boom. This development pattern, characterized by low-density single-family housing, wide highways and arterial roads, and distinctly separated residential and commercial land use, is ubiquitous throughout the country. In response to suburbanization, an alternative type of development called "smart growth" has gained significant traction starting in the 1990s. Synonymously referred to as "sustainable growth" or "new urbanism," this paradigm advocates the inclusion of higher-density multifamily housing, a decrease in car dependency in favor of walking, biking, and public transportation, and zoning amendments that promote mixed-use development (i.e., permitting residences and shops within the same building). As such, American cities are stuck between these two contradicting philosophies of urban planning. Despite a general shift towards smart growth, whose proponents cite benefits like climate change mitigation and economic growth, automobile-centrism still remains the status quo, and its widespread appeal continues to compel suburban sprawl in the urban United States.

The Denver, Colorado metropolitan area is particularly exemplary of the struggle between these two schools of urban growth. Historically known as a "sprawling 'cow town,'" the region's urban land area grew from 105 to 459 square miles from 1950 to 1990, almost entirely in a post-war suburban fashion which dominates the urban landscape to the present day. From 1990 to 2024, Denver's population saw a rapid increase of 85% from 1.65 million to 3.05 million people. In a reactionary gesture, also in combination with the rise of the smart growth movement, Denver has consequently committed to transforming itself into an example of eco-friendly new urbanism served by a robust public transportation system. This vision has spurred a variety of urban planning initiatives over the past decade, including the addition of cycling infrastructure, urban infill to replace parking lots with mixed-use developments, and local advocacy groups such as the Denver Bike Lobby and YIMBY Denver.

Denver's most drastic improvements, however, are in its rail transit network. In October 1994, the RTD inaugurated its light rail system, opening a modest 5.3-mile corridor linking Downtown Denver to the Interstate 25 Corridor, and the city has been expanding it since. FasTracks, an additional multibillion dollar expansion initiative by the agency in 2004, yielded an additional twenty-five miles of light rail track and fifty-three miles of commuter rail track as of 2023, along

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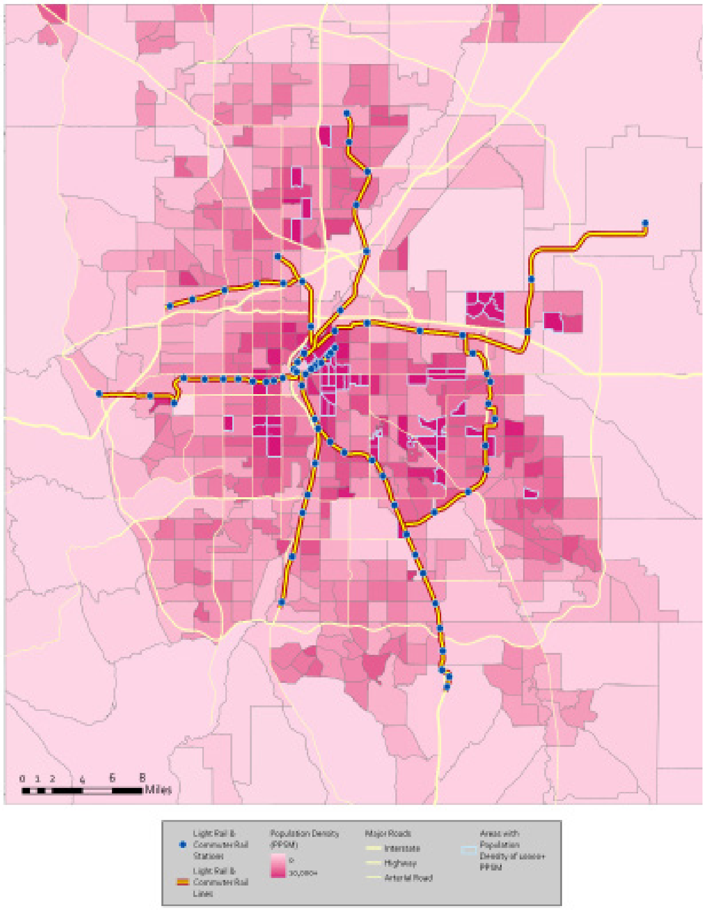
Given the massive scale and investment put into realizing FasTracks, it is worth assessing the RTD rail network's operating success over the past thirty years. One common analysis method is to examine performance metrics such as passenger ridership. Starting in 1995, the RTD saw an annual ridership of just over 4 million, steadily increasing over the next two decades and peaking in the late 2010s with around 32 million passengers yearly. Like other transit agencies, RTD system ridership dropped significantly during the COVID-19 pandemic, dropping 62% to 15.5 million trips from 2019 to 2020; But while its peer agencies have seen gradual post-pandemic ridership recovery, RTD ridership rates have not yet resurged. In fact, while most rail systems saw increased passenger volume from 2023 to 2025, light and commuter rail ridership in Denver decreased by 12.39% and 2.67% respectively, among the largest drops of all systems nationwide.

While it is too early to draw definite conclusions about the state of the RTD, the aforementioned figures are rather alarming and lend themselves to further analysis. On the one hand, Denver could just be slightly lagging behind its counterparts, and will see its ridership recover in the next few years. However, it is also possible that the RTD could see a prolonged dip in passenger ridership in upcoming years. The

Denver Regional Transportation District (RTD)
Rail Network, by Population Density



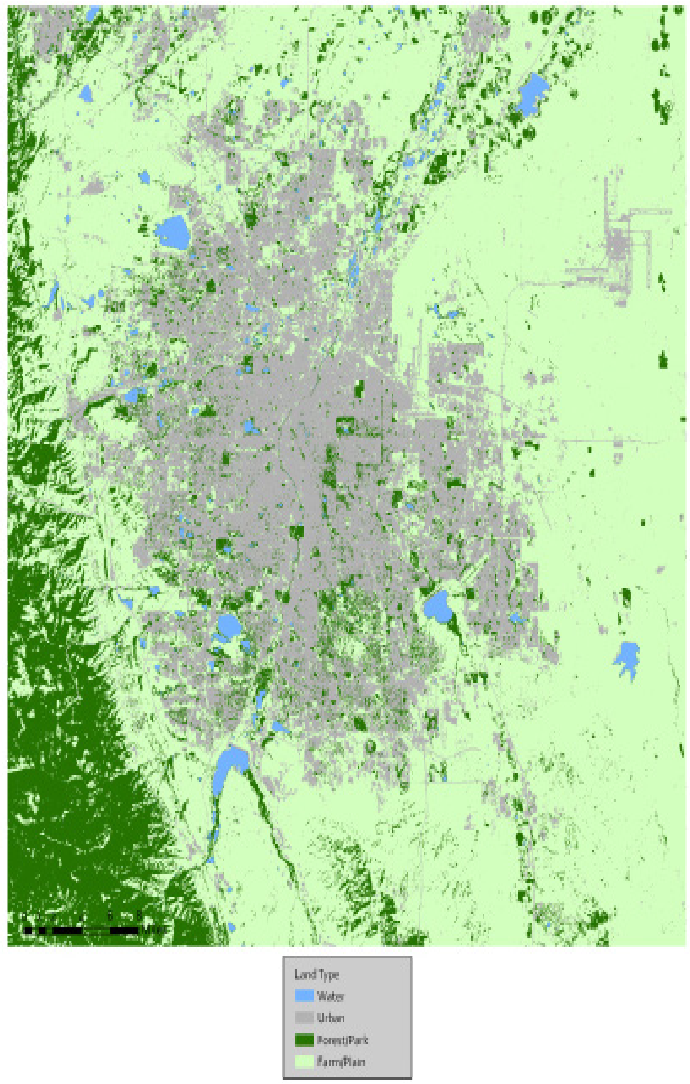
their socioeconomic implications; I do not intend on generalizing towards issues of frequency, revenue, etc. Additionally, I acknowledge that my analysis applies solely to the rail network and cannot extend to claims towards the RTD bus system. As a resident of the Denver area for over a decade, I aim to raise awareness about this salient issue to my community and contribute towards improving the rail system for its diverse rider base.

The RTD Network with Respect to Population Density

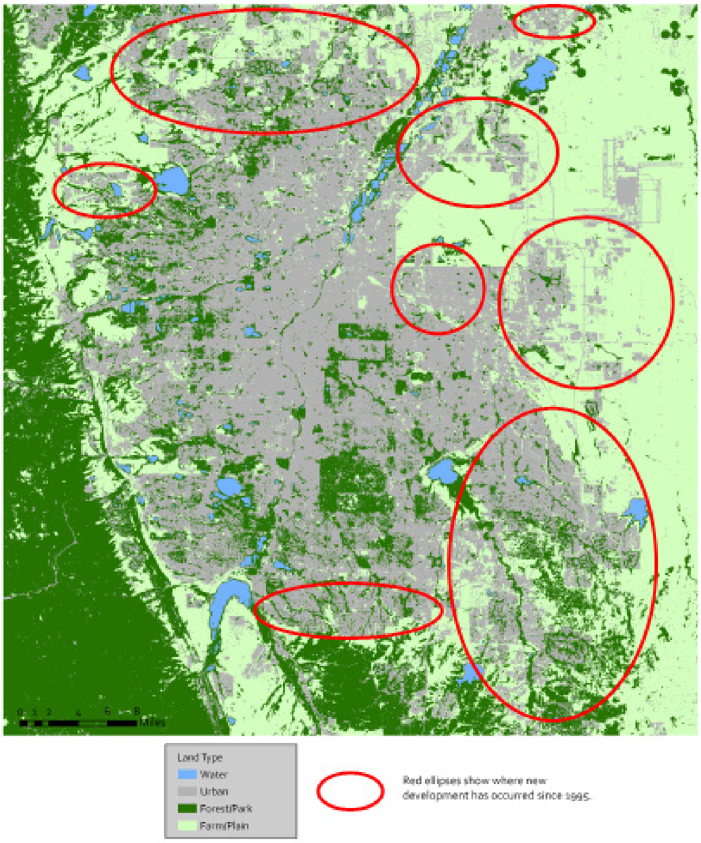
Previous literature suggests a correlation between the population density and the feasibility of transit operation in a given locale. Boris Pushkarev and Jeffrey Zupan, coauthors of the study Public Transit and Land-Use Policy, concluded that a minimum of nine dwellings per square acre—roughly translating to a population density of 11,379 people per square mile (PPSM), assuming that the average household size is 2.54 people—is required for light rail feasibility for a given area. For the purposes of this research, the threshold was simplified to 10,000 PPSM.

Only fifty-two (8.5%) of the 609 census tracts studied had a population density of 10,000 PPSM or higher. The majority of these high-density areas are located along or near high-capacity arterial roads that are lined with businesses and could serve as potential transit corridors. For example, Colfax Avenue (east–west) is lined by fourteen high-density neighborhoods;

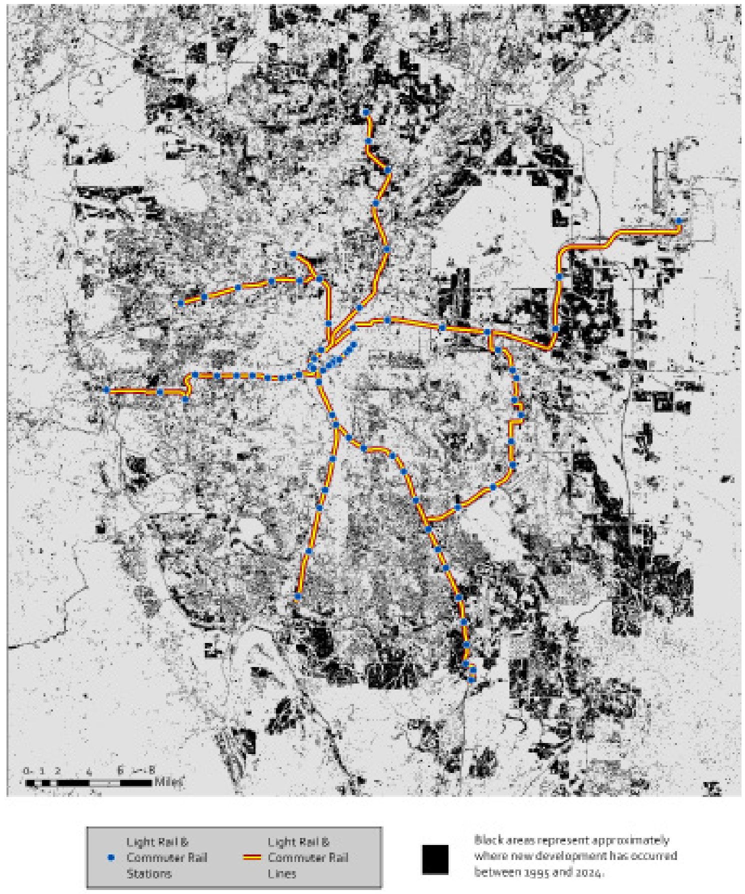
Land Classification of the Denver Metropolitan Area, 1995



Land Classification of the Denver Metropolitan Area, 2024



Denver Regional Transportation District (RTD) Rail Network, by Urban Expansion



Brighton, north Commerce City, and east Denver (namely, the areas surrounding Denver International Airport, and Central Park, located on the site of the former Stapleton International Airport). Combined, these new communities house over 432,000 residents, around 14% of the metropolitan area population; however, the vast majority are suburban in character, consisting of low-density single-family residences separated by wide arterial roads. As such, most of these developments do not possess the 10,000 PPSM density threshold required for rail transit to be economically feasible.

Figure 3. An approximate classification of different land use types in the Denver metropolitan area in 2024. The symbology is the same as in Figure 2. The red ellipses show where new development has occurred within the timespan of the two maps. Do note that there may be a slight margin of error due to seasonal differences between the two rasters used.

Figure 4 demonstrates that the current RTD rail network is not accessible to the vast majority of these new developments. Certain areas are admittedly well-served by rail stations, such as the Denver Tech Center and in Lone Tree in the south and in Central Park, communities built under new urbanist and transit-oriented development principles. However, coverage gaps are still present and are particularly wide in Parker, southeast Aurora, Broomfield, and north Commerce City, where the nearest station can be up to eleven miles away. This suggests that the RTD rail network's geographical reach has failed to expand alongside recent, automobile-centric suburbanization trends. Without the viable option of rail transit, approximately one in seven residents in the Denver area will continue to drive, since it will remain the most convenient and economically efficient mode of transportation.

Figure 4. The geography of the RTD's light and commuter rail system as it relates to urban expansion in the Denver metropolitan area from 1995 to 2024. Dense black regions of the map symbolize approximately where the majority of new development has occurred.

Conclusion

From this research, I identified two flaws regarding the RTD's rail system coverage that could be attributed to negative ridership trends. First, I concluded that the network fails to cover Denver's most densely populated regions, consequently eliminating rail transit as an option in neighborhoods where it would be the most economically viable mode of transport. Additionally, I concluded that the network fails to cover the majority of the metropolitan area's recently built urban areas, perpetuating the status-quo of car dependency in these suburban/exurban communities.

If the RTD continues to experience stagnant or declining ridership over the next several years, the agency could consider implementing expansion initiatives that would increase coverage in a geographically strategic manner. Instead of building tracks along highways, industrial zones, or open plots with minimal utility, future rail lines can be constructed along major arterial roads with focal business corridors and densely populated neighborhoods where transit usage would be highly incentivized. For example, tram-style light rail routes could be established along Colfax Avenue or Federal Boulevard. In addition to new lines, the RTD can expand current rail lines, adding stations in the new suburban developments on the outskirts of the region; such augmentation could be seen in north Thornton, Broomfield, and west Highlands Ranch and would be a realistic investment, especially since track infrastructure already exists in these areas. By taking steps to realize such concepts, the RTD would come closer to eliminating trains that go to nowhere, instead providing an attractive transportation option to a wider array of residents and retrofitting a metropolitan region long dominated by the car-centric, suburban status quo.

I should once again acknowledge that, at this point in time, addressing issues with coverage alone is not a catch-all solution to improving ridership prospects. Rather, expanding the RTD network to reach a wider range of the metropolitan area is just one component to the overall solution. Nonetheless, other aspects of improvement—adjusting and enforcing fares, eliminating slow zones, and reforming surrounding land use towards transit-oriented development, to name a few—will similarly require a joint effort between the agency and residents alike to put forth into realization.

Methods

Data. The area of study for this research comprised 1577 square miles, determined by merging and clipping four raster files of the Denver area: two from September 1995,and the other two from July 2024. Feature layers for rail routes and stations were obtained through the RTD's website. Population density data from 2015 to 2019 was obtained from the Colorado state government. Data on major roads in Colorado were found on ArcGIS Cloud. All maps were projected using the WGS 84 Web Mercator (auxiliary sphere) coordinate system to maintain compatibility between all the datasets used.

Population Density. The population density shapefile was clipped to the area of study. Values were symbolized using an unclassed scale of hot pink, with the upper limit set to 10,000 as per Pushkarev and Zupan. Census tracts with a population density of 10,000 PPSM or greater were highlighted with a light blue outline. Major road data was similarly clipped and symbolized in light yellow lines of varying thickness. RTD data were symbolized to pop out; routes were symbolized as a yellow stroke with a red outline, and stations were represented with blue dots. Statistics for Figure 1 were obtained from the data attribute tables.

Urban Expansion. I performed two unsupervised, pixel-based image classifications on the merged 1995 and 2024 rasters. A manual reclassification filtered twenty-five classes into four (water, urban, forest/park, farm/plain), symbolized in visually intuitive colors. I derived the statistics for Figure 2 and Figure 3 using the "Calculate Statistics ▯ Bar Chart" function. Each classification was further reclassified into urban and non-urban areas, symbolized as black and light grey. I overlaid the final 1995 raster onto its 2024 counterpart using the "Difference" layer blend, consequently showing newer urban areas in black and the rest as light grey. RTD data symbology remained unchanged. I supplemented the analysis on Figure 4 with proprietary knowledge about the areas discussed.

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Antisemitism and the Early Palestinian Nationalist Movement in the Mandate Period

Pauli Voelkel

Introduction

Hamas's attack on October 7 and Israel's subsequent retaliation, which has left more than 70,000 Gazans dead, renewed conversations about the national and religious character of the Arab-Israeli conflict. Arab and Jewish identities are intertwined in discourse and political action in Israel-Palestine, and politicians, the media, and academics alike frequently blame religious animosity for the absence of peace today. Discussing antisemitism is particularly important in today's context with the existence of Islamist terror and militia organizations such as Hamas and Hezbollah that target Jews in Israel and around the world.

Following the attacks carried out by Hamas, many conclude that Palestinian nationalism should be characterized by a violent hatred of Jews. Many associate antisemitism and anti-Zionism for this reason. In an article that he titles "Antisemitism, A Guide for the Perplexed," Bret Stephens makes this association, explicitly concluding that Judaism and Zionism are inextricably linked. He writes,

Remember that antisemitism can also take the form of political hatred, and Zionism — that is, support for the existence of a Jewish state, as opposed to any of its policies — is today the principal expression of Jewish politics. But even anti-Zionism increasingly expresses itself as a conspiracy theory (2023).

Charges of antisemitism evidently shape public opinion and the ways in which we discuss the conflict, where certain discussions and arguments are dismissed for being antisemitic. Israel and its staunchest supporters claim they have never had a "partner for peace" because they believe Palestinians support militant groups like Hamas out of deep-seated anti-Jewish views that stem from Arab culture. For instance, Israeli Prime Minister Benjamin Netanyahu claims that a Palestinian state "will be another terror haven" that teaches antisemitic beliefs and encourages violence against Jews (Nereim, 2024). It is worth investigating the development of Palestinian nationalism and the extent to which antisemitism was present critically to determine how we should characterize the movement, past and present.

Unlike the narrative which writers like Stephens and political leaders like Netanyahu push about Palestinian nationalists' present and historic hatred of Jews, there is no evidence to suggest that there was a universal anti-Jewish sentiment within the Muslim Arab population in the early 1900s. Muslim Arabs describe a positive relationship with Jews prior to Israeli statehood. Um Khalil, a Palestinian woman from a wealthy family from Anabta, by her account remembers, "the Muslim families would go to their Jewish neighbors and light the candles. The Jews would come and do things for us. We never thought that they were enemies. We were friends together" (Lynd et al., 27). Another Palestinian, Salah Ta'amari from Bethlehem who grew up during the 1948 war, remarks, "Jews were a part of this indistinguishable group of people. My grandfather's generation never spoke ill of Jews; they almost spoke of a good relationship" (68).

The question is: what changed for the relationship between Jews and Muslims in Israel-Palestine to become so strained? There was evidently a catalyst for the extreme violence beginning in Mandate Palestine to upset the Jewish, Muslim, and Christian coexistence. By studying two major instances of violence in which Jews were targeted during the Mandate period, the Nabi Musa riots and the Wailing Wall riots, this paper argues that Palestinian nationalism was primarily motivated by the political implications of Zionism. Antisemitism is certainly present in the rhetoric and generalizations that all Jews were necessarily Zionists, but that conflation resulted from political tensions between two nationalist ideologies. There was no extreme pre-existing antisemitism in the Muslim Arab population; in fact before World War I, Ottoman society had been progressing toward greater social equality for the Jewish and Christian minorities. Instead, any hostility towards Jews that developed during the Mandate period arose from fear of what Zionism would mean for the Palestinian state and Arab political and religious rights.

Defining Antisemitism

Antisemitism is frequently used as a rhetorical tool in Palestinian-Israeli discourse to explain tragic events and bring attention to the moral stakes of the debate. Many believe that anti-Zionism, as in criticizing Israel's actions or its legitimacy (not necessarily calling for destruction of Israel today), is akin to antisemitism, and that to dislike Israel as a state is the same as hating Jews. For example, New York Times columnist Roger Cohen reports that Jews in Europe "speak of alarm as pro-Palestinian sentiment surges," meaning that European Jews expect increased antisemitism as anti-Zionism gains popularity (Cohen, 2023). There is widespread public perception that anti-Zionism is anti-Jewish, which regrettably dismisses pro-Palestinian activism as hateful. Therefore, it is essential to determine which of the many definitions of antisemitism is conducive to productive political discussions about Israel, Zionism, and Palestinian nationalism.

There have been several attempts to define antisemitism by associating it with racism and xenophobia to better contextualize and explain it as a uniquely religious and cultural othering. The term "antisemitism" only became "socially significant" after World War II to explain and describe the prejudice and hatreds that motivated the Holocaust (Langmuir, 351). Attempts to describe antisemitism fall short when the term is associated with "racism" or "ethnic prejudice," which imply that Jewish people constitute a race or ethnicity, a false idea that ignores the racial diversity of Jews and racial discrimination within the Jewish community (314). Therefore, the othering of Jewish people is more closely related to xenophobia, or fear of an outsider (329). The comparison to xenophobia describes the historic discrimination felt by Jews in Europe well, because Jews as a group were unable to assimilate into European society and were treated as second class citizens who were not a part of the national identity. Any definition of antisemitism should consider the assumption about how Jews are characterized within the definition.

The International Holocaust Remembrance Alliance (IHRA) definition, which is widely accepted as the best definition of antisemitism, is weak because it is too vague and favors the association between anti-Zionism and antisemitism. The IHRA's definition of antisemitism is "a certain perception of Jews, which may be expressed as hatred toward Jews. Rhetorical and physical manifestations of antisemitism are directed toward Jewish or non-Jewish individuals and/or their property, toward Jewish community institutions and religious facilities." Jan Deckers and Jonathan Coulter point out that the IHRA's definition does not address the distinction between, as the IHRA puts it, "hatred toward Jews" versus "hatred for Jews," or hatred for Jews for being Jewish (734). For example, one cannot claim that condemning Prime Minister Netanyahu for his actions as a political leader is antisemitic simply because he happens to be Jewish. A more comprehensive definition would clarify that hatred toward Jews is based on stereotypes and prejudice attached to the religious and cultural aspects of the Jewish faith and community.

The definition of antisemitism that this paper will refer to is that of The Jerusalem Declaration on Antisemitism (JDA): "Antisemitism is discrimination, prejudice, hostility or violence against Jews as Jews or Jewish institutions as Jewish." The JDA also provides a list of examples of antisemitism, which are useful as a check on certain rhetoric and actions. The only guideline by the JDA that does not apply to this historical investigation is section B, point 10: "Denying the right of Jews in the State of Israel to exist and flourish, collectively and individually, as Jews, in accordance with the principle of equality." Because this paper examines the Mandate period, before Israel declared its statehood, antisemitism and anti-Zionism must be treated as separate. Antisemitism is hatred of a religious and cultural identity, and anti-Zionism is a rejection of a nationalist ideology that happens to be tied to Judaism and the Jewish community.

The observable implications of antisemitism include actions that socially and politically alienate and villainize Jews. For example, since the Middle Ages in Europe, Jews were persecuted, pushed out of European society, and consistently treated as second-class citizens. Zionism exists because of the heinous oppression and discrimination that Jews faced in Europe, which required the creation of a safe haven for the Jewish people, who had little hope for equality in Europe. In recent European history, Jews have been removed from leadership, like in the Dreyfus Affair; blamed for national failures, like after World War I; and been victims of ethnic cleansing, such as the tragic genocide committed during the Holocaust. Antisemitism in the Middle East would look much the same, with a primarily Muslim society specifically preventing Jews from having economic, political, social, and religious rights in the aforementioned ways. Similarly, consistent accusatory, conspiratorial rhetoric and targeted violence against Jews as followers of Judaism constitute observable antisemitism.

Muslims, Christians, and Jews during the Ottoman Empire

The relationship between Muslims and Jews in the Ottoman Empire looked very different from the relationship between European Christians and Jews. In the nineteenth century Ottoman Empire, the Muslim Arab majority ruled and Jewish and Christian Arabs were small minorities, with only about 9.5 percent of the population being Christian and 3.2 percent Jewish (Dowty, 7). The Ottoman Empire referred to Jews and Christians as dhimmis ("people of the pact") who, under the Pact of Umar, were permitted to govern themselves so long as they respected the occasional authority of the local Muslim sultans (Sharkey, 39). Christians and Jews did not enjoy all the same social and political rights as Muslims, but nor were they violently persecuted for their religion like they were in Europe, and nineteenth-century reforms were beginning to dissolve some of the hierarchies that favored Muslims. Christians and Jews were not restricted economically and permitted to accrue wealth; they served in some mixed courts, maintained autonomous communities, and practiced their religion and culture freely (162–163). While some scholars claim that there is a tradition of anti-Jewish hatred in the religion of Islam, there is no strong evidence to suggest that was the case in the Ottoman period (Herf, 5). In general, Jews and Christians were recognized and respected as "people of the book" because they shared the belief in the one God (Sharkey, 39). In general, any religious discrimination was against both Christians and Jews as the minority religious groups in the Ottoman Empire.

When Jews were threatened for their religious identities at the time, it was more often due to European Christian provocation. One notable incident was the Damascus affair in 1840 where Catholic missionaries at the French consulate in the Ottoman Empire accused Jews of having killed a Capuchin priest and spread blood libel myths targeting the local Jewish community (Sharkey, 156). The authorities, under direction from the French, searched the Jewish quarter and tortured innocent Jews. Cruel lies about Jewish communities, like those spread by the European missionaries, were novel and shocking to Muslims (156). Indeed, Jews were not nearly subjugated in the Ottoman Empire to the extent to which Jews were subjugated in Europe, and events like the Damascus affair were uncommon. During the late nineteenth century, Muslims, Middle Eastern Jews, and Jewish European immigrants, for the most part, had a nonviolent relationship that was improving. As for non-Arab Jews, although they did not fully assimilate into Ottoman Palestine, they did not feel threatened for their religious or national origins (Dowty, 120). From the end of the Ottoman Empire to the declaration of the state of Israel, the relationship between Muslims and Jews changed dramatically.

Violence and Nationalism

The Nabi Musa riots took place during the Nabi Musa festival in April of 1920 and was one of the first violent conflicts between Jewish communities and Muslim Arab nationals in Palestine. The festival was a religious pilgrimage to the Nabi Musa Tomb, the tomb of Moses, located in the east of Jerusalem. The festival had changed from previous years to include Jaffa Gate, one of the entrances to the Old City. Jaffa Gate was a symbol of modernity and the Ottoman Empire, due to the large Ottoman clock tower above it and the Turkish customs house below it (Mazza, 64). The choice to lead the procession through Jaffa Gate gave the festival a distinct political character. There, several elite Palestinian leaders gave inflammatory speeches attacking Jews and Zionism, catalysing the violence. There are several accounts of who began the violence, some pointing to Zionists provoking the crowd, others blaming it on Arab instigators, revealing the conflicting cultural memory of the event. In the end, rioters looted Jewish shops, beat spectators, and shot members of the procession, and in addition to the subsequent violent retaliation, the riots left five Jews and four Muslim Arabs dead (66).

The rhetoric leading up to the outbreak of violence ranged from blatant antisemitic remarks to somewhat more legitimate calls for resistance. Blatant antisemitism lacks a connection to the political and serves to insult, humiliate, hurt, and dehumanize. Then-mayor of Jerusalem, Musa Kazim al-Husayni, aggressively proclaimed, "Palestine is our land, Jews are our dogs," while the famed journalist and historian, Aref al-Aref, announced, "if we don't use force against the Jews, we will never be rid of them" (66). Musa Kazim al-Husayni's statement is certainly antisemitic, characterizing Jews as a group as submissive, subhuman, and lacking basic dignity. On the other hand, Aref al-Aref's statement is clearly more political and nationalistic in his reference to the flood of Jewish immigrants into Palestine, suggesting that antisemitic beliefs in Palestinian nationalist movements stemmed from fear of Zionism.

Determining the role of antisemitism in the Nabi Musa riots means determining what the violence was motivated by, keeping in mind the definition of antisemitism: "discrimination, prejudice, hostility or violence against Jews as Jews" (JDA). By studying several instances of mass violence, including the Holocaust, Jacque Semelin determines that inflammatory discourse that leads to violence occurs when "myths and realities are intertwined" (Semelin, 22). The myth that some Palestinian leaders were projecting was the generalization that all Jews are Zionists attempting to take over Palestine, but there was still the apparent reality that much of the European Jewish immigration into Mandate Palestine was to create a Jewish majority for the Jewish state. On the other hand, Zionists who took part in the riots also held the myth that Palestinians were a savage people, but there was still the reality that many Muslims were prepared to use to violence against Jewish people to stop the immigration. It is difficult to determine whether individual Arabs participating in the violence acted on their perception of Jews in general or their judgments of Zionism, but what is certain is that the changing political situation in Palestine greatly contributed to the intensity of conflict. The Nabi Musa riots should not be interpreted uniquely as antisemitic outburst given that there were substantial political changes occurring when the violence broke out.

Violence against Jews in Mandate Palestine was primarily a manifestation of an Arab political struggle against Zionism. During Ottoman rule in Jerusalem, protests, riots, massacres, and violent demonstrations were mild, common, and not along religious lines (Mazza, 62). In fact, it was seen as a legitimate way of bringing attention to a political struggle, or as Roberto Mazza describes it: "social practice that leads to social change" (62). Political violence early on in the Israeli-Palestinian conflict was largely uncoordinated and there were no militant groups organizing riots and attacks. Palestinian rioters were responding to the increased European Jewish immigration into Palestine that resulted in Arabs selling their land, therefore limiting the geographical and demographic dominance of the Muslim Arab population. Much of the violence was specifically against European Jewish land buyers because they represented a direct example of apparent Zionist goals in Palestine (McDowall, 11). The concentration of violence around land purchasing and changing neighborhoods signals that the violence likely originated from political concerns and fears of displacement. Violence was not specifically directed toward Jews as Jews at this point, but more specifically Zionist immigrants, as illustrated by a 1919 newspaper article "Beware of Zionist Danger" noting the "Zionist desire to settle in our country and expel us from it" (12). The idea was reasonable given that in private, Zionist leaders had agreed that a demographic Jewish majority was necessary for the Jewish state, but they must have understood that advertising the plan to transfer Muslim Arabs out of the country would trigger a strong reaction (Morris, 41). Regardless, Arabs did indeed assume that under the Zionist state, they would be evicted (Palin et al., 15). The European Zionist goal of creating a country in Palestine while undermining the people already there was terrifying to Arabs.

The notion that the violence was primarily motivated by nationalism is supported by the British authorities at the time who commissioned a report to investigate the source of the violence. Despite being biased toward Zionism, given that Great Britain had declared Palestine the new home of the Jewish people in the Balfour Declaration in 1917, the British report still stated that Palestinian grievances and their violent reaction were valid. Major General Sir Philip Palin proceeded over the Commission and interviewed 152 witnesses in eight languages, but the Commission was never published due to the anticipated Zionist pushback over the characterization of the riots (Britain Palestine Project). The Commission began by outlining the racial, ethnic, and religious division within Jerusalem in an attempt to outline the shift away from peaceful relationships between Muslim, Christian, and Jewish communities. British officials believed Muslims and Christians saw the Jewish population as "humble" and "inoffensive," and they reported that there was no regular major violence directed toward Jewish communities (5). Subsequent points summarized how the Palestinians were deeply disappointed that the British did not give them an independent state after observing the European international emphasis on self-determination, and the content of the Balfour Declaration denying Palestinians political rights. The Commission describes Muslims and Christians as feeling "dumbfounded" and "bitter" that "they were to be handed over to an oppression which they hated far more than the Turks and were aghast at the thought of this domination" (10). The Palin Commission connected the riots to the unfulfilled promise of statehood.

The Palin Commission emphasized the Palestinian Arabs' fear of European Jewish immigrants. Palestinians perceived Jewish immigrants as a threat, due to their wealth and ability to buy Palestinian land, and because they had the backing of an imperial power. The Commission conceded that these fears were not entirely misplaced, given that these were essentially the goals of Zionism and the content of the Balfour Declaration. The Commission quoted the Grand Mufti Kamil al-Husayni, the religious and political leader of Arabs in Jerusalem: "I too believe the Jews could greatly help our country, but what terrifies us are the extremists and the uncontrolled immigration" (15). The Grand Mufti judges the Jewish people not on their faith or culture, but on the political consequences of their mass migration. In addition, the Commission reported on Zionist media that had been directly outlining the plan "to remove the Arabs from the country by force" (21). Naturally, Arabs reacted in a panic having gone from thinking they would have their state to fearing they would be taken from their homes. The Palin Commission concluded the essential cause of the riots was a mix of a political reality, fear, and generalization, not hatred toward Jews as followers of Judaism, but as supporters of Zionism.

The Nabi Musa riots were an Arab reaction to Jewish immigration and fear of Zionism that would undermine the possibility of the widely desired Palestinians state. The character of the Palestinian nationalist movement at this time had not taken on the Islamist tone assumed to be present in all Palestinian nationalist movements. In fact, after World War I, there was some desire for a secular democratic state that would protect the civil and political rights of all members of Palestinian society. A 1919 Memorandum of the General Syrian Congress to the King-Crane Commission called for a "democratic civil constitutional monarchy on board decentralized principles safeguarding the rights of minorities and opposing the Zionist settlement of Palestine" (McDowall, 15). Palestinian nationalism was not primarily driven by hatred of Jews or the Jewish faith; instead there was wide-spread existential fear of Arab disenfranchisement by European immigrants. Fear of Zionism did at times manifest in some antisemitic rhetoric and attacks targeting Jews indiscriminately because of the assumption that most Jews were proponents of Zionism. Yet, the political purpose of the Nabi Musa riots and the political goals of Palestinian nationalism were primarily to demonstrate against the creation of the Jewish state outlined in the Balfour Declaration that would deny the political rights of thousands of Arab Palestinians. In the early 1920s, Palestinian nationalism was secular and political, and distinctly different from the militant Islam that we see today.

Palestinian Nationalism and Religion

The Nabi Musa riots demonstrated how political fear of mass migration generated violence against Jewish people, while the Wailing Wall riots nine years later showed how religious sites became proxies for nationalist competition. The Wailing Wall riots in August 1929 saw the use of religious dispute to promote nationalist ideologies by Muslim Arab Leaders, particularly the Grand Mufti of Jerusalem. The Wailing Wall is the western border of the Temple Mount and Haram al-Sharif and it is the holiest religious site in Jerusalem for both Jews and Muslims. The Western Wall in Judaism is the remaining section of the original Temple Mount and became a symbol for the suffering of Jews in the modern world (Mazza, 71). The Wailing Wall or "the place of wailing" in Islam is where the Prophet Mohammed tethered his magical stallion, al-Buraq, during his Night Journey to Jerusalem (72). The dispute over the Wall in 1929 grew tense when Zionists tried to purchase sections of the Wall in the Maghrebi quarter to create space for the growing number of Jewish worshipers at the Wall, drawing attention to the Zionist aims in the city (72). Zionists' attempts to claim the Wall upset the peaceful balance between Jewish and Muslim worshipers and represented an encroachment on the religious and cultural identities of Muslim Arabs.

The Wailing Wall riots originated from months of tension at the Wall. Following peaceful Jewish demonstrations in August of 1929, some 2,000 Arab Muslims marched to the Wailing Wall, and some marchers burned Torahs that were left there, a distinct sign of hatred and intolerance. Later in the month, Arabs were given a false message that the Mufti had instructed them to gather in defense of the Wall, and after several speeches, the crowd rushed out of the Haram and the violence began (46). Mazza describes these riots as a massacre, using the definition "the murder of the defenseless in a distinct time and place when the killers are not in danger" because the violence was mostly Arabs attacking Jews in Arab neighborhoods, and Jews attacking Arabs in Jewish neighborhoods (Mazza, 75). For example, Arab attacks took place in the Gurji quarter, now in East Jerusalem, and Jews targeted the Nabi 'Ukkasha Mosque in the Jewish section of Central Jerusalem (75). Attacks took place for several days all throughout the city. Religious disputes over control of holy sites were common in

Jerusalem, but the Wailing Wall riots were especially intense and bloody due to its connection to conflicting nationalist struggles (Mattar, 34). In the end, 133 Jews and 116 Muslim Arabs died.

To determine the extent of antisemitism in the Wailing Wall riots, we must investigate the new Grand Mufti of Jerusalem Hajj Amin al-Husayni's role as the head of the Palestinian nationalist movement in the city. A common narrative is that Amin incited the violence and encouraged religious fanatics to attack Jews. Although he did not encourage violence, Amin used the religious dispute to bring attention to the nationalist struggle. Amin had been exiled by British authorities, pardoned, and eventually appointed Mufti by British high commissioner Herbert Samuel, a member of the Jewish Liberal Party and a committed Zionist, after winning the election (Mattar, 20, 27) The position of Mufti was religious as well as political, but Amin's main goal, and the reason why he was so popular, was supporting Palestinian nationalism morally and monetarily (30). As the Mufti of Jerusalem and the president of the Supreme Muslim Council, he was obliged to defend the Muslim claims over the Wall (37). Unlike previous religious disputes, the Wall dispute was distinctly nationalist with Zionists calling "to pour Jews into Palestine" to reclaim the homeland and the Wall (38). Amin convened the General Muslim Council to address the Zionist claim over the Wailing Wall by creating the Society for the Defense of al-Masjid al-Aqsa and the Muslim Holy Places which created propaganda to publicize the conflict and draw attention to the effects of Jewish immigration (Porath, 272). One newspaper under Amin's direction proclaimed, "The Muslims of Palestine are determined to sacrifice body and soul in order to safeguard their religious rights. It is enough that their national rights have been stolen from them" (266). On the day the violence broke out, Amin urged that day's preacher to deliver a calm sermon, and he encouraged members of the crowd to enter the Mosque instead of demonstrating outside (Mattar, 47). Amin was not attempting to incite violence for the sake of violence, although his use of religious imagery inflamed the inter-religious tension and resulted in bloodshed, his goal was primarily to bring attention to the negative effects of Zionism on Arab life and mobilize resistance against Jewish immigration.

Religion was evidently critical for the Mufti's constituents and an important component of Arab identity, which Amin understood. For example, he inflated the budget costs of restoring a mosque to cover up money being used for demonstrations and political propaganda (Porath, 203). Religious rights were one of the rights listed for Arabs in Palestine in the Balfour Declaration, meaning Amin, in his cooperation with the British, could reasonably advocate for control over religious sites and rights for Muslims. He recognized the sensitivity of religion for Arabs present in the political conflict between Zionists and Palestinians, therefore restoration and protection of mosques and religious sites became the new fighting ground for Palestinian nationalist aims. Yehoshua Porath describes Amin's strategy during the conflict as "instead of abstract nationalist slogans about self-determination, majority rights etc., they now had a concrete symbol which was clearly understood by the Muslim masses" (272).

Narratives that suggest that religion is the driving factor in this conflict wrongfully assume cultural differences to be as divisive as political ones. In a case study on the Chewa and Tumbuka communities in Malawi and Zambia, Daniel N. Posner investigates why there is far more division between the Chewas and Tumbukas in Malawi than in Zambia. Posner concludes that the political context in Malawi creates a bigger cleavage given that both groups are large coalitions who are "politically useful in the national competition for state resources," while in Zambia, the communities are too small for political use (543). In Palestine in 1929, national leaders mobilized the religious identities for the purpose of resisting changing demographics and burgeoning calls for Jewish statehood in Palestine. The conflict developing between Muslim Arabs and Jews in Palestine similarly included two distinct groups who had coexisted previously, but the introduction of a salient political problem, in this case mass migration, resulted in greater cleavage between the two religious communities.

The Shaw Commission, another British Commission organized to investigate the source of the violence, concluded that though the Mufti did not incite the massacres, he contributed to the tension by emphasizing the loss of Muslims' religious status at the Wall. The Shaw Commission is a reliable source because it provides a relatively balanced report of the events despite being carried out by the British authorities who were biased toward the political success of Zionism in Palestine at the time. The Commission describes the Wall dispute as being both a religious and political confrontation, providing evidence of possessiveness over the holy sites and fear of Zionism contributing. Amin began what the Commission refers to as the "Burak Campaign," wherein Amin and other Arab leadership advocated for Muslims rights over the Wailing Wall. The Shaw Commission described the purpose of the Burak Campaign as "to annoy the Jews, and also to mobilize Arab opinion on the issue of the Wailing Wall" (Shaw et al., 74). The use of the mild and dismissive term "annoying" implies that the British did not believe the Burak Campaign was intended to incite mass violence and armed conflict against Jewish people. Up until the Balfour Declaration, Muslims had had priority over the religious sites in Jerusalem, and experiencing challenges to their religious sovereignty as well as challenges to their national sovereignty made the situation volatile. The Shaw Commission draws attention to the fact that, partly because of Amin, Zionism was entirely understood to be a threat to Arab rule:

> No one who has been about the country as we have been and who has listened to the applause which greeted many passages in the addresses read to us by village heads and sheikhs could doubt that villagers and peasants alike are taking a very real and personal interest both in the effect of the policy of establishing a national home and in the question of the development of self-governing institutions in Palestine (Shaw et al., 129).

The country-wide resentment over ignored Arab desires for a state erupted during the riots. Because there is no reference in the Shaw Commission to religious or cultural differences, the strict political nature of the report suggests the violence against Jewish people was mostly due to their connection to Zionism and the fear that Arabs would lose their own claim to statehood. Religion is evidently the point of distinction between the two groups, so it played an important role in the conflict, but these differences were only exacerbated and problematized by nationalism.

Jacques Semelin categorizes mass violence as "destroying to subjugate," "destroying to eradicate," or "destroying to revolt" (Semelin, 327). Determining the political purpose of the mass violence during the Wailing Wall riots can determine the extent of antisemitism in the massacre. Destroying to subjugate and destroying to eradicate have a distinctly hateful association with antisemitism, especially given the legacy of the Holocaust: Nazi Germany's hatred of Jews resulted in a policy to oppress and kill all Jews in Germany because they were Jewish, not for any legitimate political grievance. The violence in Palestinian nationalism, however, was not to subjugate or to exterminate. It is unlikely that Palestinian nationalists wanted all Jews in Palestine to be degraded, killed, or completely expelled, given that there were no prominent groups systematically organizing for these goals in Palestine. In fact, Arab states recognized the Jewish desire for a refuge in the Middle East by putting forth a proposal for a Palestinian democratic state in a UN Subcommittee proposal in 1946 and 1947 to address European Jewish immigration while retaining Arab statehood. The proposal included a democratic constitution with guaranteed sanctity of the holy places, freedom of religion, Hebrew as the official second language in places where Jews are in the majority, representation in government based on the populations of distinct religious communities, and a pledge that "the guarantee contained in the constitution concerning the rights and safeguards of the minority shall not be subject to amendment or modification without the consent of the minority concerned" (Khalidi, 688–689). The proposal was never realized because the independent Arab state in Palestine after World War II was never established.

The violence committed by a segment Palestinian nationalist movement during these riots should be classified as destroying to revolt. Semelin describes destroying to revolt as "provoking a violent insurrection against a despised system" and a "self-revolt in that it hoped that the massacre would trigger an emancipating dynamic of the 'masses'" (Semelin, 348). The Wailing Wall riots are distinctly different from other instances of destroying to revolt given that there were no terrorist or insurgent organizations conducting the violence; instead, the riots were a manifestation of tensions between Zionism and Palestinian nationalism after weeks of demonstrations where both parties claimed possession over the Wall. As the leader of Palestinian nationalism during the Mandate period, Amin sought to energize the Palestinian nationalist struggle by bringing attention to Zionist actions he saw as threatening Muslim Arab way of life, like their ability to worship at the Wailing Wall. To Palestinian nationals engaged in the violence, killing Jewish people was a disproportionate and extreme response to the despised system that the British set up in Mandate Palestine that prioritized Jewish statehood, Jewish immigration, and Jewish religious rights. Jews were not primarily targeted for their religion and culture, but they were attacked for being associated with Zionism and for challenging Muslim political dominance. Had it been Christians creating a state in Palestine and attempting to take possession of the Holy sites, the response may have been the same.

Antisemitism as a European Import

During the 1930s, as tensions between Muslims and Jews in Palestine grew, antisemitic Nazi propaganda reached the Arab world. In 1933, Amin contacted the head of the German Consulate in

Jerusalem welcoming the new regime and explaining his desires for weakening the economic power of Jews in Palestine and abroad (Herf, 16). The connection to Zionism is apparent given that Palestinian leadership was deeply concerned with the capability of Zionist immigrants to buy Palestinian land and were willing to discredit, exclude, and oppress European Jews to stop it. Amin was equally looking for an international ally to support the establishment of an independent Palestinian state. The relationship between Amin and the Nazi regime grew with Amin meeting with Hitler in the hopes of securing a relationship with a European power to challenge British and Zionist presence in Palestine (Nicosia, 85). The Nazis disguised their disdain for Arabs as non-Aryans and concealed that they did not intend to challenge British occupation in the region (Nicosia, 85). With the help of Amin, the Nazis launched a propaganda campaign spreading classically European antisemitic tropes to Arabs. For example, in a speech broadcasted from Berlin, Amin accused the world Jewish population of conspiring with the Allies and directing them to take over Palestine (Herf, 215). Part of the Nazi strategy was also to appeal to Arabs via religion and encourage jihad against Jews (Herf, 129). New lies were being fed to Muslims regarding Jews that, rather than relying on pre-existing antisemitic views, relied on Arab distrust of Zionism and the assumption that Germany would emancipate them from British and Zionist rule.

In the Arab world, antisemitism, as in hatred of Jews for being Jewish, grew as Arab leaders embraced Nazi propaganda in an attempt to undermine Zionism in Palestine in the 1930s (Herf, 5). This period marked a turning point for Jewish-Muslim relations. Distinctly European antisemitism, characterized by conspiratorial rhetoric about the world Jewish population, was everywhere. The Arab political conflict with Zionism became colored with religious stereotypes and prejudices. Antisemitic propaganda was effective in the region as Jewish immigration only increased and regional tensions grew. Nazi contributions toward antisemitism and jihadist ideology in the Middle East was substantial in expanding antisemitic rhetoric in the conflict.

Conclusion

The new hostile relationship between Palestinian Muslims and Jews solidified during what Palestinians refer to as "the Nakba," or the catastrophe, during the Arab-Israeli 1948 war where half of the Arab population was either expelled or fled. Israel declared itself a state and Palestinian nationalism suffered a military, political, and diplomatic defeat. With Israel's declaration of statehood and the realization of Zionism, the future of Palestinian statehood was bleak. One hundred years of war and failed peace deals continue to contribute to the tension between Muslims and Jews and the discrimination, prejudice, and oppression prevalent on both sides. Denial of political rights and less and less hope for a Palestinian state draw more and more Palestinians to support radicals like Hamas, while Palestinian nationalism continues to be dismissed because of its association with antisemitism and terrorism. Following attacks against Israeli soccer fans in Amsterdam, former Prime Minister of Israel Ehud Olmert shared his thoughts with a New York Times columnist.

What happened in Amsterdam is primarily a reflection of hatred by many Muslims against the State of Israel and its citizens, because of what is transpiring in our region. It is not a continuation of the historic antisemitism that swept Europe in past centuries, the sources of which are Christian religious fanaticism and a lack of tolerance for the Jewish people in general. [...] The events in Amsterdam drew on deep roots in the past of the Jewish people. But they also drew on an unending stream of social media images of the devastation of Gaza without any Israeli plan offering a better way for Jews and Palestinians to live side-by-side. To focus entirely on the first and totally ignore the second is about the most dangerous thing Jews everywhere could do today (Friedman, 2024).

Olmert's insight points out the way we oversimplify violence in this conflict and how delegitimizing Palestinian nationalism and ignoring the political causes of the conflict threatens peace and is dangerous for Jews. By investigating the limited extent to which antisemitism was present in early Palestinian nationalism, this paper hopes to challenge the way we consider religious difference and its connection to violence in the history of the movement.

In the Nabi Musa riots and the Wailing Wall riots, violence was an expression of a desperate and existential opposition to Zionism. Having been promised a state by the British, Palestinian nationals reacted strongly to their impending disenfranchisement. Antisemitic rhetoric was a result of hatred of Zionism, which Palestinians observed with the influx of European Jewish immigrants. Understanding these violent incidents is difficult because of the ambiguity of some of the evidence and the challenge of discerning motivations for individual rioters. However, given that Muslims and Jews had a peaceful relationship during the Ottoman period, it was likely not a latent widespread antisemitism that prompted the riots, but more an extreme demonstration of political disagreement. The Nabi Musa riots marked a moment where a cultural and religious festival was transformed into a political demonstration, while the Wailing Wall riots illustrate how Arab religious sensitivity and fear of how Zionism would affect the religious sovereignty of Muslims in Jerusalem erupted into a massacre. Arab leaders recognized how Zionism and Jewish immigration would forever change Arab life in Palestine, so they embraced antisemitic Nazi propaganda in the 1930s in the hopes of using an alliance with Germany to stop Zionism.

Palestinian nationalism began as a movement focused on the creation of a Palestinian state to protect the political and religious rights of Palestinian Arabs. If a similar nationalist movement had been attempted by Christians or Europeans, Muslims Arabs would likely have had the same reaction. Historical analysis suggests that opposition to Zionist ideology at the time was not based in old religious hatred. Today, there is certainly antisemitism in the core beliefs of radical Palestinian nationalist groups, but the current narrative is far too simplistic because it discounts the evolution of the conflict and assumes Middle Eastern antisemitism has always been as rampant and historic as European antisemitism. Antisemitism in the Middle East does not have to be a fact of life. Considering antisemitism as a symptom of greater nationalist issues and not just the cause complicates how we envision a lasting peace that allows Muslims and Jews to prosper without fear of oppression and violence.

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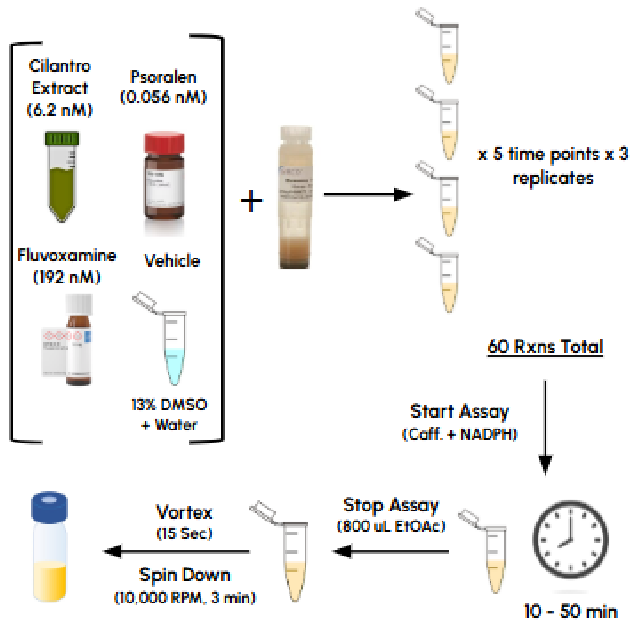
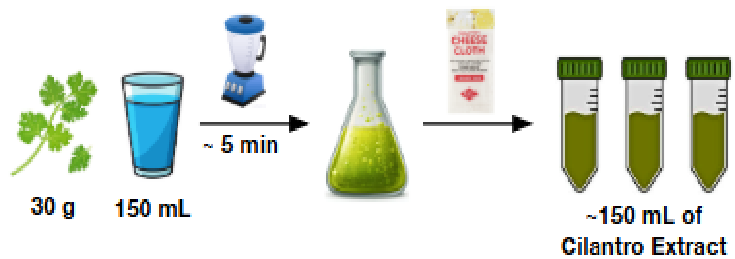
Evaluating Natural CYP1A2 Inhibitors: Psoralen Quantification and Comparative Inhibition by Pure Compound and Cilantro Extract in Human Liver Microsomes

Chris Flores





Abstract:

Cytochrome P450 1A2 (CYP1A2) plays a key role in xenobiotic metabolism and is responsible for approximately 95% of caffeine clearance in humans. Naturally occurring inhibitors of CYP1A2, including furanocoumarins found in Apiaceae vegetables, alter drug metabolism and contribute to clinically relevant food-drug interactions. To investigate whether whole-plant extracts exhibit greater inhibitory activity than isolated compounds, we compared CYP1A2 inhibition by pure psoralen with that of a cilantro extract containing multiple naturally occurring phytochemicals. Additionally, we quantified psoralen abundance in cilantro using a newly developed GC-MS method. Psoralen was successfully detected using selected ion monitoring (m/z 187), and a standard curve confirmed linear quantification. GC-MS analysis revealed 716.7 ng/g psoralen in fresh cilantro, a concentration higher than previously reported values. CYP1A2 inhibition was assessed using human liver microsomes incubated with either pure psoralen, whole-cilantro extract, fluvoxamine (positive control), or vehicle. Caffeine metabolism served as a proxy for CYP1A2 activity and was monitored over a 50-minute time course via GC-MS. Across all treatments, caffeine concentrations remained unchanged, preventing interpretation of inhibitory effects. These inconclusive results likely reflect methodological limitations (N=1), including diluted reaction components, suboptimal assay temperature, and insufficient turnover time. Despite this, the study established a functional psoralen quantification workflow and provides a framework for refinement of microsomal assays. Future studies should optimize reaction conditions, test additional furanocoumarins, and validate CYP1A2 inhibition at shorter, single time points before full time-course analysis.

Keywords: CYP1A2 Inhibition • Furanocoumarins • Human Liver Microsomes • Psoralen Quantification • Food–drug Interactions

Introduction

Cytochrome P450s are a large class of heme-containing enzymes responsible for the metabolism of drugs and other xenobiotics (Basic Review of the Cytochrome P450 System, 2013). Among them, CYP1A2, a member of the CYP1A subfamily, plays a major role in drug metabolism (Thorn et al., 2012).

CYP1A2 is estimated to account for approximately 95% of caffeine metabolism in humans (Cornelis et al., 2006) and is known to metabolize over one hundred additional substrates (Thorn et al., 2012), a consequence of its relatively promiscuous and flexible binding pocket. In addition to xenobiotics, CYP1A2 metabolizes many endogenous compounds such as steroids and arachidonic acid (Zhou et al., 2009). CYP1A2 is expressed primarily in liver tissue (Hwang et al., 2021; Thorn et al., 2012), where it functions by coupling the oxidation of NADPH, via cytochrome P450 reductase, with the oxidation of a substrate. This chemical change makes the substrate, often a drug, more polar, thus increasing clearance.

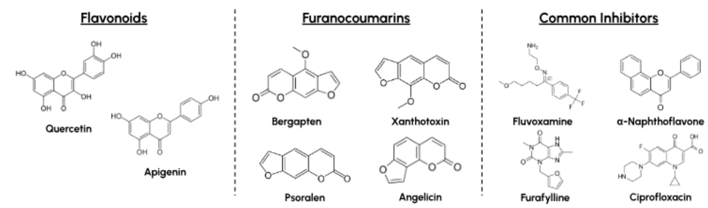


Figure 1. Inhibitors of CYP1A2. Family groups of natural inhibitors found in Apiaceous vegetables, such as flavonoids and furanocoumarins, and common synthetic inhibitors.

The enzymatic activity of CYP1A2 can be inhibited by many different compounds, many of which compete with substrates for access to the active site or bind allosterically to alter enzyme conformation, therefore altering substrate affinity. Several inhibitors have been identified and well-characterized for CYP1A2. Synthetic inhibitors such as fluvoxamine, α-naphthoflavone, furafylline, and ciprofloxacin are frequently used in pharmacological studies to characterize enzyme kinetics and confirm isoform specificity (Bourrié et al., 1996; Liu et al., 2013) (Figure 1). In addition to synthetic xenobiotics, naturally occurring inhibitors of CYP1A2 include plant-derived furanocoumarins (e.g., psoralen, bergapten, xanthotoxin) and flavonoids (e.g., quercetin, apigenin), which are commonly found in Apiaceae vegetables (Alehaideb et al., 2021; Berteina-Raboin, 2025; Kang et al., 2011). Despite their known inhibitory activity, literature on furanocoumarins remains limited, which poses a significant health concern as CYP1A2 metabolizes many therapeutics, including caffeine, clozapine, and other aromatic drugs. Thus, CYP1A2 inhibition by dietary furanocoumarins from Apiaceae vegetables, such as celery, parsley, parsnip, and cilantro, may alter drug clearance and plasma concentrations, emphasizing the clinical importance of understanding these food-drug interactions (Alehaideb, 2023; Kang et al., 2011).

Intrigued by the range of natural inhibitors, we sought to investigate whether psoralen, the parent molecule of many furanocoumarins, and other natural CYP1A2 inhibitors exhibit cooperative effects when consumed together within an Apiaceae vegetable. To assess this potential cooperativity, we compared CYP1A2 inhibition by a whole-plant cilantro extract with that of pure psoralen. We hypothesized that treatment with the cilantro extract would produce stronger inhibition than the pure psoralen compound, as the whole-plant extract likely contains multiple inhibitory compounds that function as a naturally occurring inhibitory cocktail. To evaluate potential synergistic interactions, we compared the magnitude of CYP1A2 inhibition between the cilantro extract and commercial psoralen. To compare CYP1A2 inhibition, human liver microsomes were selected as the in vitro system for CYP1A2 activity assays. Microsomes are small vesicles (100-200 nm) that contain concentrated amounts of cytochrome P450 enzymes (Alberts et al., 2002). Although microsomes are not naturally occurring cellular structures, they form through the fragmentation and resealing of the endoplasmic reticulum (ER) after disruption by sonication and centrifugation (Appendix A). Due to their enrichment in ER-derived P450s, microsomes are commonly used as model systems to characterize the metabolic activity of cytochrome P450 enzyme variants (Alehaideb et al., 2021). Given the limited literature on psoralen abundance in cilantro, we also quantified psoralen levels by GC-MS and compared our measured concentration (ng/g fresh weight) with current literature values. These findings may guide future bioprospecting efforts for naturally occurring multi-compound inhibitors and additional furanocoumarin derivatives. Furthermore, elucidating the active inhibitory components of cilantro will also contribute to a deeper understanding of diet–mediated food-drug interactions involving CYP1A2.

Methods

Experiments were carried out following the “Independent Project Week 1 - Psoralen Standard Curve and Cilantro Extraction” and “Independent Project Week 2 - Microsomal Assays, Caffeine Extractions, and Second Cilantro Extraction” protocols from the BIOL 303 Pharmacology lab component, kindly provided by Cynthia Holland, Ph.D. (Department of Biology, Williams College). Final concentrations and volumes are listed in greater detail below. Preparation of the psoralen standard curve. A standard curve relating psoralen concentration (μg/mL) to GC-MS peak area was generated by preparing a series of psoralen standards (0.01, 0.1, 1.0, 10, and 100 μg/mL in EtOAc; Cayman Chemical). Each standard was analyzed by GC-MS using a newly developed SIM method (2025_HollandLab_Psoralen_Splitless_SIM_8min.M) adapted from a previous caffeine protocol (2024_HollandLab_Caffeine_Splitless_SIM_8min.M). Peak areas were recorded and plotted against psoralen concentration, and a linear regression was performed on GraphPad Prism (version 10.4.1) to construct the standard curve. Preparation of stock cilantro extract. A cilantro extract was prepared by blending raw cilantro (30 g; Stop & Shop, Williamstown, MA) with dH2O (150 mL). The aqueous extract was then decanted and filtered to remove particulates. A fraction (45 mL) of the cilantro extract was reserved for GC-MS analysis, and the remaining extract was wrapped in aluminum foil and stored at -20 °C until it was thawed for use in microsomal assays. Psoralen extraction from cilantro extract. Psoralen was extracted by combining 5 mL of EtOAc with 45 mL of cilantro extract. The mixture was vortexed for 30 seconds at max speed and spun down at 10,000 RPM for 3 minutes. Following phase separation, 600 μL of the top EtOAc layer was transferred to a labeled GC-MS vial for analysis. Psoralen GC-MS method. Psoralen extracted from the cilantro extract was analyzed by GC-MS using the method 2025_HollandLab_Psoralen_Splitless_SIM_8min. Samples were run in selected ion monitoring (SIM) mode at m/z 187, corresponding to the protonated [M+1] molecular ion of psoralen. Helium served as the carrier gas at a constant flow rate of 1.9 mL/min. Injections were made in split mode (10:1). The oven was programmed to initially hold for 2 min at 60 °C, followed by a ramp to 300 °C at 60 °C/min, and finally hold at 300 °C for 2 min. The transfer line temperature was maintained at 280 °C. The mass spectrometer was operated with an electron ionization (EI) source at 70 eV with a source temperature of 180 °C. Timed microsomal assays. Human liver microsomes (50 donors; ThermoFisher Scientific) expressing CYP1A2 were incubated with their respective inhibitor treatments for 15 minutes prior to initiating the assays. Each reaction consisted of 5 μL microsomes (20 mg/mL), 183 μL of 10 mM PBS (pH 7.4; ThermoFisher Scientific), and 2 μL of either of the following: pure psoralen (0.056 nM; 0.14% DMSO in dH2O), cilantro extract (psoralen concentration: 6.2 nM), fluvoxamine (192 nM in 10 mM PBS, pH 7.4), or vehicle (0.14% DMSO in dH2O). Reaction mixtures were incubated at room temperature. Treatment with the vehicle served as the negative control, to simulate no CYP1A2 inhibition, whereas the fluvoxamine served as a positive control, maximizing inhibition. To measure CYP1A2 activity, caffeine was added to each reaction (final assay concentration: 0.05 mM). The metabolism of caffeine during the assay was measured to assess CYP1A2 activity in the presence of different inhibitors. Timed assays (10, 20, 30, 40, and 50 minutes) were conducted in triplicate. Staggering the start of each reaction by one minute, reactions were initiated with 10 μL of NADPH (9.23 mM in 10 mM PBS, pH 7.4). This protocol required approximately 2.5 hours to complete (60 reactions). Reactions were quenched using 800 μL EtOAc and vortexed for 15 seconds at max speed. Caffeine extraction from microsomal assays. Microsomal assay samples were spun down for 3 minutes at 10,000 RPM. The top EtOAc layer (600 μL) was pipetted into an appropriately labeled GC-MS vial. The settings and parameters on the spectrometer were set following a GC-MS SIM method (Holland 2025) found in “Week 2- Caffeine Extractions from Saliva” (2024_HollandLab_Caffeine_Splitless_SIM_8min.M). The method used selected ion monitoring (SIM) at m/z 194 (Lisko et al., 2017). Converting raw abundance from GC-MS to [caffeine]. Utilizing the caffeine standard curve (Y = 255747*X -15451) from “Week 3b- Graphing GC-MS Data in GraphPad Prism” (Holland 2025), raw GC-MS peak areas for all assay samples were converted to caffeine concentrations (mg/L) remaining after the time course using the equation: [caffeine]=(Peak Area + 15451)255747.

Results

Developing detection and quantification of psoralen in cilantro by GC-MS. Since microsomes originate from the collapse of the endoplasmic reticulum, they are enriched in membrane-bound enzymes, particularly cytochrome P450s such as CYP1A2, making them a robust system for probing xenobiotic metabolism (Alberts et al., 2002). Psoralen, the parent furanocoumarin from which many Apiaceae-derived analogs arise, was selected as a representative inhibitor to enable direct comparison with whole-plant extracts across this botanical family. To test whether furanocoumarins like psoralen exhibit cooperative inhibitory properties when present alongside additional phytochemicals, we treated human liver microsomes with four conditions: cilantro whole-plant extract, pure psoralen, fluvoxamine (an established CYP1A2 inhibitor), and a vehicle control. These data would ultimately contribute to a broader understanding of diet-mediated modulation of drug metabolism. Before performing microsomal inhibition assays, we first needed to establish whether psoralen is present at detectable levels in cilantro. Prior reports identified quantifiable psoralen in celery and parsnip, two Apiaceae relatives, with targeted GC-MS in SIM mode for m/z at 187, but data for cilantro is limited (Peroutka et. al 2007). We therefore developed a GC-MS protocol to measure psoralen abundance in cilantro extract, expressed as ng/g of plant material. Using the newly developed GC-MS protocol, psoralen was successfully measured in a psoralen standard (100 µg/mL, N=1), confirming the method's suitability for detection. The compound eluted at a retention time of 6.6 min (Figure 2).

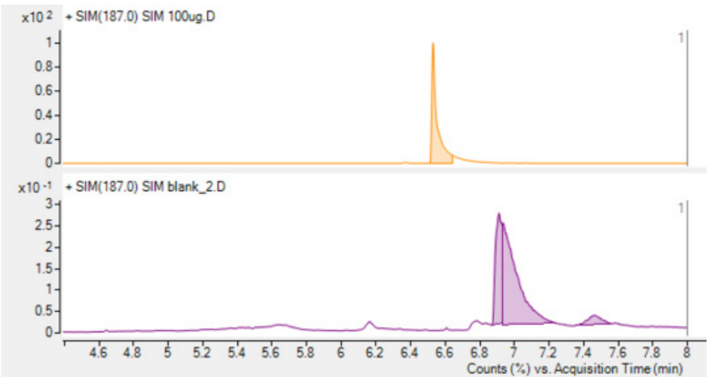


Figure 2. Detection of psoralen at 100 µg/mL on GC-MS. A psoralen standard (100 µg/mL, N=1) confirmed a new GC-MS protocol's applicability for detecting psoralen using SIM for m/z at 187. Peak was identified at a retention time of 6.6 minutes.

Quantification across concentrations 0.01, 0.1, 1, 10, and 100 µg/mL (N=1) generated a linear relationship between peak area and psoralen concentration modeled by: *Peak Area = 14361 × [psoralen] (µg/mL) + 5065* (Figure 3).

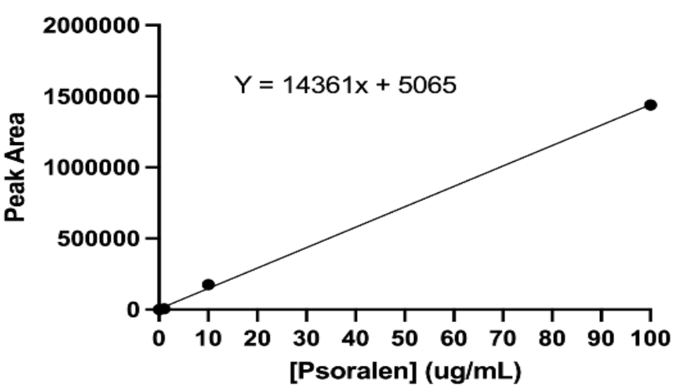


Figure 3. Standard curve relating psoralen concentration to GC-MS abundance peak area. Peak Area = 14361[psoralen] (ug/mL) + 5065 with an R2 = 0.999. [Psoralen] tested were 0.01, 0.1, 1, and 100 ug/mL (N=1 for each). GC-MS analysis of cilantro whole-plant extract detected a peak with retention time 7.0 min (N=1), which, due to instrument variability, is generally accepted as sufficiently similar, corresponding to a psoralen concentration in cilantro of 716.7 ng/g (fresh weight) (Figure 4, see Appendix B for calculations).

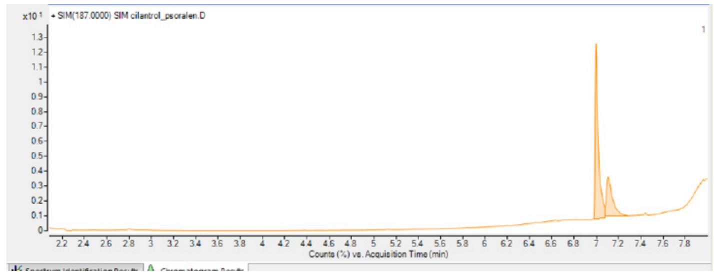


Figure 4. Detection of psoralen in cilantro whole-plant extract. A peak for m/z 187 was identified at retention time 7.0 minutes (N=1) with a peak area of 29268. This corresponded to a concentration of psoralen of 1.69 µg/mL in the sample.

Assessing CYP1A2 inhibition by cilantro extract and psoralen in human liver microsomes

We hypothesized that microsomes treated with whole-plant cilantro extract would display greater inhibition of CYP1A2 activity than those treated with pure psoralen. This expectation was based on the likelihood that cilantro contains additional furanocoumarins and other CYP1A2-active constituents capable of acting cooperatively. CYP1A2 activity was assessed by monitoring caffeine disappearance over a 50-minute time course. GC-MS analysis revealed peaks consistently at retention times near 6.5–7 minutes. Across all conditions, caffeine concentrations remained essentially unchanged (Figure 5). With overlapping flat trends for all treatments, average [caffeine] was 1.41 mg/mL. Notably, neither fluvoxamine nor the whole-plant extract treatments produced measurable inhibition relative to the vehicle.

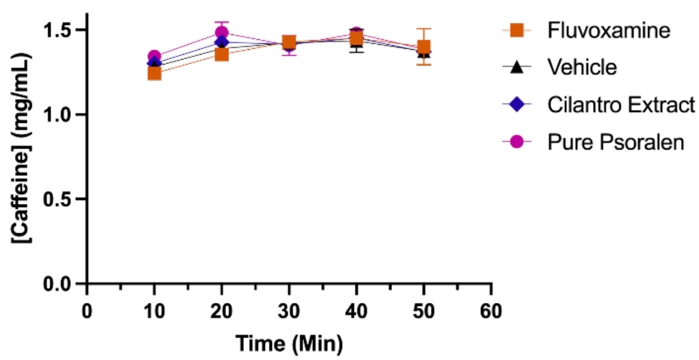


Figure 5. Metabolism of caffeine by CYP1A2. Treatments included fluvoxamine, vehicle (0.14% DMSO), a whole-plant cilantro extract, and pure psoralen. [Caffeine] (mg/mL) remained consistent throughout the time course (t=10-50 min) with an average [caffeine] of 1.41 mg/mL (range: 1.25–1.55 mg/mL). For all data points, sample sizes were N=3, with error bars representing standard deviation.

This unexpected absence of CYP1A2 inhibition contradicted our predictions and prevented meaningful comparison of whole-plant versus pure-compound effects. As such, the data did not allow evaluation of potential synergistic interactions among furanocoumarins within cilantro extract. Instead, the uniformly flat caffeine trends suggest either insufficient inhibitory activity under the assay conditions or potential issues in assay sensitivity, enzyme activity, or experimental parameters.

Discussion

Analysis of our microsomal assay data revealed no noticeable differences in CYP1A2 activity across treatments. Notably, caffeine concentrations did not differ between our positive control (fluvoxamine) and negative control (vehicle), strongly suggesting that the assay conditions were not sufficient to generate measurable CYP1A2 activity (Figure 5). From this, the experimental outcomes are inconclusive and likely reflect technical limitations rather than true biological effects. A major limitation of our assay design was the unintended dilution of reagent concentrations. Due to last-minute adjustments to caffeine concentrations, the reaction volume was scaled to 250 µL without proportionally scaling the concentrations of microsomes, NADPH, inhibitor treatments, or caffeine. This is reflected in our methodology. Future studies should adjust to meet the ThermoFisher protocol's call for a total reaction volume of 200 µL. As a result, all reagents were diluted below their intended working concentrations, potentially compromising enzymatic activity and preventing measurable caffeine depletion over the assay period. NADPH concentration posed a second significant limitation, given its central role as the electron donor for CYP1A2 catalysis. The recommended concentration for CYP1A2 microsomal assays is 20 mM, yet logistical constraints required us to use NADPH at half this concentration (9.23 mM). Because NADPH is essential for cytochrome P450 catalytic activity, this reduction may have slowed reaction rates or limited the extent of caffeine metabolism. Although reducing NADPH and the total number of reactions (60 reactions rather than 72) allowed us to run more replicates, this compromise likely contributed to the low metabolic turnover observed. The preparation of the positive control also warrants consideration. While fluvoxamine is a well-established CYP1A2 inhibitor with a low IC_{50}, we used the IC_{50} concentration rather than a concentration well above it. Under ideal conditions, a positive control should produce near-complete inhibition to clearly distinguish it from the negative control; in contrast, the IC_{50} concentration is expected to only partially inhibit under optimal conditions. Although this factor alone does not explain our inconclusive results, it should be corrected in future studies. Additionally, psoralen concentrations differed substantially between our pure psoralen treatment (0.056 nM) and our cilantro extract treatment (6.2 nM). Due to time constraints, the psoralen content in cilantro was not quantified prior to conducting the microsomal assays. Thus, we were unable to match psoralen concentrations between the purified and extract treatments. Our preliminary estimates of psoralen abundance, based on limited literature, greatly underestimated the concentration we determined via GC-MS. This further complicates the interpretation of the inhibitory conditions. Assay conditions may also have affected enzymatic activity. According to the ThermoFisher protocol, microsomal reactions should be incubated with inhibitors in a water bath at a controlled temperature, followed by incubation at 37 °C during the assay. In contrast, our reactions were carried out entirely at room temperature. Because CYP1A2 activity is temperature-dependent, conducting the reaction below physiological temperature likely slowed caffeine metabolism, contributing to the minimal turnover observed over the 50-minute time course. It is also possible that our caffeine concentration was too high for the assay window. If caffeine levels exceeded the range in which depletion could be reliably detected, the enzymes could have been saturated, thereby the reaction may have appeared static even if metabolism occurred at low rates. Optimizing substrate concentration will therefore be essential in future experiments. Finally, 50-minute microsomal assays may not have been long enough to observe a measurable decrease in caffeine concentration. It should be noted that previous studies demonstrated CYP1A2-mediated caffeine metabolism and inhibition in as little as 10 minutes (Alehaideb et al., 2021). In future studies, an initial single-time-point assay should be performed to verify CYP1A2 inhibition before committing to a larger time course experiment. Despite these limitations, our study successfully established a robust GC-MS method for quantifying psoralen in cilantro. Published measurements of psoralen content in cilantro are limited, and our approach enabled rapid determination of psoralen abundance, providing a foundation for future work examining the contributions of individual furanocoumarins to CYP1A2 inhibition. Our measured concentration of 716.7 ng/g was nearly three times higher than the reported value of 258.2 ng/g (Melough et al., 2017). That study employed an Agilent QuEChERS kit, originally developed for pesticide residue analysis, which incorporates multiple wash steps that may reduce psoralen recovery. In contrast, our more simplified extraction method involved blending cilantro with water (without wash steps), followed by a single EtOAc extraction, which may have resulted in higher apparent yields. They also used an internal standard to calibrate their measurements, and differences in calibration strategy may further account for the difference between our measured concentrations. Moving forward, several improvements should be implemented. First, optimizing the psoralen extraction protocol is a priority to improve recovery and enable more direct comparison with published values. Our initial extraction (200 µL extract: 800 µL EtOAc) produced an inconclusive signal on the GC-MS, prompting us to shift to a 45 mL extract: 5 mL EtOAc ratio, which yielded reliable GC-MS detection. While this allowed for quantification, alternative extract-to-solvent ratios should be explored to maximize recovery and reproducibility. Second, isolated testing of additional furanocoumarins and flavonoids is warranted, because although psoralen is the parent molecule of many Apiaceae furanocoumarins, it may not be the primary contributor to CYP1A2 inhibition. Other constituents of cilantro may exhibit stronger inhibitory activity, and comparing their effects to whole-plant extract will help clarify potential cooperative interactions. These improvements, in parallel with greater replicates of the conditions outlined in this study, should yield clarifying results on the nature of psoralen inhibition of CYP1A2. Lastly, once data is acquired, statistical analysis should be performed. Using GraphPad Prism version 10.4.1, the extra-sum-of-squares between treatments should be calculated and analyzed for changes in the half-life of caffeine metabolism. This significance (or lack thereof) would be interpreted in the context of biological processes and physiological conditions. In summary, although our microsomal assays yielded inconclusive results, the study highlights several methodological refinements necessary for accurately assessing CYP1A2 inhibition by natural products. Our psoralen quantification method provides an analytically simple yet effective tool for future work, and continued optimization of assay conditions and extraction procedures will help deepen our understanding of food–drug interactions involving furanocoumarins.

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Appendix A. Formation of human liver microsomes.

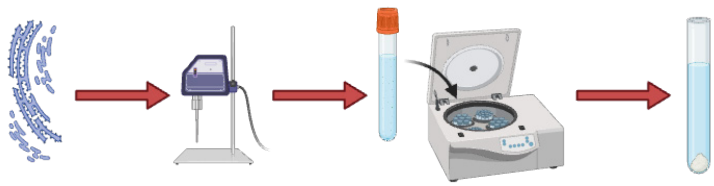

Diagram showing the formation of microsomes and centrifugation (created on biorender).

Appendix B. Sample Calculation of [psoralen] in cilantro.

Cilantro concentration in extraction sample
Initial extraction: 30 g cilantro / 150 mL H2O = 0.20 g/mL (cilantro/H2O)
For 45 mL of extract: 45 mL * 0.20 g/mL = 9 g cilantro
Psoralen concentration in EtOAc layer
Standard curve equation: Y = 14361*X + 5065
Peak area from extraction: 29267.6
Calculated [psoralen]: (29267.6 – 5065) / 14361
= 1.69 µg / mL (Psoralen/EtOAc)
Total psoralen in EtOAc layer
5 mL EtOAc * 1.69 µg/mL = 6.45 µg psoralen
Normalized psoralen content per cilantro mass
6.45 µg psoralen / 9 g cilantro = 0.72 µg/g cilantro * 1000 ng/ug
Equivalent to **716.7 ng/g** (Psoralen/cilantro)

Reprogramming Tumor Associated Macrophages Leads to T Cell and B Cell Interactions

Zoe Gabriel

Abstract

Triple-negative breast cancer (TNBC) is an aggressive subtype of breast cancer defined by the absence of estrogen receptors, progesterone receptors, and HER2 receptor protein expression. The current standard of care combines immune checkpoint blockade with chemotherapy to activate anti-tumor immunity; however, stage TNBC still has a 77% 5-year survival rate. TNBC tumors often develop immunosuppressive microenvironments, characterized by a high abundance of tumor-associated macrophages (TAMs) and reduced infiltration of lymphoid cells, both of which contribute to poor patient prognosis. Previous work has shown that an MerTK inhibitor, MRX-2843, is a strong candidate for reprogramming TAMs to recruit increased T-Cell activation and infiltration in various cancers such as acute myeloid leukemia and glioblastoma. Currently, the Rosen lab is working to evaluate treatments integrating MRX-2843 for TNBC models. This combination treatment produced a durable long-term anti-tumor response (LTR), eliminating tumors in mice. When the same tumors were then re-introduced (mice were re-challanged), mice rejected the implanted tumor cells. This study aimed to identify the biological changes responsible for generating long-term immune memory following TNBC treatment. The response showed anti-tumor immunity due to increased infiltration of T cells, B cells, dendritic cells, and reprogrammed macrophages, increasing the amounts of cytotoxicity and antigen presentation in the tumor microenvironment. It was hypothesized that lymph nodes and the spleen would support sustained immune memory-based anti-tumor immunity by facilitating immune cell interactions. To test this, immunohistochemistry (IHC) was utilized to spatially resolve CD8 and CD4 T Cells, as well as B Cell localization within the TDLN and spleens of treated mice. Results demonstrate that combination-treated mice exhibit increased recruitment of CD4+T cells and CD20+ B cells within the spleen. In the TDLNs, these mice further showed a marked reduction in F4/80+ macrophages compared to untreated tumor-bearing control mice. Additionally, further IHC revealed enhanced formation of germinal center-like structures composed of CD4+ T cells and CD20+ B cells. Notably, CD20+ B cells in LTR mice displayed migratory patterns consistent with movement from the follicular zone toward the T cell zone, indicating active crosstalk. These observations suggest that effective germinal center formation relies on coordinated interactions between CD4+ T cells and CD20+ B cells. Co-staining via immunofluorescence confirmed these interactions through the colocalization of CD4+ and CD20+ cells within germinal-center-like regions. Overall, MerTK regulated checkpoint therapy can be targeted to alter suppressive TNBC microenvironments to support adaptive immunity, increasing clinical efficacy. This information illustrates that the combination of MRX and CTX in treatment offers a strong anti-tumor immune response via facilitating TAM reprogramming to issue effective immunotherapeutic strategies to combat TNBC.

Introduction

Triple Negative Breast Cancer (TNBC) is defined by the absence of estrogen receptors, progesterone receptors, and HER2 receptor protein expression. As a result, it is a clinically aggressive and rapidly growing subtype of breast cancer that has a higher mortality rate than other cancers and accounts for 10-15% of breast cancer cases. TNBC is known to develop an immunosuppressive tumor microenvironment, utilizing different ways of evading the immune syste7. This can be seen by a high abundance of tumor-associated macrophages, (TAMs), which reduce infiltration of lymphoid cells, and contributes to poor patient prognosis. Specifically, TAMs lead to T Cell suppression, preventing them from activating, expanding, and infiltrating to attack the tumor cells. To properly treat TNBC with immunotherapy, the current standard of care focuses on a combination therapy to reprogram TAMs to become recognized as antigen presenting cells by Cells, supporting T Cell activation towards tumor cell death. One target is the immune checkpoint molecule PD1, which is known to suppress host anti-tumor immunity in the tumor microenvironment. Currently, anti-PD1 antibodies have been shown to suppress PD1 and are used in clinical settings.

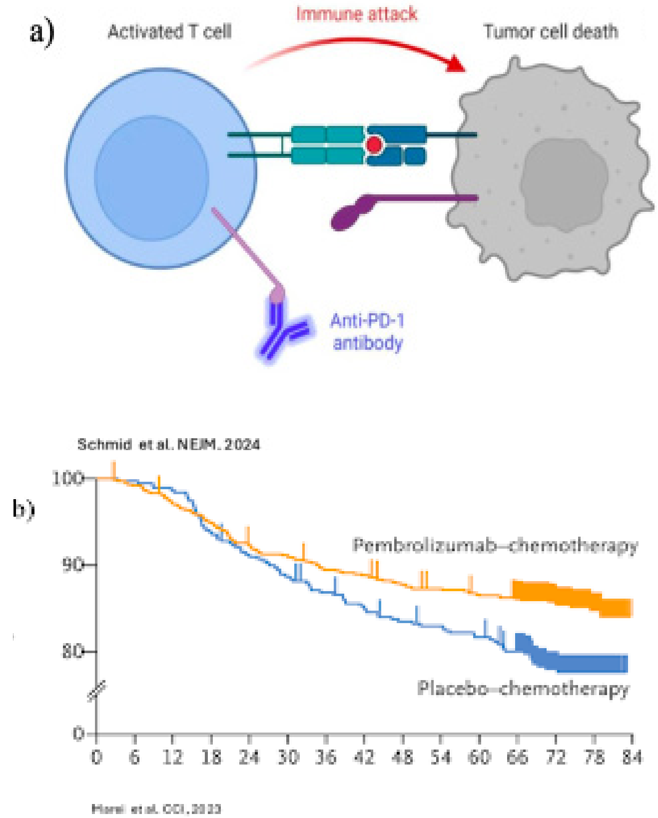

Figure 01. a) Visual representation of anti-PD-1 antibodies used to reprogram activated T-cells to target tumor cells. b) TNBC therapeutic standard of care uses anti-PD, showing increased survival rate.

An additional target for TAM reprogramming is MerTK receptors which are expressed on multiple immune cells, including TAMs. When MerTk is activated it suppresses inflammatory responses resulting in immunosuppression that allows tumors to evade immune detection and reduce T-cell activity. Previously, the Rosen lab at the Baylor College of Medicine Lester and Sue Smith Breast Center studied the effects of using MRX-2843 (MRX), a small-molecule MerTK inhibitor, in combination with the chemotherapy agent cyclophosphamide (CTX). It was shown that together, this treatment can re-educate the tumor microenvironment to increase T cell activation against cancer cells. This reprogramming of TAMs via MerTK can improve anti-PD1 therapy for TNBC patients.

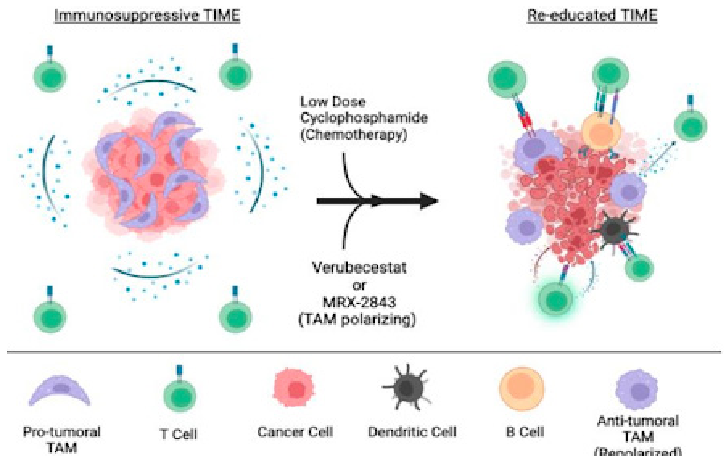

Figure 02. Low dose cyclophosphamide and MRX-2843 in combination treatment re-educates the tumor microenvironment from an immunosuppressive state to an immuno-active state.

When MRX was administered with CTX in 2153L p53-null TNBC tumor-bearing mice, this combination treatment produced a durable long-term anti-tumor response where mice were eliminated of cancer cells and resisted the rechallenged TNBC tumor cells. These triple combination treated mice exhibited a statistically significant higher survival rate than double treated mice without aPD1 and non-treated (Vehicle Control; VC) mice (Figure 03). Flow cytometry data from the tumors of combination treated vs control additionally revealed an increased number of reprogrammed TAMs and corresponding increased numbers of T Cells.

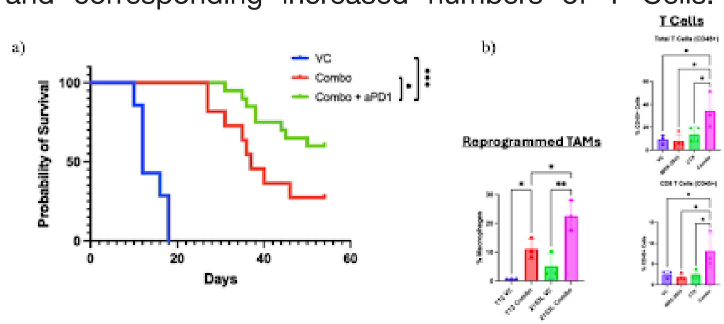

Figure 03. a) Survival plot demonstrating that triple combination treatment of MRX, CTX, and aPD1, generates a positive anti-tumor long-term response. b) Activated CD8+ and CD4 T Cells increased in 2153L COMBO treated tumors at Day 18.

The correlation between T cells in combination treated mice with increased survival conveyed a gap in the understanding of how the immune system was physically adapting; specifically, how the combination therapy led to systemic immune changes in lymphatic tissues.

Methods

Transplantable Syngeneic Mouse Models Mimic TNBC

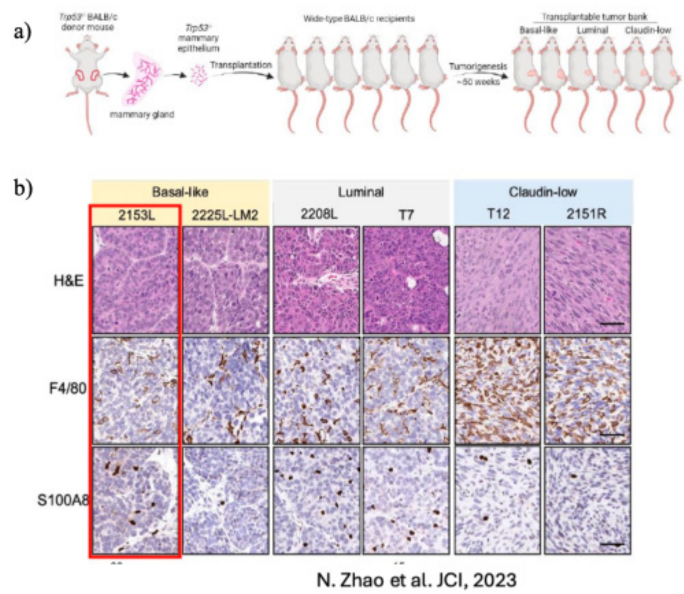

Figure 04. a) Representation of how syngeneic mouse models were made to mimic TNBC. b) H & E and IHC staining of different TNBC tumor lines.

This study utilized syngeneic mouse models which were developed using a p53-null BALB-C mouse. Knockout of p53 leads to lymphomas and osteosarcomas, but not breast cancers. In order to intentionally develop breast cancer, p53 null mammary cells were transplanted into the mammary fat pads of dozens of wildtype BALB-C mice which grew tumors that were harvested to create a tumor cell line bank that included a variety of different tumors (Basal-like, luminal, claudin-low, etc). For this study, the 2153L tumor line was used.

Spleen Analysis

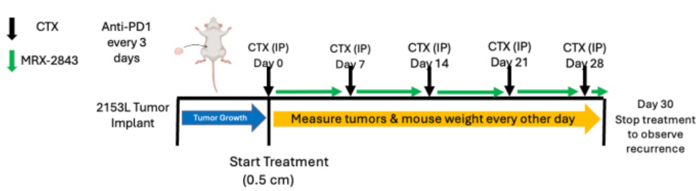

Figure 05. Timeline of combination treated mouse study to analyze effects on the spleen.

2153L tumors were implanted in p53-null mice and allowed to grow for one week before starting combination treatment (CTX, MRX, and anti-PD1). On day 18, spleens were harvested from Vehicle Control (non-treated; abbr. VC) and combination treated (COMBO) mice. Sections were sliced using a microtome and then stained with IHC with validated rabbit and rat antibodies.

Lymph Node Analysis

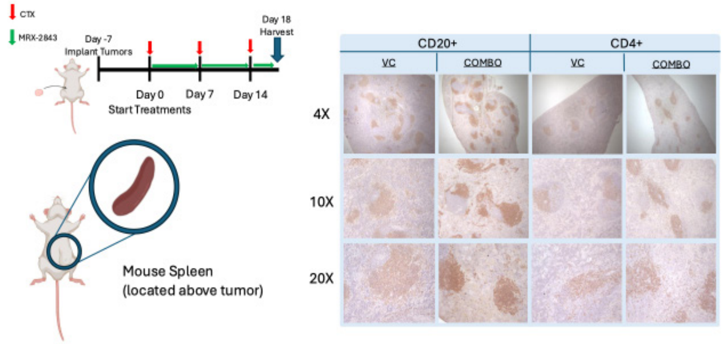

Figure 06. Timeline of combination treated mouse study to analyze effects on the tumor draining lymph node.

To evaluate long-term immune responses, Tumor Draining Lymph Nodes (TDLN) from long-term responder (triple combination treatment of CTX, MRX, and anti-PD1 and survived, LTR) mice were harvested. LTR mice showed the highest survival rate after triple combination treatment (Figure 03). TDLN sections were sliced with a microtime and stained with IHC and immunofluorescence for macrophages, $CD8^+$ cytotoxic T cells, $CD4^+$ T cells, and $CD20^+$ B cells. B220 was also validated as an alternative B cell marker for co-staining with CD4. Imaging focused on identifying cell localization and potential germinal center-like structures.

Results and Discussion

Immunohistochemistry (IHC) from the 2153L spleens showed remodeling of the lymph tissue. The combination-treated mice displayed an increase of T cells compared to the vehicle control (non-treated) mice (Figure 07). Furthermore, CD4+ T cells and CD20+ B cells in the triple-combination (COMBO) treated spleens visually appeared to be more clustered in a germinal-center like pattern compared to the weaker clustering shown in the vehicle control (Figure 07). This splenic remodelling suggested systemic changes in lymphatic tissue, shifting focus towards how tumor-draining lymph nodes (TDLNs) sustain memory-driven anti-tumor responses through coordinated cell interactions.

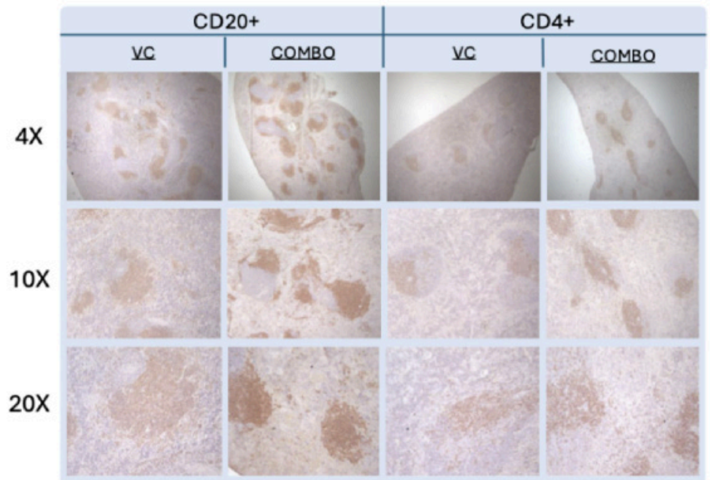

Figure 07. Remodeled spleen tissue from Day 18 in combination treated versus untreated vehicle control 2153L mice.

IHC of sections of the TDLN suggested a decrease of macrophages and an increase of CD8+ cytotoxic T Cells in the LTR mice compared to NTB mice. Additionally, further IHC revealed enhanced formation of germinal center-like structures composed of CD4+ T cells and CD20+ B cells. Notably, CD20+ B cells in LTR mice displayed migratory patterns consistent with movement from the follicular zone on the outside of the lymph, towards the T cell zone, indicating active crosstalk between the B cells and T cells. These observations suggest that effective anti-tumor long term response may rely on coordinated interactions between CD4+ T cells and CD20+ B cells to initiate memory. In order to validate this claim, a visualization of B Cells and T Cells together was necessary for identification of colocalization (whether or not B and T Cells were grouped together).

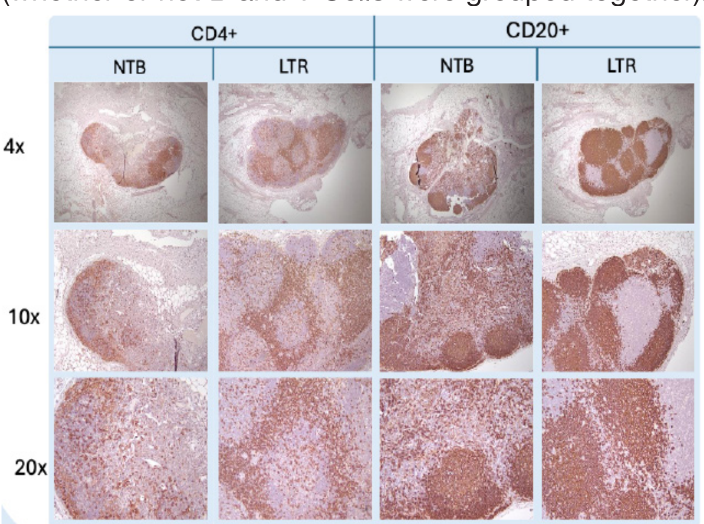

Figure 08. CD4+ T Cells and CD20+ B cells show more clustering in long-term responding (LTR) mice compared to non-tumor bearing (NTB) 2153L mice.

Utilizing immunofluorescence yielded a visual representation of the colocalized clusters of T-Cells and B-Cells in the LTR mice (Figure 09). In LTR mice, these clusters appeared to migrate inwards towards the T-Cell zone of the lymph node, whereas in the NTB mice, these co-loculized clusters appear to predominantly remain on the follicular zone towards the outer edge of the lymph node (Figure 09a). To better validate these results, IHC was run with a separate group of rat antibodies and validated the B220 antibody for IF. Once validated, B220 and CD4 were used to co-stain for B cells and T Cells. The LTR clusters show both migratory patterns and increased co-localization of CD4 tangled with the B Cells in the cluster compared to the NTB (Figure 09b).

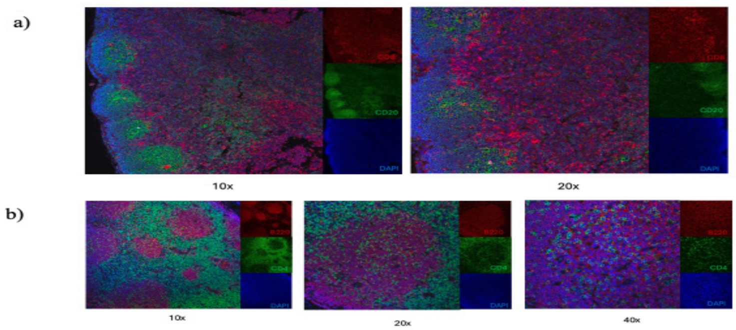

Figure 09. a) Non-Tumor Bearing (NTB) mice show B Cell Clusters predominantly in the follicular zone of the TDLN. CD20 displayed in green, CD8 displayed in red. b) LTR mice exhibit B220 B cells and CD4 T cells clustering in close proximity migrating to the T cell zone. CD4 displayed in green, B220 displayed in red.

This observed migration of CD20+ B cells from the follicular zone into the T-cell zone of the TDLN suggests the active interactions between B cells and CD4+ T helper cells, leading to potential formation of germinal center-like structures. This spatial reorganization is indicative of B cell activation and antigen presentation, a process critical for the development of high-affinity antibody responses and memory T cell formation. In the context of MRX, CTX, and aPD1 triple-combo treatment, this migration supports a model in which these specific interactions with B cells function as antigen-presenting cells (APCs) that help sustain a long-term, memory-based anti-tumor immune response. This finding reinforces the role of adaptive immune coordination facilitated by TAM reprogramming in order to achieve durable immunotherapy outcomes in TNBC.

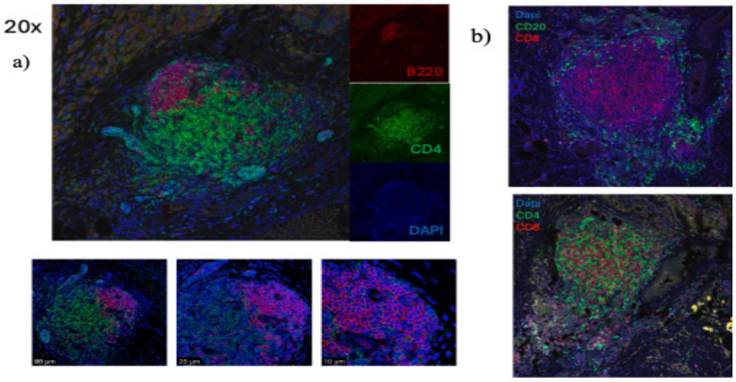

Figure 10. a) Formation of a tertiary lymphoid structure composed of B220 and Cd4 cells found in the residual non-lymphatic tissue of the tumor bed in LTR mice. b) A second TLS previously found by the Rosen lab in separate LTR mouse images with CD8+ cytotoxic T-Cells, CD20+ B-Cells, and CD4+ helper T cells.

Another key finding of this study regarded the formation of lymphoid aggregates. Previous studies have shown that tertiary lymphoid structures (TLS) formation is a positive biomarker of successful TNBC treatment with anti-PD19. They have been found in tissues of patients who have responded well to TNBC immunotreatment, whereas patients who did not respond well, do not exhibit this TLS formation10. While imaging the LTR mice, a lymphoid aggregate, thought to be a TLS, composed of B220+ cells and CD4+ cells was found in the residual tumor bed of a LTR mouse (Figure 10a). This TLS may be a strong plausible source of the LTRs active immune system targeting TNBC, forming the immune memory this treatment aims to generate.

Conclusions

These results are promising; however, biological replicates will be needed to further validate the TDLN results for the LTRs. Additionally, equal replications with the appropriate Non-Tumor Bearing controls will be necessary. Moreover, to analyze the data with more efficiency and accuracy, future actions should be taken to scan the spleen IHC slides and quantify the number of marked cells such as CD20+ B cells and CD4+ T cells with a machine learning program. The TDLN and co-localized clusters should be measured not only in quantity, but also in their respective distance from the center of the TDLN to the edge of it to quantify the observed migration patterns. Concurrently, the lymphoid aggregate structure the mechanisms by which TLSs form remain poorly understood, though promising. Due to the nature of their small size and the way tissue samples are collected and sampled, it is difficult to find these lymphoid aggregates and TLS structures and discern their difference. Further staining of the TDLN should be conducted to identify more of these formations, and better methods in doing so should be generated. Understanding the formation and role of these TLS will aid with developing a better understanding if B cells are actually the key acting antigen-presenting cells in the tumor microenvironment, as well as respectively identifying the specific subsets of B-Cells are critical to activate and support T cells in anti-tumor immunity, as well as identifying if these clusters are in fact germinal centers.

Acknowledgments

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