



WUJUR

WASHINGTON UNIVERSITY JOURNAL OF UNDERGRADUATE RESEARCH

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To the WashU Community,

The *WUJUR* team and I are thrilled to present Vol. 2 No. 2., an edition of consistent progress, big changes, and an exciting horizon. Within, you will find six original research articles of high caliber—from film studies to ecology, and art studies to data curation. We present here our greatest number yet of Features, spotlighting student and professor researchers within the WashU community. All articles are accompanied by outstanding original artwork and photography.

In collaboration with WashU Libraries Scholarly Communication & Digital Publishing Services (ScholPub), we continue to enhance *WUJUR* for our authors and readers. This February we launched our Digital Repository, a hub for archived articles and all steps of the publication process. The Repository marks an important step in our consistent efforts to streamline and improve submission, production, and publication operations. We are also pleased to announce the implementation of Digital Object Identifiers (DOIs) to all accepted student articles, both past and present, for the foreseeable future. These permanent identifiable strings associated with works enhance visibility, promote archival access, and strengthen citations. Finally, we are celebrating our first semester as Category I, the highest level of funding from WashU Student Union. These are important milestones. *WUJUR* is rapidly approaching an exceptional level of professional, operational, and academic maturity.

The publication of this edition marks the end of my time here as a student, and with that, the passing on of *WUJUR* to the next class of students. It has been incredible to see so many talented students come together to fulfill the journal's mission—to promote student research and the discovery of knowledge. As I leave my role as Editor-in-Chief, I know that founding and building *WUJUR* has been one of the most formative experiences thus far in my life. I have always emphasized the life competencies which I believe *WUJUR* should and does promote: qualities like excellence, passion, and curiosity; skills like project management and technical knowledge; practices like vision-setting and creation. I have seen these traits develop in myself and amongst my peers, and I believe that *WUJUR* will change and grow and remain a powerful catalyst for the next generation of students, thinkers, artists, and people.

Thank you to everyone who has contributed to the growth and success of *WUJUR*. Thank you to our talented Reviewers, Editors, and Illustrators. Special thanks to Cadence Cordell of ScholPub for her constant and essential support. Thank you to our collaborators across and beyond the University. Thank you to our professor and student spotlights for sharing their inspiring stories. And as we surpass more than 3000 distinct views to our site, thank you to our readers—readers like you.

Sincerely,



Cedric Bruges
Co-Founder, Editor-in-Chief

The Washington University Journal of Undergraduate Research

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WUJUR (the Washington University Journal of Undergraduate Research) is a student-run organization and peer-reviewed journal dedicated to student research and the discovery of knowledge across all disciplines at WashU.

Cover image: Andy Mai '28

Forest Park

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Any field, any discipline, any WashU student.

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Outstanding Impact Award

For research with demonstrated potential for societal or disciplinary impact

WUJUR is pleased to present the Vol. 2 No. 2 Outstanding Impact Award to Rachel Tang '28 for her manuscript titled:

Influence of Weather on Questing Strategy by Amblyomma americanum Nymphs

Awarded for demonstrating exceptional potential to make a meaningful impact outside the university setting, Tang exemplifies how undergraduate research can connect disciplines, inspire change, and drive innovation at WashU and beyond.

Call for Submissions

Fall 2026

Looking to publish your own work?

WUJUR will open submissions for its next edition, Vol. 3 No. 1, at the beginning of the Fall 2026 semester. Eligible materials include original research publications, poster, theses, and review articles.

We invite you to take this exciting opportunity to share your work with the broader WashU community and beyond. By submitting to WUJUR, you will gain recognition and valuable experience, while contributing to a longstanding tradition of undergraduate research at our university.

Any field, any discipline, any WashU student.

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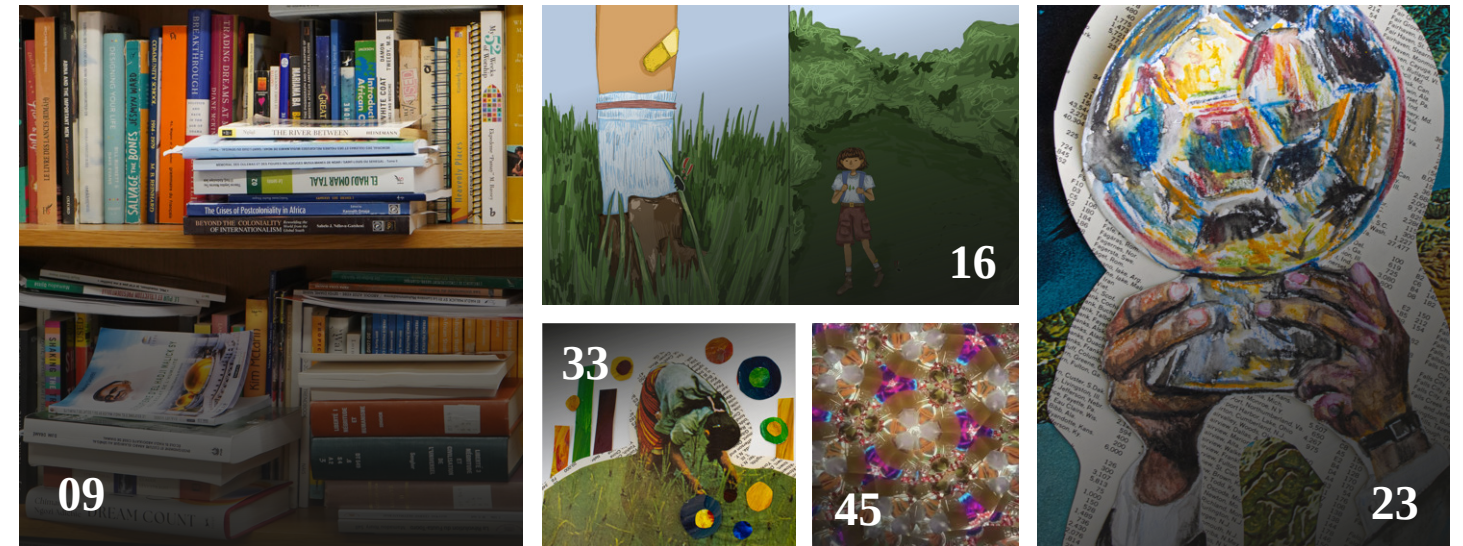


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Features

PROFESSOR SPOTLIGHT | ARTS AND HUMANITIES

Treating the System: A Spotlight on Dr. Salma Abdalla



Written by Kefan Cui '29
Washington University in St. Louis

In Sudan, if you get really high grades in high school, you become a doctor or an engineer,” Dr. Salma Abdalla laughed, recounting her initial introduction to medicine. Though a physician by training, Abdalla doesn’t currently practice medicine. Rather, she’s an Assistant Professor at WashU’s School of Public Health, and a researcher who investigates how social and economic policies impact health outcomes. From authoring dozens of papers on health policy and mental health to coauthoring the Surgeon General’s Report in 2021 and assisting the World Health Organization (WHO) in reviewing the COVID-19 response, Abdalla’s work speaks for itself. Getting there, however, required leaving medicine behind.

Abdalla attributes this pivot towards public health and policy research to a realization that struck her during medical school. Deeply passionate “about helping people in [her] community,” Abdalla “thought medicine was a good vehicle to do that.” But, once inside the hospital, a pattern emerged: I got into medical school in 2007 and it was clear most of the health issues [my patients] faced came from factors outside of the healthcare system.”

At first, Abdalla assumed the solution was to “fix the health care system” from within, which drove her to work with the Minister of Health in Sudan. Two experiences during her rotations would prove her wrong. The first was a malnourished infant, less than one year old, who kept returning to the hospital. “He would always come to the hospital,” Abdalla explained, “because his family didn’t have enough food to feed him well enough, and they weren’t educated.” Every time, the treatment was the same. “We would give him food for malnutrition so he would get better, then he would leave, and then he would come back again after a few months.” The futility hit

her immediately. Not only was the child suffering, but she knew early malnutrition carried “developmental delays that would affect him for the rest of his life. There must be a better way for the system to intervene,” she thought.

“
I got into medical school in 2007, and it was clear most of the health issues [my patients] faced came from factors outside of the healthcare system.

Dr. Salma Abdalla

The second came from advocacy campaigns Abdalla worked “to eliminate female genital mutilation (FGM) in rural areas in Sudan.” There, she encountered a striking paradox. “Mothers who themselves underwent FGM still thought [FGM] was the best way to go [for their daughters], despite health complications.” It “wasn’t because they didn’t know it’s bad for their health,” Abdalla clarified, “they just thought there’s something larger they need to worry about.”

That larger concern was financial security. For many families, FGM is a precondition for marriage. And, as Abdalla explained, for a lot of women who are not educated, marriage is the only reliable path to financial security. Just talking to mothers about health risks, no matter how medically sound, was not sufficient. This problem operated at an entirely higher level.

These two experiences crystallized a distinction Abdalla would carry through her entire career: the difference between a

treatment intervention and a systemic one. Telling someone what’s bad for their health means very little if the conditions shaping their choices remain unchanged. The solution, she realized, must come from upstream.

What Abdalla lacked, until 2014, was a framework. That came through an internship at the WHO’s Social Determinants of Health Unit. There, Abdalla met Sir Michael Marmot, the “father of social determinants of health,” who gave language to everything she’d been grappling with. Marmot spoke to her about “how political systems, economic systems, and social systems” also determine health outcomes. “I was sitting in Geneva,” Abdalla recalled, “and it just clicked when someone explained how an entire system actually shapes health outcomes.” She chuckled, “I think the next day, I just applied for my master’s degree.”

That application led her to Boston University (BU). At BU, Abdalla found her mentor, Dean Sandro Galea, whose research centered on “social and economic policies” and their impact on health outcomes. At BU, Galea’s research targets perfectly matched Abdalla’s budding interests.

One of the first areas she gravitated towards was mental health, and she immediately ran into a wall of skepticism.

Abdalla explains. Yet, her work consistently proved the opposite. It was actually the “poorest people who are most affected by [mental health conditions]. If you’re someone who lost your job and you don’t have enough money, you’re actually more susceptible to depression. But society is set up in a way that is minimized and people think, oh no, it’s only rich people who have the time to worry about their problems.” What this resistance to mental health research ultimately reflects, Abdalla argues, is the broader tendency in how we

Photo by | Andy Mai '28

“tell stories about diseases in a way that minimizes the social and economic factors that shape them.”

To avoid these pitfalls, Abdalla grounds her research in systems thinking. This concept demands one thing above all: the recognition that solving one problem without understanding the whole can quietly create another.

The consequences of ignoring systems thinking became clear to Abdalla during her time on the WHO’s independent panel reviewing the global COVID-19 response. More specifically, Uganda’s case still features prominently in her mind. “Uganda didn’t have a lot of COVID-19 cases,” Abdalla noted, “Education was picking up [in Uganda]...COVID hits, and they managed to control it, but they also closed their schools.” Two years later, Uganda’s schools are still closed. “Now there is a generation of kids in Uganda that missed school who didn’t need to.” In fact, since education is a strong determinant of health, Abdalla argues that these kids’ “health outcomes are likely going to be much worse.” One question driving her research crystallizes here. Why do decision-makers keep missing the full picture?

Abdalla’s Lancet paper on cardiovascular disease may offer one answer to why we currently have, as she puts it, “policies in place that clearly privilege a very small minority of people.” The paper finds that the top 20% of earners saw consistently better health outcomes than the rest of the population. Yet, beyond this finding is a crucial implication. “The top 20 percent matters, at least for me,” Abdalla expressed, “because those are the people who make policies—the people running the hospital, the politicians, and the judges. These are the ones who actually make the decisions that affect the rest of the population.” “Our hope,” Abdalla says, “is just to shed light on those connections”—ones that the very people responsible for fixing them may not even recognize they’re missing. That’s the core of why Abdalla’s research matters.

But Abdalla isn’t just theorizing about her research’s impact on policy. Working with Bloomberg Philanthropies across 15 cities globally, she is now evaluating whether recommended interventions actually work. In Dakar, Senegal, her team will spend the next four years tracking whether policies improving access to healthy food in schools actually reduce child obesity. “I’m really excited about this,” Abdalla beamed, “Now I can see whether or not the

type of work we’re doing actually improves health outcomes.”

Abdalla noticed a deeper-rooted issue in modern-day public health—the collapse of public trust. Trust is all about “actually convincing people that what we’re doing is reasonable, is scientific, and we actually care about the health of the population...and it seems like there is a big gap there.” To her, this dilemma demonstrates how “public health itself is at such a pivotal moment right now.” It was this pivotality, coupled with the potential “to think differently about how we train, think, act, and do public health differently,” at WashU’s new School of Public Health, that brought Abdalla from BU to St. Louis. In fact, WashU’s location in the Midwest matters deeply for Abdalla to begin addressing the crisis of trust. “I think I get to speak to more people who might have different views than me, which I very much appreciate,” Abdalla explained, “especially if we want to talk about trust, that’s where we need to start.”

The topic of trust is also the animating concern behind the Purple Public Health Project, developed alongside Dean Sandro Galea, who became WashU’s inaugural School of Public Health dean in January 2025. The name signals their intent to move beyond political polarization in public health and focus on practice and communication. Abdalla is direct about what that requires.

“
We can’t do this except by going on the ground, talking to people, listening to people who have been leading communities for a while, and then hopefully learning from them.

Dr. Salma Abdalla

In fact, her team “just did a survey of about 6,000 public health professionals across the U.S...taking it to the ground and seeing, what do communities actually think of us? And what can we do to improve?”

The tension she’s working through is most visible in debates like harm reduction. The science supporting hard reduction is solid, but advocacy campaigns that frame

the issue purely in moral terms tend to trigger an equal and opposite moral counter-framing from communities. To Abdalla, the failure isn’t scientific—it’s empathetic. “If trust is the goal, then separating the science from your values is the only path,” Abdalla said.

“
Are you, as someone doing harm reduction, who clearly cares deeply about this, capable of saying: those are not bad people. They just have a very different view of the issue than me?

Dr. Salma Abdalla

Abdalla is asking these hard questions, which don’t have straightforward answers. So, she started the Healthier Futures Lab—a think tank and gathering point for researchers wrestling with the same questions about public health’s future. Already, like-minded researchers have reached out wanting to collaborate, proof perhaps that the questions Abdalla is asking are the ones the field has been quietly sitting with for a while.

For students wondering how any of this gets started, Abdalla’s answer is simple. “I think you need to read a lot,” she says, “and you need to read from different disciplines all the time.” Yet, reading isn’t the full picture. The other ingredient is discomfort. “If you’re interested in this, that means something is bugging you that you’ve seen that just doesn’t make sense,” she tells students. “You should research the thing that’s bugging you a lot.” For those who don’t yet have a thing that’s bugging them, she has equal advice: find someone whose work you admire, reach out, and say yes to projects until one clicks.

This is, in a way, the same philosophy that has always guided her. Years ago, a malnourished infant kept returning to the hospital, yet standard treatment kept falling short. That nagging feeling never left her. The itch, it turned out, was all she needed to follow. ■



PROFESSOR SPOTLIGHT | SOCIAL SCIENCES

What’s on Your Desk?

A look into the office of African & African American Studies Professor Samba Diallo

Story by | Kefan Cui '29
Photo by | Mimi Zhou '28



1 “I’m originally from Senegal. Every other year, my wife and I take students to Senegal. One year after COVID, we went and we talked about stressing a lot. In Wolof, my mother’s language, there’s no term for stress. It doesn’t mean that stress doesn’t exist, but just through different forms. So I bought that painting, just saying to students, ‘no stress. We don’t need stress. That’s why I put it there.’”

2 “This is a guitar from the late Professor Garrett Albert Duncan, a professor in my department, African and African-American studies, who also first hired me at WashU.”

3 “These are also from Professor Duncan...he gave me these from his office. One is of the African continent and the other, it’s like a mother and then an African child—child bearing is very important in our society.”

4 “I like music. I’m not a musician, but I have a lot of songs that I bought from iTunes. I also have a sound system at home that, when we have our event here in Pudd, I bring my sound system and just let them relax and have fun. Because the reason why we are here is because of the students. So I want them to be happy. I want them to eat well and relax and enjoy being a student here at WashU.”

5 “This says ‘Greetings from Ghana.’ I visited a few years ago for a conference organized by the Association of the Study of the Worldwide African Diaspora. I presented a paper there on a Sufi order called the Tijaniyya, an widespread islamic movement in West Africa that has a lot of followers in Ghana.”

“How can you preserve their memories, those people, their heritage, if you don’t study them?”

6 “A poster of my second book, ‘Science and Sufi Brotherhoods in Senegal: New Approaches to Violence and Democracy.’ It’s on the role of violence in generating democracy—like removing a dictatorial regime and installing a peaceful democracy. I take Senegal as a case study, showing the role of religious leaders in building a democracy and democratic processes because most of the time, these people are neglected. We just talk about the elites, those who can speak French, who are in power, who write the laws, but not traditionalist people, or those using their religion to promote peace. They wrote in their own languages—Fulani, Hausa, and Wolof. Sometimes, people don’t consider them as a form of knowledge because knowledge should be just in European languages. It’s important to see ideas and forms of democracy that are deeply rooted in the community.”

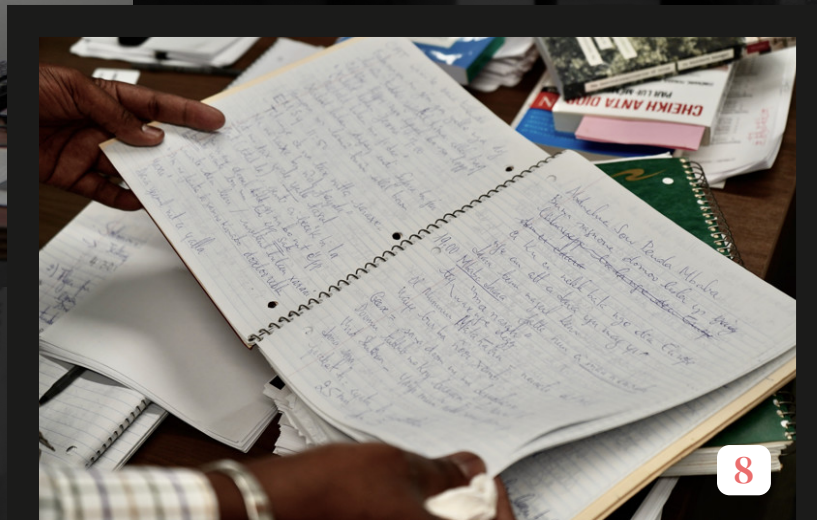
7 “My poster of Cheikh Ahmed Tidiane Sy—a religious leader who really inspires me because he’s a very good philosopher. Most Senegalese people refer to his work and his videos and talks. I use him as a reference, instead of always using European and Western thinkers. We have local thinkers who developed very good ideas about universalism. I want to know their perspectives and what they think about those global themes. It’s important because how can you preserve their memories, those people, their heritage, if you don’t study them?”

8 “I take an audio cassette that [Cheikh Ahmed Tidiane Sy] made in 1960, then I listen to it, translate it, and transcribe it. A full cassette can be quite long, around 2 to 5 hours, but transcribing it makes writing about his philosophy easier because I know where everything is in my notebooks.”



Photos by | Mimi Zhou '28

Above: Professor Samba Diallo sits in his office. He is a professor of African & African American studies. His research focuses on Islam in West Africa, Sufism, Francophone Africa and cultural connections within the African diaspora,



RESEARCHER SPOTLIGHT | NATURAL SCIENCES, MATHEMATICS, AND ENGINEERING

Quantifying Controversy: An Interview with Lucas Olmeta and Ben Kras

Written by Saanvi Kumar '29
Washington University in St. Louis



Lucas Olmeta '28



Ben Kras '28

When the Ballon d'Or announced French soccer player Ousmane Dembélé as its 2025 winner, fans around the world expressed their surprise. Among the many questioning this decision, two curious WashU students, who had noticed the Ballon d'Or's repeated controversies, decided to find out for themselves who the true winner should have been.

Lucas Olmeta, a sophomore double-majoring in Data Science and Finance, and Ben Kras, a sophomore majoring in Data Science, are close friends. Both grew up watching soccer, developing a love for the sport. The pair had also eyed the field of data science for a while. Kras applied to WashU for Data Science, explaining that "it's always kind of been on my radar."

“

Doing something related to soccer was really fun for us because we're such big fans.

Lucas Olmeta '28

Olmeta was inspired by his older brother, who studied data science in college. Olmeta explained that "he told me a lot about it...he shared his projects with me—that was really cool. So, I was sort of interested in it in high school as well." Having been exposed to data science for quite some time, it was only natural that the pair would find this unique way to tackle the controversy of the Ballon d'Or.

As Olmeta listened to his friends' arguments regarding the controversy, he decided to find the answer for himself. Once he gathered the data, he invited Kras to

help with the analysis. Olmeta added, "I think it was the first time that me and Ben together have done a project, so that was sort of a really cool experience. Especially doing something related to soccer was really fun for us because we're such big fans." Kras also shared his enthusiasm for the project, explaining that "I haven't worked with very interesting data sets up until pretty recently just because I've been doing a lot of foundational statistics classes... But I think there's always just been an innate curiosity about the potential for these kinds of applications."

With enthusiasm and skill, the two began the project, though developing it was no easy task. The goal of the project was to analyze quantitative data from previous Ballon d'Or awards as well as various player statistics and awards. The two approached this problem in different ways.

Olmeta took several player metrics and compared them to previous award winners. Meanwhile, Kras developed a model to predict vote shares. He explained that the Ballon d'Or went to the player with the most points, which are based on votes from prestigious magazines. The goal of the model was to accurately predict the percentage of total votes that a player receives and rank players accordingly.

As they developed their respective techniques, they faced numerous challenges. Olmeta pointed to the difficulties in actually attaining the data, since much of it was locked behind a paywall. After gathering what he could, he then had to figure out how to quantify similarities between players and previous winners.

For Kras, a major problem was the small sample size he had due to the limited number of Ballon d'Or nominees from only the past four years. This is when the techniques he learned in class became useful. Kras used ridge regression to shrink the co-

efficients to a size where results would be more accurate, preventing overfitting from the small sample size. He also used a technique called bootstrapping, which is a method that resamples the data to estimate how stable or reliable the results are, making the data easier to work with.

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If you frame an issue correctly, it probably can be solved or at least thoroughly investigated with data science.

Ben Kras '28

After working through their challenges, Kras's model predicted the first few winners with surprising accuracy, although the model was unable to rank the remaining nominees accurately. Olmeta found similar results, finding Dembélé to be ranked high among several metrics. After compiling their results, to the surprise of both, it seemed that Dembélé was the statistically favored player to win the award.

Throughout the project, Kras and Olmeta enjoyed applying their skills in a fun and innovative way. In discussing an idea about data science that should be more well-known, Kras said, "If you frame an issue correctly, it probably can be solved or at least thoroughly investigated with data science," which is a principle that proved itself through their project.

They both plan to continue in the field well into the future. Olmeta is looking to possibly become a data scientist or work in sports analytics. Both look forward to pursuing passion projects in their future. ■

RESEARCHER SPOTLIGHT | ARTS AND HUMANITIES

Getting Hip with Art History: An Interview with Helen Ives

Written by Julia Claire Johnson '28
Washington University in St. Louis



The rhythmic hum of a treadmill or the vibrant pulse of a salsa social night might seem worlds away from the quiet contemplation of an art gallery, but for Helen Ives, these physical outlets are essential to her scholarly process. A senior from Boston double-majoring in studio art and art history with a minor in French, Ives embodies the interdisciplinary spirit of WashU.

As Co-President of the Art History Club, she works as a part of the department's "social arm," helping students engage with art on campus and across St. Louis. "I love the club because we can do the fun stuff that makes the major feel like a community," Ives said. "It's about making art history accessible."

Although Ives has previously published research in the *Journal of Illustration* and presented at the College Art Association (CAA) conference, her featured research began in Dr. Ila Sheren's class, "Picturing the Anthropocene: Landscape, Land Art, and Eco-Art." The course explored the Anthropocene—the era in which human activity has fundamentally altered the Earth's ecosystems—and prompted students to connect these global anxieties to the local landscape. Ives chose to analyze the work of her friend and fellow senior, Emma Wang, an artist who creates "ethereal, beautiful, and often functional," objects from reclaimed materials.

In her paper, Ives contextualizes Wang's practice through the lens of "hippie modernism," a 1960s movement where counterculture intersected with rising computer culture. She uses the two as "foils for each other" to explore shared themes like the use of found materials to bypass mass production, and what Wang's work signals about cultural anxieties today compared to in the past. "There are a lot of interesting religious undertones that the hippie mod-

ernists had," Ives says, noting the overlap in how both the movement and Wang use spiritual motifs to reflect the world around them.

While Ives initially viewed research through a strictly "STEM-based" lens, her research in art history allowed her to lean into the "poetics" of the humanities, enjoying the opportunity to develop her own authorial voice, even within the formality of academic writing. "There's a kind of whimsy... I can write sentences that make me feel good, not only because I state something clearly, but it's like there's a part of me in it."

“

There's a kind of whimsy....

I can write sentences that make me feel good, not only because I state something clearly, but it's like there's a part of me in it.

Helen Ives '26

However, Ives maintains that both fields share a bedrock of simple but analytical observation. "In science, you might look at chemicals in a beaker... while in art history, you're looking at a canvas. Both require you to sit still and actually see what is in front of you before you start theorizing," she notes.

Writing about a living artist and close friend presented unique challenges, requiring Ives to balance her personal relationship with historical critique. "I wanted to

write about her lifestyle and who she is as a person, since that definitely informs the way she thinks... but with a 13 to 15 page paper, I did not have that space." Instead, she adopted a "journalistic" approach, running drafts by Wang to ensure her visual analysis was accurate. "I had a second pair of eyes that was like, 'I'm definitely not trying to do that with my artwork,'" Ives recalls jokingly.

Beyond this project, Ives is completing a senior thesis investigating "post-craft": how contemporary artists use traditional craft to respond to technology and ecology. Her passion lies in practice-based research, a niche she defines as a "combination of art research and practice."

"Practice-based research can operate on a sliding scale," Ives explains. "Sometimes it's more medium-specific and it's helping me talk about printmaking or painting or the way a certain thing feels or is done by artists and their processes. And sometimes it's personal... like a mode for reflection, keeping my thesis in the back of my mind to help inspire my artistic practice."

As she prepares to join the masters program in History, Theory, and Criticism of Architecture and Art at MIT after graduation, Ives advises new researchers to build a "constellation" of mentors. As someone focused on the arts and humanities, "You really don't think of yourself in that context until you're shown that you can exist there," she says. "But you can't be afraid to talk to your professors, advisors, or subject librarians. There's a wealth of information out there; you just have to be brave enough to ask the first question." ■

PROFESSOR SPOTLIGHT | SOCIAL SCIENCES

Beyond the Headlines: Professor Douglas Flowe on Race, Crime, and American Cities

Written by Blair Wagner '29
Washington University in St. Louis



Media often portrays crime through a racial lens, contributing to a disproportionate representation of Black or Hispanic individuals as perpetrators and white individuals as victims. Dr. Douglas Flowe explores the societal and racial factors behind instances like these and how they influence communities today.

Flowe is an Associate Professor of History, an author, and a Dean's Fellow of Inclusive Excellence. He studies how criminality, masculinity, and race shape the landscape of American cities and the way people understand and experience crime. Flowe's interest in these topics originated from what he witnessed growing up in two unique environments. "As a person who grew up in New York City and also in Orlando, Florida...I wanted to understand how those communities became that way, and what forces were pushing people to make decisions about their lives in those places," Flowe explained.

His father worked as a police officer in New York, and during Flowe's time in Orlando, he was exposed to heavily policed and underserved communities. Having inhabited both worlds gave him a perspective few researchers share. These early experiences fuel Flowe's desire to explore beyond surface-level understandings of crime. "I was interested in criminal justice, but from the perspective of people affected by it," Flowe clarified.

While writing his first book, *Uncontrollable Blackness*, Flowe explored the connection between imprisoned individuals, community surveillance, and the justice system. To make sense of what he found, Flowe developed a theoretical framework he coined, "The Crucible of Black Criminality." This framework examines how historical factors, such as racial

violence, economic inequality, and cultural narratives, worked together to entrench stereotypes about Black men. Many of these misconceptions, rooted in slavery and reinforced during the Jim Crow era, persist in modern media and culture through subtler but deliberate methods. Flowe's current project, a new book, develops this model further by focusing more directly on Black male imprisonment within the New York prison system and what happens to the communities left behind.

“
I wanted to understand how those communities became the way they are and what forces are shaping people's decisions in those places.

Dr. Douglas Flowe

This research led Flowe to a concept French historian Michel Foucault calls "carceral archipelagos." Carceral archipelagos refer to the way carceral systems extend their reach beyond prison walls and into everyday community life, especially communities heavily affected by incarceration. "Not only is the person incarcerated under scrutiny," Flowe explained, "but their community, their families, public and private institutions end up getting surveyed too." Parole requirements alone can subject entire households to state inspection, binding families to the carceral system even after a loved one's release.

Beyond his current work, Flowe has

several projects taking form. Among them is a study of how Disney World's development reshaped the urban design and economic structure of Orlando. In fact, growing up in a Black community near the Disney area, Flowe personally experienced how large-scale corporations can condition the lives of entire communities. Disney wasn't just an entertainment company. Rather, Flowe argues, it was furtively "one of the city's biggest lobbyists, for how space would be used, where the airport would be located, and where the highways would run." Flowe's proximity also allowed him to see firsthand how jobs, infrastructure, and resources were unevenly distributed. "I want to understand how Disney shaped the space of the city," Flowe said, "and how race was taken into account as the city was being shaped and reshaped over the course of the second half of the 20th century."

Across all his projects, the throughline is the same: Who shapes the spaces people live in, and who pays the price. For Flowe, that question has never been purely academic. As he puts it, his work benefits from having inhabited these two worlds; it gives him the perspective that continues to shape the questions that he asks as a historian. For Flowe, these questions he asks are the same ones he's been asking his entire life. ■



ORIGINAL RESEARCH

Influence of Weather on Questing Strategy by *Amblyomma americanum* Nymphs

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Washington University in St. Louis, Tyson Research Center

Ticks are ectoparasites that feed exclusively on blood from vertebrate hosts using questing (host-seeking behaviors) strategies such as ambushing (sitting/waiting on vegetation for hosts to brush by) or active pursuit (chasing after hosts). Tick abundance is assessed with flagging/dragging and carbon dioxide (CO₂)-baited trap methods, which target ambushing and actively pursuing ticks, respectively. Many studies employ only one collection method; however, the lone star tick, *Amblyomma americanum*, uses both ambushing and active pursuit. Weather is an environmental factor whose effect on questing strategy remains unclear. We hypothesized that if *A. americanum* changes host-seeking behaviors in response to weather, then the success rate of collection methods will vary accordingly. Sampling events occurred 3 rounds in 3 plots within each of 14 sites—including Tyson Research Center—across St. Louis County, Franklin County, and Jefferson County, using both flagging/dragging and CO₂ traps (N=110). During each survey, we recorded temperature, relative humidity, wind speed, and cloud cover. Using generalized linear mixed models with a binomial distribution, we modeled the influence of weather variables on the probability of *A. americanum*, nymphs either ambushing or actively pursuing hosts. Over the course of 4 months, we collected 2,255 *A. americanum* nymphs via flagging/dragging, and 1,682 via CO₂ traps. Saturation deficit, the “drying” power of the atmosphere, and visit round had the greatest influence on tick questing behavior. Active pursuit increased as saturation deficit increased, but ambushing increased over the questing season. Cloudy conditions promoted ambushing and sunny conditions promoted active pursuit. These results underscore how weather can confound tick population estimates due to variability in tick behavior. Future *A. americanum* studies should employ flagging/dragging and CO₂ traps simultaneously. As climate change extends tick questing seasons, understanding how weather influences tick questing strategies is crucial for accurate tick surveillance.

Ticks are small ectoparasites that feed on blood from vertebrate hosts. They have four distinct life stages: egg, larva, nymph, and adult. In each of the stages, ticks use behaviors known as questing to locate a host and feed on it. They feed once per life stage, each lasting anywhere from several months to a year, and use bloodmeals to molt or develop eggs [1]. During the feedings, ticks may be infected with disease-causing pathogens from their hosts, and they may also transmit these pathogens. Tick-borne diseases include Lyme disease, spotted fever rickettsioses, ehrlichiosis, and babesiosis [2]. The lone star tick, *Amblyomma americanum*, is a common tick species in Missouri. It transmits several human and animal pathogens, including agents of ehrlichiosis and tularemia [3, 4]. Tick-borne disease cases have more than tripled from around 20,000 cases in 2004 to over 70,000 cases in 2022 [2], [5]. As pathogens spread by *A. americanum* become more prevalent in the United States, it is crucial to understand questing behaviors of ticks, since a successful quest can transmit disease-causing pathogens to humans and other hosts [6]. Further, standard methods to estimate the abundance of free-living ticks rely on ticks exhibiting specific questing behaviors. Human-biting ticks commonly use two different questing methods: “ambushing,” where a tick sits on vegetation and waits for a host to brush by, and “active pursuit,” where a tick chases after a host [1]. To measure tick abundance, dragging or flagging methods target ambushing ticks and CO₂ traps collect actively pursuing ticks [7]. Dragging involves a cloth with a rope tied on two ends. For flagging, the user holds the end of a flag’s pole and sweeps it in front of them. Both methods aim to brush through vegetation and collect ambushing ticks. CO₂

traps consist of a container of CO₂ and a fibrous cloth. The container of CO₂ mimics a host’s breathing, which can trigger a tick to start chasing down the source of the CO₂, hence actively pursuing its host. Certain tick species of human health concern such as blacklegged ticks (*Ixodes scapularis*) are known to primarily use the ambushing behavior and therefore, they are typically collected through dragging/flagging. Notably, *A. americanum* are very flexible in their host-seeking strategies, using both ambushing and active pursuit, but many *A. americanum* population studies conventionally only use dragging/flagging or CO₂ traps, not both simultaneously [8]. Effective public health interventions for tick-borne diseases require a better understanding of tick questing behavior [9]. Therefore, more information is needed on factors that influence which questing strategy *A. americanum* use and how these factors may confound research and surveillance efforts. Little is known about how weather affects if *A. americanum* ambush or actively pursue hosts. Most studies on how abiotic conditions affect tick questing are conducted in labs, making it unclear how these results translate to natural conditions [10]. Previous research suggests that temperature, humidity, and wind speed, along with seasonal physiological variation, can affect *A. americanum* host-seeking frequencies, but there is a lack of studies on how these weather variables affect which questing behavior they use [10, 11]. In particular, temperature and humidity can be combined into one variable: saturation deficit, the drying power of the atmosphere. Higher saturation deficit indicates high temperature and low relative humidity. Studies have shown that *A. americanum* are more likely to quest at high saturation deficit since they can tolerate drier

conditions [11], [12], [13]. The warming climate is likely to extend the questing period for ticks, making it all the more important to study how specific weather variables affect tick questing behavior [13]. High wind speeds can interfere with CO₂ trap effectiveness and cause fewer ticks to quest [7]. In terms of seasonal changes impacting tick questing, Mangan et al. (2022) found that there was an increase in *A. americanum* nymphs questing from spring to summer, though this was only observed in a forest habitat and not in field habitats. This study will examine how weather affects if questing *A. americanum* nymphs ambush or actively pursue a host. We hypothesized that if *A. americanum* changes questing behaviors in response to weather, then the success rate of collection methods will also change.

Methods

Field Data Collection

We sampled 14 sites in the St. Louis, Missouri region with a diversity of habitats (Fig. 1). All sites were predominantly characterized by deciduous forest and were located in three different counties: St. Louis County, Franklin County, and Jefferson County. Three sites at Tyson Research Center were indistinct habitat types (ForestGEO, Glades, Patchidor). The ForestGEO site is mostly oak-hickory forest with an understory mainly consisting of woody shrubs, such as pawpaw (*Asimina triloba*) and spicebush (*Lindera benzoin*) [14]. The Tyson Glades were grass dominated with encroaching Eastern Red Cedar. The Tyson Patchidor was an old field habitat, which is a grassland established on previously disturbed land. Three sites were conservation areas. Powder Valley Conservation was an oak-hickory forest habitat but situated within a suburban environment. Forest 44 Conservation Area was characterized by Ozark uplift, an uplifted plateau. The Pacific Palisades Conservation Area was primarily cropland and grassland. Three sites were county parks, with Kirkwood Park and Emenegger Nature Park situated in a suburban area and West Tyson County Park in a predominantly oak-hickory forest habitat in a rural area. Mastodon State Historic Site has several natural springs with open grassland and oak-hickory forest. Tyson Annex Property is predominantly native grasses near a creek. Finally, one site was a ranch. Long Meadow Rescue Ranch was an oak-hickory forest and has a high concentration of domesticated animals. At each site, 3 plots were established. Each plot consisted of sampling paths called transects totaling 750 meter long for flagging/dragging and a CO₂ trap location adjacent to the transect. We collected ticks

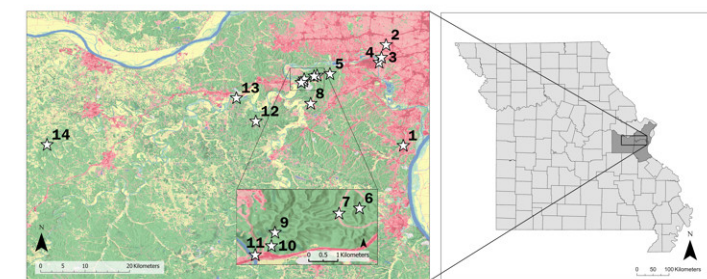


Fig. 1 | Map of the 14 sampling sites. 1. Mastodon State Historic Site, 2. Kirkwood Park, 3. Powder Valley Conservation Nature Center, 4. Emenegger Nature Park, 5. Forest 44 Conservation Area, 6. ForestGEO TRC1, 7. Patchidor TRC2, 8. Pleasant Valley Nature Preserve, 9. West Tyson County Park, 10. Glades TRC3, 11. Route 66 State Park, 12. Sandstone Creek-Annex, 13. Pacific Palisades Conservation Area, 14. Longmeadow Rescue Ranch. These encompass part of the urbanization gradient that transitions from urban to rural areas in St. Louis, as shown by the National Land Cover Dataset (NLCD) [15]. The green, yellow, and red covers indicate forest, agriculture, and urban areas, respectively. On the right side of the figure with the Missouri counties in light grey, the sampled counties, St. Louis County, Franklin County, and Jefferson County, are shaded in dark grey.

from April through July of 2025 for a total of 3 visits using two collection methods during each visit. On average, there were about 31 days between each visit. Dragging, as the name entails, involves dragging a 1.5 square yard cloth with a rope tied on two ends. For flagging, a cloth is attached to the end of a pole and swept in front of the user. Both methods are commonly used to collect ambushing (sit and wait) ticks [7]. Since ticks are attracted to CO₂ emitted from their hosts, CO₂ traps were placed to target actively pursuing ticks [16]. For each CO₂ trap, a container of dry ice is placed in the center of a 1 square yard sheet of cloth [7]. CO₂ traps were set for one hour during the dragging/flagging of transects. We used a handheld weather meter (Kestrel®, Nielsen-Kellerman, USA) to record the temperature, relative humidity, and wind speed for each visit. In addition, we also recorded the cloud coverage as a categorical variable, which was either sunny, partially cloudy, or majority cloud cover. The ticks collected from each plot were transported back to a -80°C freezer to preserve specimen before identification using dichotomous keys for Ixodidae [17, 18]. Ticks were then sorted by species, sex, and life stage.

Statistical analyses

We filtered collection data to include only *A. americanum* nymphs identified at all sites with a maximum of 3 visits, where each visit used both flagging/dragging and CO₂ traps. The nymphal stage is the most important life stage for tick-borne disease risk, because they are small enough to evade detection, have a greater likelihood of being infected from their first blood meal as larvae, and reach peak questing from spring to summer when humans are more likely to engage in outdoor activities and animal hosts are more active [19]. We used the temperature and relative humidity measurements from each visit to calculate saturation deficit—the “drying” power of the atmosphere—using the following formula from Randolph and Storey (1999):

$$SD = \left(1 - \frac{RH}{100}\right) 4.9463e^{0.0621T}$$

where SD is saturation deficit, RH is relative humidity in mmHG, and T is temperature in Celsius. Each row of sampling event data consisted of the site, plot, number of *A. americanum* nymphs on

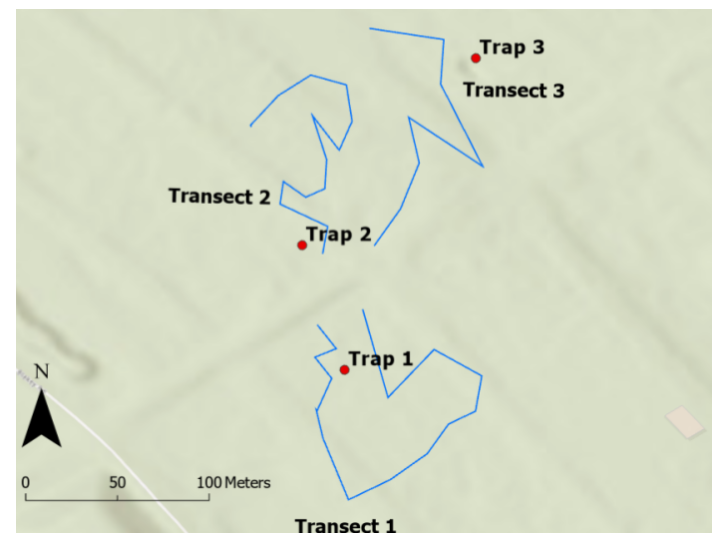


Fig. 2 | Example of 3 plots with their respective transect and CO₂ trap location at Route 66 State Park. Each transect averages 250 meters long, totaling to 750 meters of transects for each site.

traps or transect, cloud coverage, wind speed, the hour a trap was collected or a transect was complete, and saturation deficit. We used logistic regression in R to assess the odds that lone star nymphs were collected from flags/draggs or CO₂ traps at each plot and to determine which variables best predicted those odds. Continuous variables—saturation deficit and wind speed—were centered and scaled prior to modeling. We created 11 generalized linear mixed models (GLMMs) with different combinations of predictor variables, setting site as a random effect for all models. We compared models using Akaike’s Information Criterion for small samples in order to prevent overfitting (AICc) [20]. Prior to constructing models, we tested for correlations among covariates; time of day and saturation deficit were strongly correlated (Pearson correlation coefficient, r=0.706). Therefore, we created two global models with one of each variable to avoid having correlated variables in the same model. Statistical analysis was conducted in R version 4.5.1, and the packages lme4 and MuMIn were used for creating the GLMMs and evaluating the GLMMs, respectively [20], [21], [22]. To evaluate the fit of our models, we used the Diagnostics for Hierarchical Regression Models (DHARMA) package to test for overdispersion and evaluate residuals between our model’s predictions and the observational data [23]. Finally, the ggeffects package was used to calculate the prediction responses from our best model by computing marginal predictions for ticks’ questing strategy while controlling for cloud coverage, wind speed, saturation deficit, and visit round [24].

Results

Overall, we collected and identified 8,669 *Amblyomma americanum*, 18 *Dermacentor variabilis*, 10 *Ixodes scapularis*, and 1 *Haemaphysalis longicornis*. A total of 3,937 *A. americanum* nymphs were collected, with 2,255 via flagging/dragging, and 1,682 *A. americanum* nymphs via CO₂ traps (Table 1). According to standard tick surveillance protocol, survey were not conducted during rainy or extremely windy conditions (greater than 20 mph) [7]. Over 80% of our visits were during sunny conditions.

Site	EMG	F44	KWP	LMR	MSP	PAC	PVC	PVP	R66	TAP	TRC 1	TRC 2	TRC 3	WT P	Total
Transect total	222	465	9	138	0	6	64	11	158	126	317	373	151	215	2,255
Trap total	122	111	38	16	2	0	11	16	54	213	277	426	275	121	1,682
Total	344	576	47	154	2	6	75	27	212	339	594	799	426	336	3,937

Table 1 | Summary of total *A. americanum* nymphs collected on transects (flagging/dragging) and CO₂ traps for each site. Sample counts for transect and trap totals across sites were roughly equal (2,255 vs. 1,682), demonstrating that we had similar active pursuit and ambushing sample effort overall.

Out of the 11 GLMMs, the global GLMM with saturation deficit, wind speed, cloud coverage, and visit round had the lowest AICc value by more than 15 ΔAICc, indicating the best relative model fit. A smaller AICc value indicates a better fit model [20]. This GLMM was also the only model with a weight, the numerical value representing the importance of a model variable, greater than 0, indicating that it has the highest likelihood of being the best model of the set for predicting tick questing strategy (Weight = 1) (Table 2). The weight is the numerical value representing the importance of a model variable [20]. To verify the fit of our best model, an overdispersion and uniformity test was conducted on the two global models using DHARMA. Overdispersion tests evaluate the variability of observations residuals to simulation residuals, and a significant test (p<0.05) indicates that a model has overestimated variability. Uniformity tests evaluate the distribution of

Model	k	Delta AICc	Weight
Saturation deficit, Wind speed, Cloud coverage, Visit	8	0.0000	1
Wind speed, Cloud coverage, Time, Visit	8	15.7728	0
Time, Wind speed, Cloud coverage	4	292.5378	0
Saturation deficit, Wind speed, Cloud coverage	6	681.2117	0
Saturation deficit, Cloud coverage	5	752.6353	0
Wind speed, Cloud coverage	6	754.9056	0
Wind speed, Saturation deficit	4	788.2680	0
Wind speed	5	790.3165	0
Saturation deficit	4	1869.3244	0
Cloud coverage	3	1875.1804	0
Time	3	1972.6638	0
Visit	3	1984.7157	0
Intercept only	2	2005.1367	0

Table 2 | Summary of 11 models’ variables, number of parameters (k), delta AICc, and weights. The model with saturation deficit, wind speed, cloud coverage, and visit had the lowest AICc and a weight of 1.

residuals, and a significant test indicates that residuals substantially deviate from a uniform distribution. The dispersion test was non-significant (p=0.79). For the Kolmogorov-Smirnov uniformity test (KS test), which measures the difference in data distribution between two independent models, the p-value was also non-significant (p=0.20) (Fig. 3). Saturation deficit, cloud coverage, and visit had a significant p-value (p<0.001). The odds ratios (OR) of of saturation deficit is greater than 1 (OR=1.78, Table 3), indicating that an increase in saturation deficit was associated with higher odds of active pursuit. Meanwhile the odds of active pursuit decreased over the course of three visits from 0.09 to 0.02 (Table 3).



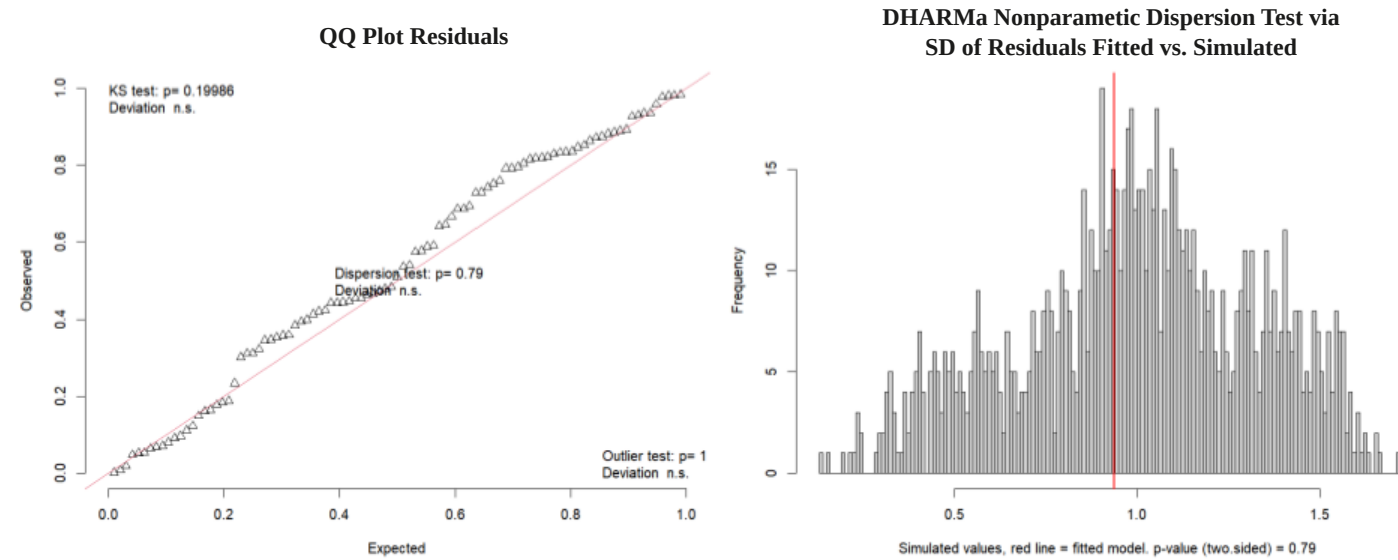


Fig. 3 | Assessment of data normality and dispersion. The linear trend of the QQ plot indicates that the data aligns well with the distribution. The nonparametric dispersion test displays the simulations as gray lines and the fitted model as a red line, and the roughly symmetric distribution suggests equal dispersion.

Probability of active pursuit over ambush			
Predictors	Odds Ratios	CI	p
(Intercept)	0.04	0.01 – 0.18	<0.001
Saturation deficit	1.78	1.49 – 2.13	<0.001
Wind speed	0.93	0.77 – 1.12	0.455
Partial cloud cover	402.87	141.82 – 1144.45	<0.001
Sunny	59.22	29.01 – 120.88	<0.001
Visit 2	0.09	0.06 – 0.14	<0.001
Visit 3	0.02	0.01 – 0.03	<0.001
Random Effects			
σ^2	0.08		
τ_{00} site	5.88		
ICC	0.99		
N_{site}	14		
Observations	95		
Marginal R^2 / Conditional R^2	0.545 / 0.994		

Table 3 | Summary of our best model displaying the exponentiated odds ratios, calculated based on coefficient estimates for each predictor variable Odds ratios greater than 1 indicate increased odds of active pursuit while odds ratios less than 1 indicate increased odds of ambushing.

Our model predicted that the probability of active pursuit decreased over the course of visits, and ticks were least likely to use active pursuit under majority cloud cover conditions (Fig. 4). The probability of active pursuit shows a slight decrease with increasing wind speed, while the probability of active pursuit increases as saturation deficit increases, but slows down starting around 12.9 mmHg (Fig. 5).

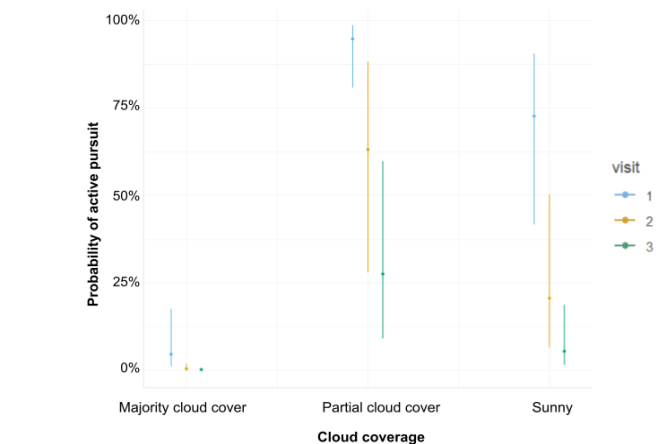


Fig. 4 | Probability of active pursuit over ambush as a function of cloud coverage and visit. Points represent model-predicted mean response and lines represent 95% confidence intervals. For each coverage, visits 1, 2, and 3 are the blue, yellow, and green plots, respectively.

Discussion

The best prediction model for *A. americanum* nymph questing behavior used saturation deficit, wind speed, cloud coverage, and visit. As saturation deficit increased, *A. americanum* nymphs were more likely to actively pursue hosts. Increasing wind speed decreased the probability of active pursuit. During majority cloud cover, the possibility of an *A. americanum* nymph ambushing its host was greater than 75% for all visits. Interestingly, the cloud coverage with the highest probability of *A. americanum* nymphs actively pursuing a host was partial cloud cover. However, the confidence intervals overlapped, which may indicate that the difference in cloud coverage is not significant. One reason for a stronger response during partial cloud coverage could be that is the optimal condition for *A. americanum* nymphs to chase after their hosts, since there is a balance of enough humidity, warm enough temperatures, and shade to risk spending energy on movement. Eisen et al. (2016) found that when there is low humidity, black-legged ticks (*Ixodes scapularis*) and western black-legged ticks (*Ixodes*

pacificus) will spend more time re-hydrating, which could take away their energy from chasing a host. Increasing saturation deficit increased the probability of *A. americanum* nymphs actively pursuing, albeit slowing down at higher saturation deficit, which aligns with our results. Towards the end of July, the probability of *A. americanum* nymphs actively pursuing decreased. Saturation deficit was a better predictor of *A. americanum* nymph questing behavior than the time of day. Marshall (2025) suggested that the temperature, a variable in saturation deficit, previously experienced by ticks may also impact their movement, or whether they actively pursue or ambush a host. Future studies could expand on this finding by studying the questing strategies of wild ticks after being exposed to a range of temperatures. At higher wind speeds, ticks may be less likely to actively pursue hosts because they can stabilize themselves while mounting on a vegetation stem, albeit at a lower height than they usually would [26].

Our finding that less ticks actively pursue hosts also aligns with Center for Disease Control tick collection guidelines, which advises against CO₂ traps during extremely windy conditions due to limited tick questing [2]. Windy conditions may also deter ticks

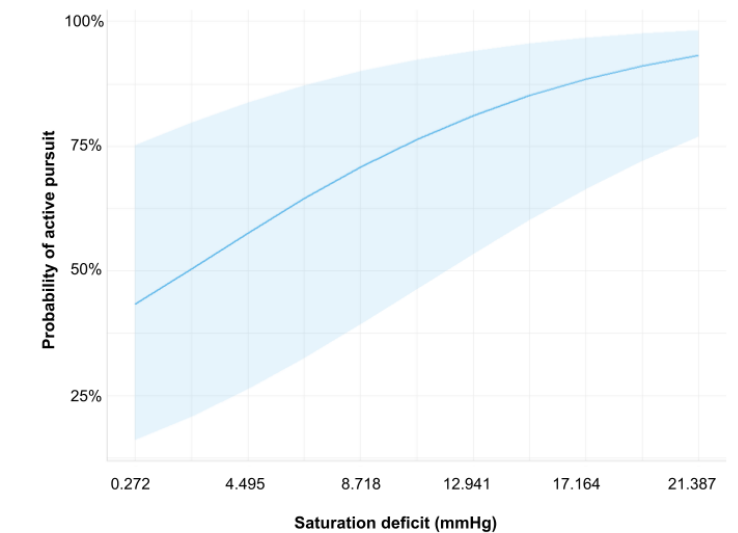
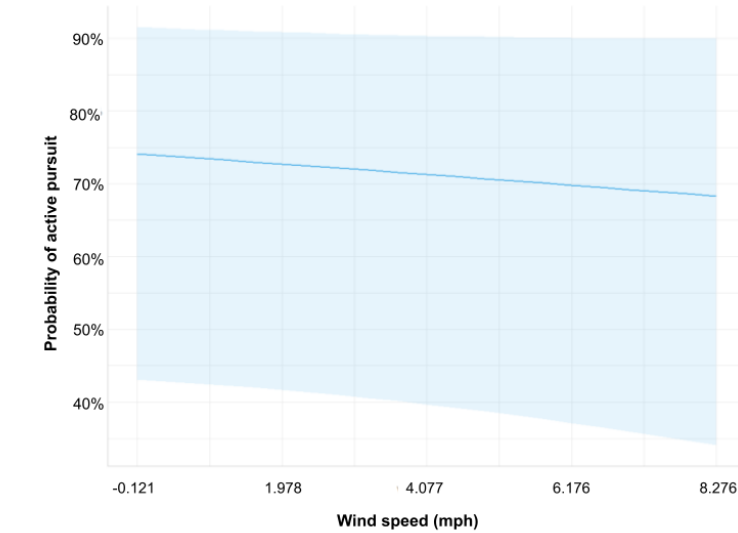


Fig. 5 | Probability of active pursuit over ambush as a function of wind speed and saturation deficit. Lines represent model-predicted mean response and shaded areas represent 95% confidence intervals. Visit 1 and sunny conditions were held constant for wind speed (left) and saturation deficit (right).

from active pursuit because there is increased evaporated water-loss, resulting in higher desiccation risk [26]. The decline in active pursuit across all three visits demonstrates that physiology may also play a role in questing behavior. Ticks need to survive for long periods between each blood meal and therefore need to balance questing with minimizing energy expenditure [1]. Mangan et al. (2022) found that the time *A. americanum* nymphs spend questing relative to energy use decreased from spring to summer. There was an observed increase in *A. americanum* nymphs both ambushing and actively pursuing from spring to summer, though this increase was only observed in a forest habitat and not in field habitats, though the reason remains unclear. Since active pursuit requires more energy than ambushing, our findings reflect a similar trend. One limitation of this study is that we did not conduct 3 visits using both drags/flags and CO₂ traps for all sites. In addition, we did not survey sites during rainy and very windy days (over 8 mph winds) per standard tick collection protocols, so due to the period of time we conducted tick surveys (April to July) and avoiding rainy and extremely windy days per standard tick collection protocols, over 80% of our visits were sunny, which may have biased the model. Future studies could conduct multiple collection methods for all survey sites across a longer period that encompasses a more proportional distribution of cloud coverage. Another potential study could also collect data on how rain affects tick questing behavior, as previous research suggests the number of *A. americanum* nymphs ambushing decreases after a rainfall event [27]. Our study suggests that weather factors influence tick questing behavior, and that for tick species with flexible questing strategies like *A. americanum*, reliance on a single collection method during surveys may bias estimates of tick abundance. Based on our results, we recommend that both dragging/flagging and CO₂ traps should be used simultaneously when surveying *A. americanum* populations. Tick questing strategy needs to be an important consideration when surveying tick species, especially for species like *A. americanum* that have flexible questing strategies. Moreover, climate change is expected to extend questing activity periods for many tick species, including *A. americanum*, since warmer summers and shorter winters facilitate tick activity. Therefore, this is also predicted to increase the risk of tick contact [28]. Characterizing how environmental factors like weather affect tick questing behavior can improve public health surveillance and interventions for reducing tick-borne disease transmission.

Acknowledgement

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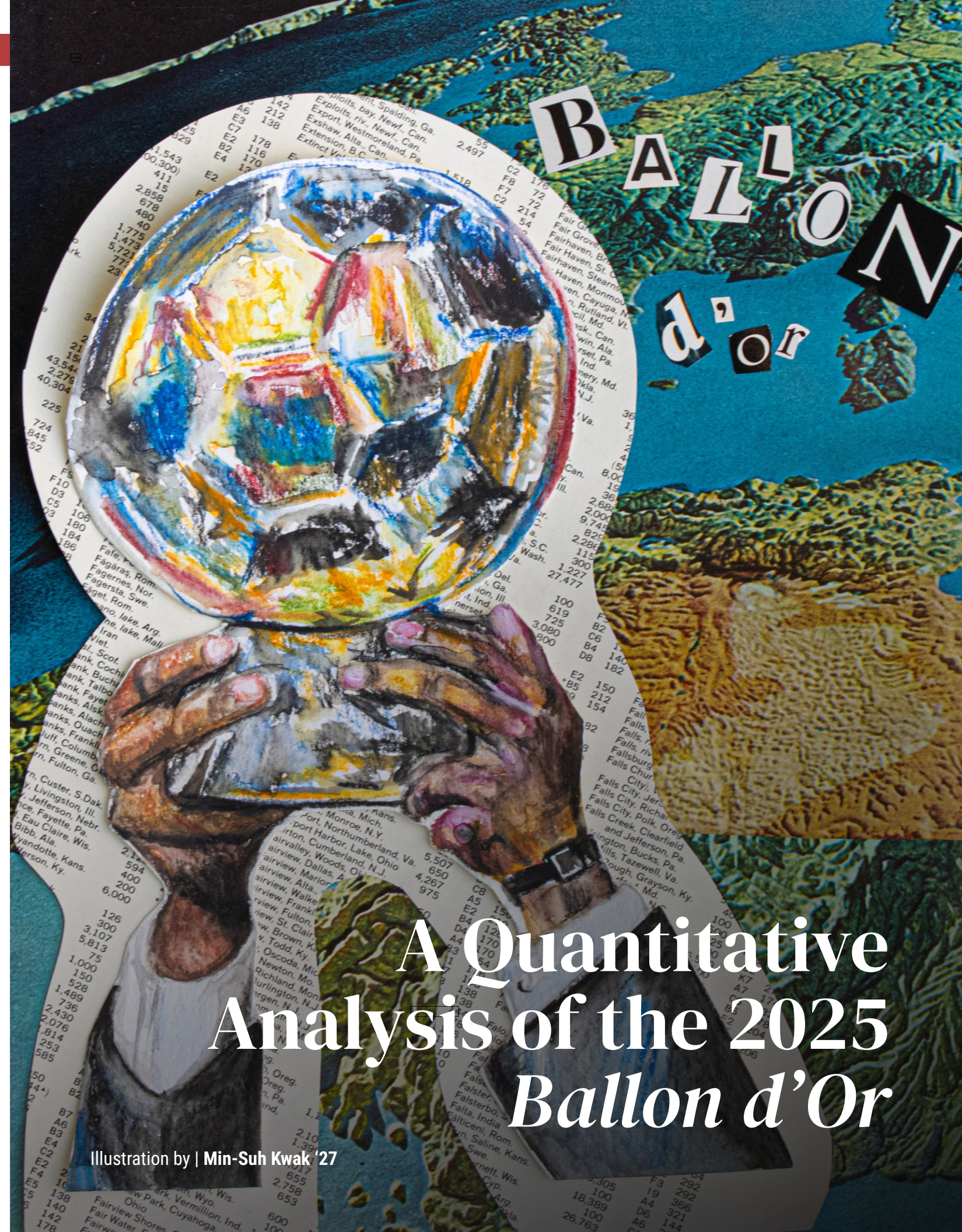
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A Quantitative Analysis of the 2025 Ballon d'Or

Illustration by | Min-Suh Kwak '27

ORIGINAL RESEARCH

A Quantitative Analysis of the 2025 Ballon d'Or

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The Ballon d'Or debate often reflects disagreement over whether the award recognizes pure on-pitch performance or a combination of performance, honors, and narrative. This tension implies two distinct analytical goals: evaluating performance-based "deservedness" and modeling how voters actually convert performances and achievements into rankings. We study the 2025 race with a nominee-only dataset and complementary methods—descriptive rankings, historical winner profiling, and within-season vote-share modeling—to address both perspectives. Using ridge regression with softmax normalization to map performance statistics and major trophies to expected voting outcomes, we find that including trophy indicators substantially improves ranking fidelity and identifies the correct winner on the held-out 2024–25 season. Uncertainty analysis via stratified bootstrap reveals clear predicted separation at the top of the ballot with the winner's dominance robust across resampled training sets. Taken together, these approaches show how different defensible framings of "deservedness" yield distinct conclusions and clarify the gap between performance-based expectations and realized voting outcomes.

1. Introduction and Research Questions

1.1 Motivation: Why 2025 is Debated

The Ballon d'Or is intended to recognize the world's best footballer over a season, yet the award's outcome often reflects a blend of individual performance, team success, and narrative. The 2025 race is debated because it plausibly admits multiple "best player" definitions that can yield different winners: (i) best underlying on-pitch contribution independent of trophies, (ii) most decorated season on the biggest stages, or (iii) the player whose season most resembles historically rewarded profiles. For instance, this split is perfectly illustrated by the debate over whether the underlying statistical dominance of a player like Mohamed Salah should outweigh the trophy-laden, high-leverage performances of Ousmane Dembélé. The public disagreement is therefore not merely about disagreements in statistics, but about disagreements in what the award functionally measures and how voters convert performances and achievements into points. This paper treats the 2025 controversy as an empirical question: given the historical voting record and nominee performances, what outcome would be expected under different defensible framings, and how large (or small) are the implied differences between the leading candidates?

1.2 Research Questions

This paper is organized around three research questions designed to separate descriptive performance claims from claims about voter behavior. To achieve this, the study combines descriptive performance analysis, historical winner comparison, and predictive modeling to evaluate the leading candidates.

RQ1 (Deservedness / performance). Among 2024–25 Ballon d'Or nominees, who had the strongest season according to reproducible performance evidence, and how sensitive is that conclusion to reasonable choices about efficiency, volume, and durability?

RQ2 (Closeness / uncertainty). How close was the 2025 race in expected vote share terms, and what is the uncertainty around the predicted separation between the top contenders?

RQ3 (Historical comparability). Was the 2025 winner's season similar to prior winners' when evaluated on consistent, normalized measures?

These questions are answered by triangulating across complementary methods: descriptive rankings, historical winner profiling, nominee-only vote-share modeling, uncertainty quantification, and transparent composite scoring.

1.3 Scope, Definitions, and Nominee-Only Framing

Unit of analysis. The fundamental observational unit is a player-season restricted to Ballon d'Or nominees. Each row corresponds to one nominee's club-season statistical record aligned to the Ballon d'Or voting associated with that season.

Population and selection. This is explicitly a nominee-only study. The dataset does not represent all professional footballers; it represents the subset of players the award ecosystem has already deemed award-relevant. This framing is deliberate: it matches the real decision problem faced by voters (choosing among nominees) and avoids conflating "not nominated" with "not worthy." However, it implies that conclusions should be interpreted as conditional on nomination. Consequently, this restricts the comparison to an already elite tier of footballers, meaning our conclusions evaluate marginal differences at the absolute upper echelon of the sport rather than against the global average.

Positions and exclusions. The main modeling analysis focuses on outfield nominees. Goalkeepers follow different statistical regimes and require a specialized feature set; mixing them into one model would generally degrade interpretability and fairness. Descriptive sections may mention goalkeepers where helpful, but the central comparative claims are for outfield players.

Outcome definition: voting points vs vote share. The award is

decided by voting points, but raw point totals can vary across seasons due to changes in voting scale and electorate. Therefore, the primary modeling target is defined as within-season vote share, i.e., each nominee's fraction of total points awarded that season among the nominee set being analyzed. This choice yields three advantages: comparability across seasons even if point scales change; interpretability as a "probability-like" quantity (nonnegative, sums to one); and natural alignment with the paper's "how close was it?" question, since differences in vote share are directly interpretable as gaps in expected support.

Performance vs résumé variables. We distinguish two conceptually different feature families: (i) performance features derived from match event aggregates (e.g., chance creation, scoring threat, progression) expressed per-90 where appropriate, and (ii) résumé/trophy indicators capturing team achievements and high-salience accolades. This separation supports two legitimate but different conclusions: "best on-pitch season" versus "most consistent with historical voter reward patterns."

1.4 Overview of Parts and Contributions

Part 2 (Data acquisition). We construct a dataset by collecting season-level player statistics from FBref and Ballon d'Or voting outcomes from structured sources.

Part 3 (Descriptive context). We rank nominees on interpretable baseline metrics (e.g., goals/assists, expected goals and assists, totals and per-90 variants) to provide transparent context and establish the main tradeoffs (volume vs efficiency, availability vs peak rate).

Part 4 (Winner profile and similarity). We characterize historically rewarded nominee seasons by examining associations between features and voting outcomes and constructing a past-winner profile. We then measure how similar each current nominee is to the historical winner profile, providing a complementary lens that is descriptive rather than predictive.

Part 5 (Nominee-only vote-share model). We train constrained models on past nominee seasons to predict within-season vote share, producing expected rankings for 2024–25 and decomposing discrepancies between predicted and actual outcomes. We include uncertainty quantification to estimate win probabilities and expected separation between the top contenders, directly addressing "how close was it?"

Part 6 (Synthesis). We discuss all methods to provide a robust conclusion, clearly separating performance-based claims from claims about voter behavior, and we document limitations and future improvements.

Part 7 (References). We list references, mainly our data sources.

1.5 Modeling Assumptions and Constraints

Small-sample regime and regularization. The nominee-only panel spans only a few seasons and a limited number of nominees per season. This imposes a strict bias-variance tradeoff: flexible models risk overfitting idiosyncrasies of a single season. By using regularized models like Ridge regression, we can prevent the algorithm from overreacting to highly correlated football statistics, such as expected goals and shot creating actions, thus reducing the risk of overfitting. Consequently, the modeling strategy prioritizes constrained, regularized approaches and evaluation metrics aligned with the project's decision goal (ranking) rather than only minimizing pointwise error.

Ranking is the primary estimand. The central inferential object is not an exact prediction of raw points, but the implied ordering of nominees and the magnitude of expected vote-share gaps. Therefore, rank-based metrics (e.g., within-season rank correlation, top- k inclusion) are treated as primary. Calibration of absolute share values is treated as secondary and is assessed cautiously.

Within-season normalization and comparability. The key comparability device is vote share rather than voting points. This implicitly assumes that, within a season, the nominee vote distribution meaningfully captures relative consensus, and that comparing shares across seasons is more stable than comparing raw totals under potential rule changes.

Season structure and dependence. Nominees within a season are not independent in the sense that their vote shares must sum to one and their narratives and team outcomes are correlated. Uncertainty estimation is therefore designed to respect season structure (e.g., resampling within seasons) rather than treating rows as independent and identically distributed observations.

Feature measurement and role heterogeneity. FBref aggregates are role-dependent (forwards, midfielders, defenders generate different distributions). Without perfect position/role control, any single "best season" ordering risks conflating role with value. The composite score (Part 5) mitigates this by grouping metrics into categories and by enabling position-aware normalization if labels are available, but the nominee-only data still limit fully causal interpretations.

Minutes/durability as both signal and confound. Availability is plausibly part of value (a durable elite season is different from a short peak), but minutes also mechanically inflate totals. The analysis treats durability explicitly rather than letting it leak implicitly through totals alone; however, it remains a core modeling tension and is addressed via per-90 features plus controlled durability terms and ablations.

Omitted-variable bias and narrative factors. Voting incorporates factors not captured by the statistical tables (e.g., international-tournament timing, media narratives, positional expectations, "big moments," leadership, prestige effects). The model should therefore be interpreted as predicting votes conditional on included measurable covariates, not as a complete causal explanation of voting.

2. Data Acquisition

2.1 Data Sources and Seasons

Performance features for all seasons were sourced from FBref via Engelmann, T.'s soccerdata Python package, and joined into one continuous DataFrame[A1.1][A1.2]. While publicly sourced datasets may be limited by their depth, detail, and accuracy, they are also the most accessible and reproducible. Data was collected for the 2021–2022, 2022–2023, 2023–2024, and 2024–2025 seasons. This range was chosen to match the switch in the Ballon d'Or voting format starting in 2021–2022, which switched the voting period from the calendar year to the European club season calendar. This DataFrame was subsequently supplemented through manual data-entry of résumé and trophy features sourced from Transfermarkt.

2.2 Fbref Scraping and Table Coverage

All available performance features were sourced from FBref for both outfield players and goalkeepers. Data ingested includes every player in the FBref database for the aforementioned seasons,

not just those who were nominated for the Ballon d’Or. FBref offers a wide breadth of performance features, including but not limited to, advanced metrics such as expected goals, shot types, pass types, set piece types, defensive actions, and goalkeeping actions.

2.3 Ballon d’Or Voting Points Collection

Ballon d’Or voting point totals for each year were added through manual data-entry. Totals were sourced from Wikipedia [1]. It should be noted that beginning in the 2022-2023 season, the Ballon d’Or voting system was changed from a 5-choice ranking system to a 10-choice ranking system. As a result, the total pool of voting points is larger for the 2022-2023, 2023-2024, and 2024-2025 seasons than it is for the 2021-2022 season.

2.4 Data Schema and Storage (Raw vs Cleaned)

Raw data ingested from FBref was accumulated into a single DataFrame and aggregated by name and season to avoid duplicates. Since observations were split by name and season, each observation is uniquely identifiable through its name and season features. We also cleaned the data by normalizing player names through the removal of accents and most special characters. After this process, we made several different datasets available in the data section of our GitHub repository. Depending on the dataset, they differ by both features and observations. Several of the files are dedicated to specific subsets of observations, such as nominees, outfield nominees, and goalkeeper nominees. These files only include the features relevant to their population, with the outfield nominees file including only outfield features, and the goalkeeper nominees file including only goalkeeping features.

3. Basic Nominee Rankings and Descriptive Context

3.1 Nominee Set and Exclusions

We began by comparing all the 2024-2025 outfield nominees directly based on various basic metrics. This not only served to help gain a better understanding of the data, but also to set a baseline for the rest of the analysis. Both total and rate metrics are included in the descriptive analysis. Calculating totals throughout a season-long time frame allows us to quantify total impact throughout the entire voting window, and rewards players who stay healthy, play consistently throughout the season, and log substantial minutes. On the other hand, rate and per-90 metrics allow us to measure productivity more directly by standardizing output to a common time basis (such as 90 minutes). This helps to control for differences in minutes played, which can be driven by factors outside of a player’s underlying quality or resilience (such as certain contact injuries, extra cup games due to team quality, and differing amounts of league games).

3.2 Volume Metrics: Totals

First, these nominees were ranked by several common key metrics accumulated across the entire season, beginning with non-penalty expected goal contributions. Non-penalty expected goal contributions is a common way to quantify the quantity and quality of chances a player has created for themselves and others. It is calculated by summing the probability of a goal resulting from every shot and pass a player takes throughout a season. According to BBC, expected goals “has become commonplace across football analytics” and is “is seen as a good indicator of how a player or team has been performing in front of goal” [2].

3.3 Rate Metrics: Success Percentages and Per 90 Efficiency

To gauge offensive efficiency, metrics such as non-penalty expected goal contributions per 90 and shot creating actions per 90 were plotted and compared on a peer-to-peer basis. These metrics allow us to quantitatively measure offensive efficiency, rewarding players who create chances for both others and themselves. As a measure of efficiency less skewed towards attackers, successful take-on percentage was also calculated and plotted using the following formula:

$$\text{Successful take-on \%} = 100 \times \frac{\text{Successful take-ons}}{\text{Take-ons attempted}}$$

3.4 Visualization Summaries for 2024-25

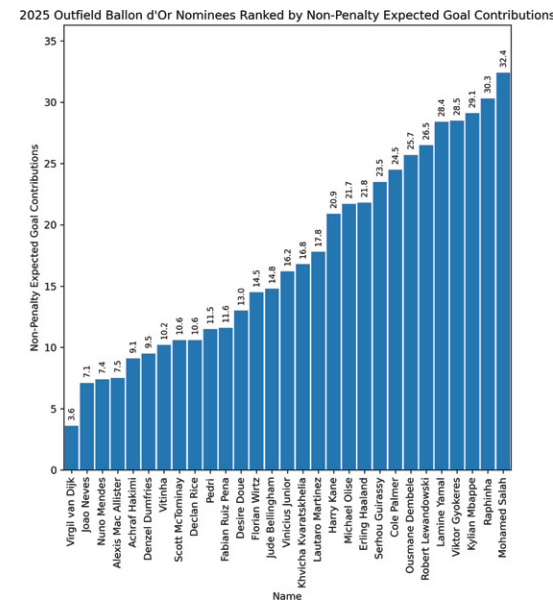


Fig. 1 | 2024-2025 outfield nominees ranked by expected non-penalty goal contributions. Higher values suggest a higher attacking impact across the entire season.

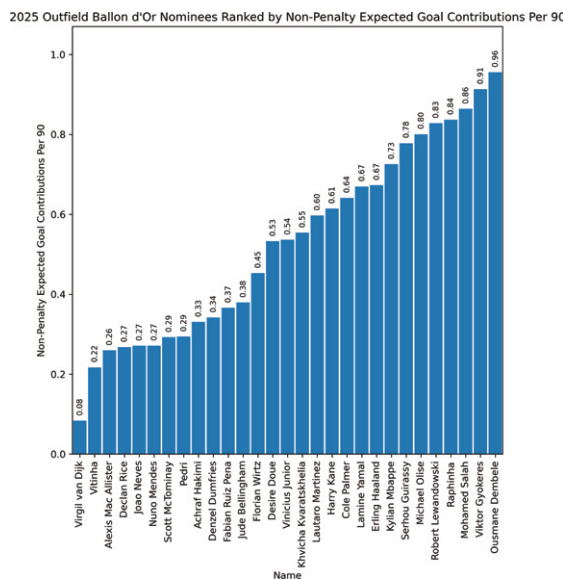


Fig. 2 | 2024-2025 outfield nominees ranked by expected non-penalty goal contributions per 90 minutes. Higher values suggest more efficient attacking productivity.

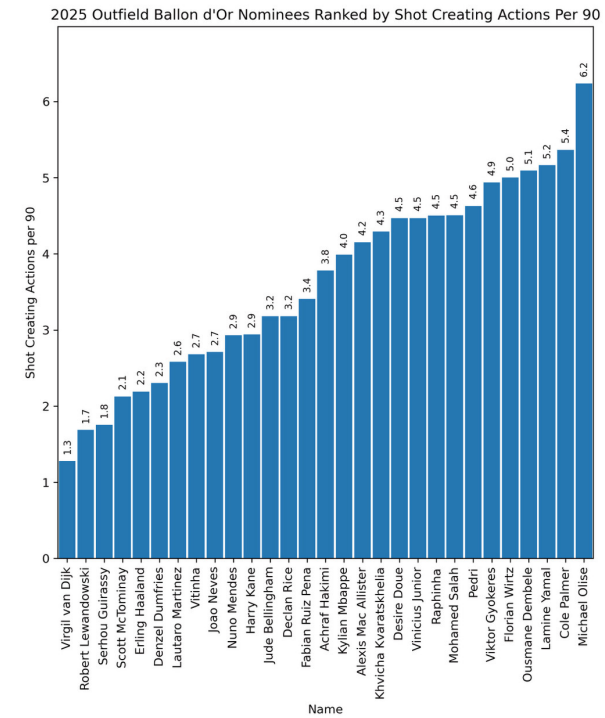


Fig. 3 | 2024-2025 outfield nominees ranked by shot creating actions per 90 minutes.

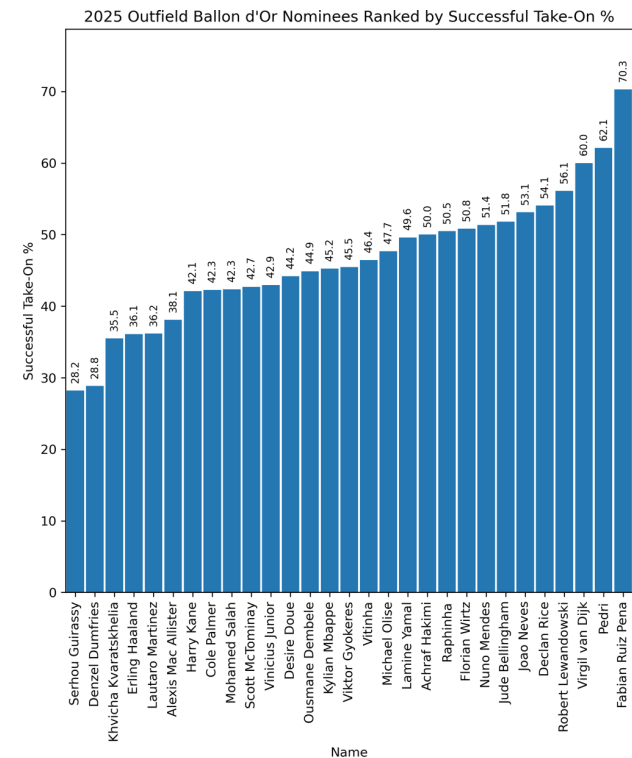


Fig. 4 | 2024-2025 outfield nominees ranked by successful take-on percentage.

3.5 2024-25 Descriptive Visualization Analysis

As expected, attackers dominate both the non-penalty expected goal contribution and non-penalty expected goal contribution per-90 graphs, with Mohamed Salah, Raphinha, and Viktor Gyokeres all occupying spots within the top 4 for both graphs. Interestingly, Ousmane Dembele goes from 7th to 1st when changing from the total to the per-90 regime, while Kylian Mbappe suf-

fers from the opposite problem. With respect to the shot creating actions per-90 graph, high usage wingers dominate the top spots, with the occasional creative central midfielder or striker appearing. Conversely, the successful take-on % graph is much more diverse in positional terms, seemingly accomplishing its goal of skewing less towards attackers. Notably, Virgil Van Dijk, a center back, ranks at 3rd, while Declan Rice, a defensive midfielder, sits at 5th. The top 2, Fabian Ruiz Pena and Pedri, are both also central midfielders.

4. What Past Winners Look Like: Correlation and Similarity

4.1 Feature-Vote Relationships (Correlation Ranking)

To determine the profile of a past Ballon d’Or winner, we first had to gain an idea of the factors that have influenced voting in the past. To do so, we used correlation coefficients to rank features by the strength of their association with within-season vote share. While correlation coefficients hold less statistical power and are generally more susceptible to outliers when used with small datasets, our sample of 84 previous nominees is large enough to draw general conclusions from. Correlation coefficients were calculated using Pearson’s correlation:

$$\rho_{X,Y} = \frac{\text{Cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}}$$

Here, x_i and y_i denote the i th observations of the feature and vote share (within a fixed season), \bar{x} and \bar{y} are sample means, σ_x and σ_y are sample standard deviations, and n is the number of nominees in that season.

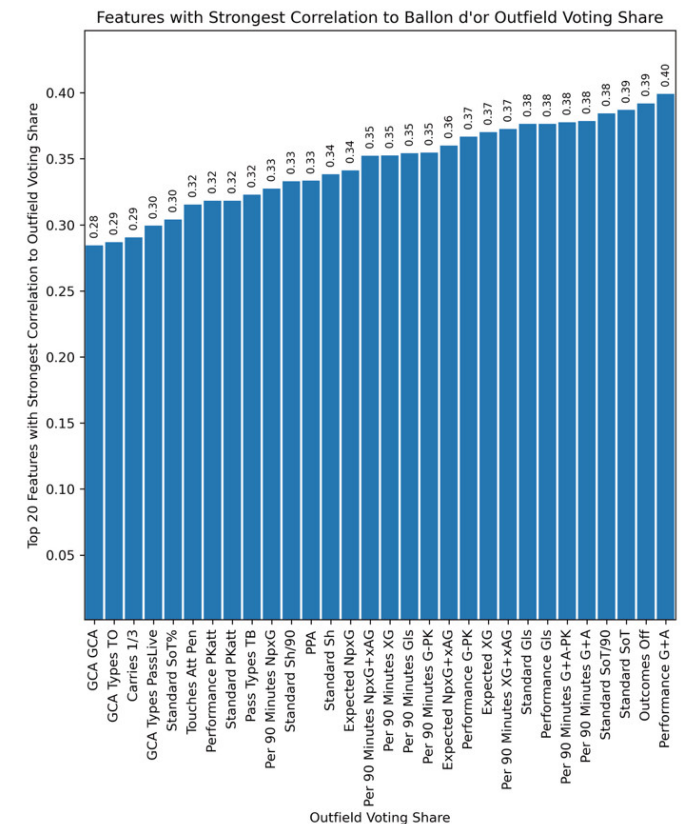


Fig. 5 | Features ranked by strength of their relationship with outfield voting share. Higher values suggest a stronger relationship.

4.2 Building a “Previous Winner Profile”

Using the statistics most strongly correlated with voting outcomes, we can construct a winner profile by summarizing how past winners tend to perform on these features. To ensure a complete winners profile, the selected features were not just the eight most correlated features. Rather, they were chosen to represent as many different areas of play as possible. The final chosen list of features (Goal Contributions, Shots on Target, Offsides, Passes into Opponent Penalty Area, Through Balls, Touches in Opponent Penalty Area, Open Play Passes, Expected Non-Penalty Goal Contributions) all have high correlations with vote share (> 0.3), and collectively represent metrics quantifying passing, shooting, positioning, and offensive output.

After choosing our features, we construct a “past-winner profile” vector by first converting each winner’s feature values into within-season percentile ranks (relative to that season’s nominee peers), and then averaging those percentile ranks across all the three previous Ballon d’Or winners in our dataset. Percentile ranks were chosen as the method of normalization because they are robust to outliers and quantify the dominance shown compared to peers within their season. We can therefore compute the vector $\bar{\mathbf{x}}$, representing the per-feature, peer-relative, average profile of past Ballon d’Or winners, with the following formula:

$$\bar{\mathbf{x}} = \frac{1}{N} \sum_{i=1}^N \pi_{s_i}(\mathbf{x}_{w_i}),$$

where $\pi_{s_i}(\mathbf{x}_{w_i})$ denotes the vector of percentile ranks for winner w_i in season s_i (computed relative to that season’s nominee peers).

4.3 Nominee Similarity to Past-Winner Profile

To quantify how similar a nominee is to past winners, we compare the nominee’s eight-feature vector to the past-winner profile vector. We can measure profile similarity using cosine similarity, which compares vectors by direction, but not magnitude. In this context, cosine similarity lets us compare nominees’ relative patterns across the eight features (i.e., which features they are stronger or weaker on), while being less sensitive to overall “scale” differences. A player’s cosine similarity to the past-winner profile vector ($\bar{\mathbf{x}}$) can be computed using the following formula:

$$\cos_sim(\pi_s(\mathbf{x}_i), \bar{\mathbf{x}}) = \frac{\pi_s(\mathbf{x}_i)^T \bar{\mathbf{x}}}{\|\pi_s(\mathbf{x}_i)\| \|\bar{\mathbf{x}}\|}$$

Cosine similarity lies within [-1, 1]. In our setting, because the percentile-rank feature vectors are non-negative, cosine similarity lies within [0, 1], where 1 indicates identical feature-direction patterns and 0 indicates orthogonality (no alignment).

4.4 Case Study: Top Contenders Comparison

With methodology established, we can now quantify players’ similarity to past Ballon d’Or winners. As a case study, we selected the four main Ballon d’Or “favourites” from the 2024-2025 season (Lamine Yamal, Mohamed Salah, Ousmane Dembele, Raphinha) [3]. These four players were widely viewed as the leading candidates for the award by the public, with all four players producing historic seasons. The spider chart below visualizes each of these favorites’ profiles, alongside the past-winners profile calculated in Section 4.2.

We can also plot their cosine similarity scores to the past-winner profile, visualizing which of the favorites’ archetype is closest to the winners from previous years.

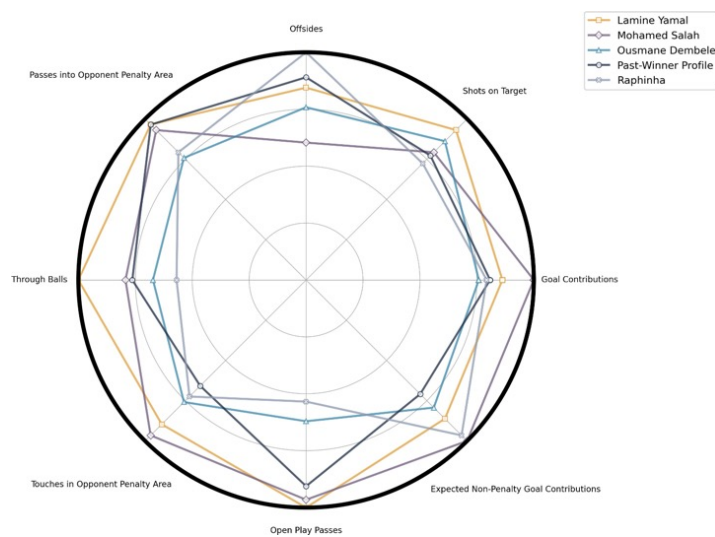


Figure 6 | The four main 2024-2025 Ballon d’Or favourites plotted against the past-winner profile.

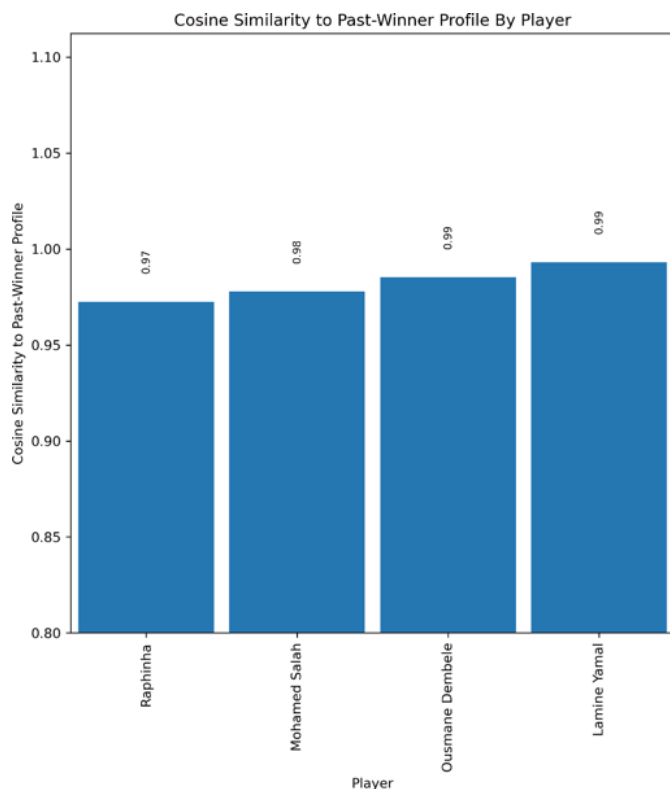


Fig. 7 | The four main 2024-2025 Ballon d’Or favourites ranked by cosine similarity to the past-winner profile.

5. Predicting Ballon d’Or Outcomes with a Nominee-Only Model

This section builds and evaluates a nominee-only predictive model of Ballon d’Or outcomes. The modeling goal is intentionally narrow: using only information observable from season performance and major trophy indicators, we predict within-season vote shares among outfield nominees and assess whether the model can (i) recover the overall ranking structure and (ii) identify the winner and close contenders. We treat this model as a struc-

tured, reproducible benchmark for the “deserved winner” debate: it formalizes a mapping from performance/trophies to voting outcomes, and it provides a way to quantify uncertainty in how close the top of the ballot was. This model is not a claim about objective player value. It is a structured approximation of historical Ballon d’Or voting behavior conditional on the performance and honors signals we observe.

5.1. Target Definition (Points vs Vote Share)

Ballon d’Or voting is recorded as total voting points. Because point totals are not directly comparable across years (e.g., changes in electorate size or voting rules) and because our model is trained across seasons, we define the primary target as outfield vote share within each season:

$$y_{i,s} = \frac{\text{Points}_{i,s}}{\sum_{j \in N_s} \text{Points}_{j,s}},$$

where i indexes an outfield nominee and N_s is the outfield nominee set for season s . This transformation produces a stable unit-free target in [0, 1] that sums to 1 within each season. It also aligns with the substantive question of “how much of the ballot” each nominee captured, and it enables cross-season training without requiring assumptions about point-scale comparability.

We restrict the modeling dataset to outfield nominees only. Goalkeeper voting is governed by different positional priors and feature relevance; mixing keepers and outfielders substantially increases model misspecification in a small-sample setting.

5.2. Feature Sets and Model Choices

Design principles. The dataset is small (four seasons with roughly 27–29 outfield nominees per season; ≈ 114 total rows). We therefore use a disciplined feature design and a model class that is robust to multicollinearity and overfitting. In particular, many football statistics are strongly correlated (e.g., different measures of chance creation, volume vs per-90 rates, minutes vs starts). Feature explosion can produce unstable coefficients and misleading inferences.

Model class: standardized Ridge regression. We use Ridge regression (L2-regularized linear regression) on standardized features. Ridge is well-suited to this setting: it shrinks coefficients smoothly under correlation and provides a stable linear scoring function that can be interpreted and stress-tested. This proportional shrinkage is preferable to alternatives like Lasso or Elastic Net, which tend to arbitrarily zero out highly correlated but contextually important metrics—such as actual goals versus expected goals—when we instead want to preserve the player’s complete statistical profile. Let $x_{i,s}$ be a feature vector. The model produces a real-valued score:

$$\hat{z}_{i,s} = \beta_0 + \beta^T \tilde{x}_{i,s},$$

where \tilde{x} denotes standardized features.

From scores to vote shares (within-season softmax). Raw linear scores are unbounded and may be negative; vote shares must be nonnegative and sum to 1 within a season. We convert scores to predicted shares using a softmax normalization within each season:

$$\hat{p}_{i,s}(T) = \frac{\exp(\hat{z}_{i,s}/T)}{\sum_{j \in N_s} \exp(\hat{z}_{j,s}/T)},$$

where $T > 0$ is a temperature parameter. Importantly, for fixed T , the softmax transformation is monotonic in \hat{z} , so the within-season ranking implied by \hat{p} matches the ranking implied by \hat{z} . This allows us to evaluate both rank quality (e.g., Spear-

man) and share-level calibration/residual magnitudes on a common scale.

Feature specifications. We evaluate several closely related feature specifications to understand which modeling choices matter most:

- **Performance-only (core):** a small mixed set combining attacking efficiency (per-90), creation/progression, and durability (minutes/starts).
- **Performance-only (all per-90 + durability):** resolves a common pitfall by expressing creative/progression totals as per-90 rates while keeping explicit durability variables. This is intended to reduce the confounding of “quality” with “minutes played.”
- **Performance-only (minimal durability):** a lighter durability variant.
- **Performance-only (log-target):** same disciplined per-90+duration features, but fits Ridge on $\log(y + \epsilon)$ (with very small ϵ) to emphasize relative differences among low-share nominees; predicted shares are still obtained via softmax.
- **Performance-only (simple metric + minutes):** a two-feature “sanity check” model using a single per-90 attacking metric and minutes.
- **With trophies:** the core performance set plus binary indicators for major trophies (league title, UEFA Champions League, domestic cup, major international continental trophy, World Cup). This specification approximates “voter behavior” by allowing a separate trophy signal beyond performance statistics. Because trophies are partly driven by team strength and context (and are therefore endogenous), we treat them as proxies for how voters reward honors rather than as causal drivers of individual quality.

Interpretability outputs. For transparency, we save standardized coefficient plots and permutation-importance plots (computed on the validation season) to illustrate which covariates drive the model’s predictions. These diagnostics are treated as qualitative (small n , correlated inputs) rather than as definitive causal statements.

5.3. Train/Validation/Test Design Across Seasons

Season splits. We use a strict season-based split to avoid leakage:

- **Train:** 2021–2022 and 2022–2023
- **Validation:** 2023–2024
- **Test:** 2024–2025

This design matches the real forecasting setting: the model is trained on past seasons and evaluated on a future season.

Regularization selection. For each specification we tune the Ridge penalty α on the validation season. We choose α by maximizing Spearman rank correlation between actual vote shares and predicted shares on 2023–2024. (Operationally, for each α we fit on training seasons, predict validation scores, transform to within-season shares via softmax, and compute Spearman.)

Temperature calibration. While ranking metrics are invariant to monotone transformations, share magnitudes affect residual-based analyses (e.g., “over/under-rated”) and “how close was it?” gaps at the top. Therefore, after selecting α , we calibrate the softmax temperature on the validation season by minimizing mean squared error between predicted shares and true shares on 2023–2024. We use MSE for interpretability in absolute vote-share differences (useful for residuals and “how close was it?” gaps), rather than a probabilistic scoring rule like KL or log-loss. This keeps or-

dering fixed but improves share-level interpretability.

Final evaluation. After selecting α and T on 2023–2024, we refit the model on train+validation seasons and evaluate once on 2024–2025.



Fig. 8 | Standardized Ridge coefficients for the with_trophies model (validation-trained). Trophy indicators and attacking efficiency/progression features receive the largest absolute weights, consistent with a combined performance-and-honors voting story.

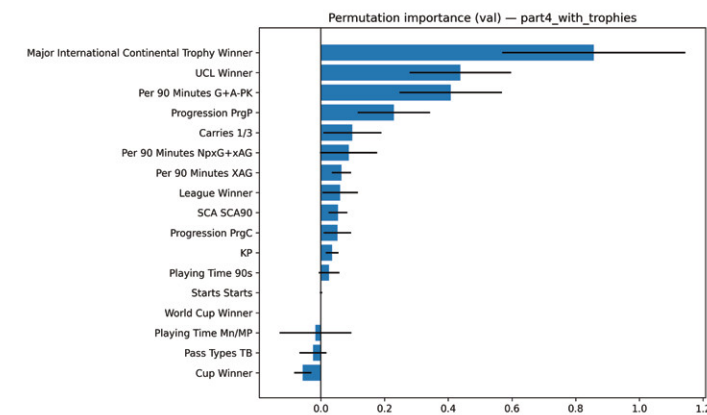


Fig. 9 | Permutation importance on the validation season for the with_trophies model (sanity check). The strongest degradations arise from trophy indicators and core attacking efficiency features, suggesting predictive reliance on these variables.

5.4 Results: Predicted vs. Actual Rankings

Evaluation metrics. We report:

- Spearman ρ between actual vote shares and predicted vote shares (ranking fidelity).
- Pairwise accuracy: the fraction of nominee pairs ordered correctly by the prediction (ties ignored). This is a robust, human-interpretable measure: “how often do we rank two nominees in the right order?”
- Winner rank / top-k hit rates: whether the actual winner is predicted at rank 1 (top-1), within top 3, and within top 5.

Our main finding is that trophies meaningfully improve predictive ranking performance. Across both validation (2023–2024) and test (2024–2025), the with_trophies model produces the strongest overall rank performance and successfully identifies the winner on the held-out test season. On the validation season (2023–2024), with_trophies achieves Spearman $\rho = 0.677$ and pairwise accuracy = 0.762, and it predicts the winner (Rodri) at rank 4 (top-5 hit). On the test season (2024–2025), with_trophies achieves Spearman $\rho = 0.573$ and pairwise accuracy = 0.705, and

it predicts the winner (Ousmane Dembélé) at rank 1 (top-1 / top-3 / top-5 all hit).

Baselines and ablations. A single-metric baseline using Per 90 Minutes NpxG+xAG is competitive on 2024–2025 in Spearman ($\rho = 0.297$) but does not win overall and does not consistently identify the winner across seasons. The “similarity-profile” baseline (cosine similarity to an average prior-winner profile) underperforms the main model on both seasons. Among performance-only variants, the disciplined per-90 + durability model (performance_only_all_per90_durability) correctly predicts the 2024–2025 winner at rank 1 but with lower overall rank fidelity than with_trophies (test Spearman $\rho = 0.177$, pairwise accuracy = 0.559). The log-target variant performs well on validation (Spearman $\rho = 0.512$) but degrades on test ($\rho = 0.062$), consistent with instability under small-sample tuning and distribution shift.

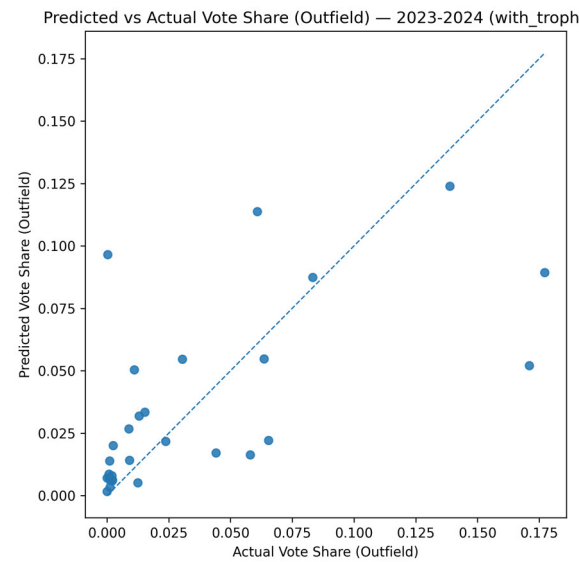


Fig. 10 | Predicted vs actual outfield vote share on the validation season (2023–2024) for the with_trophies model. The dashed line indicates perfect calibration.

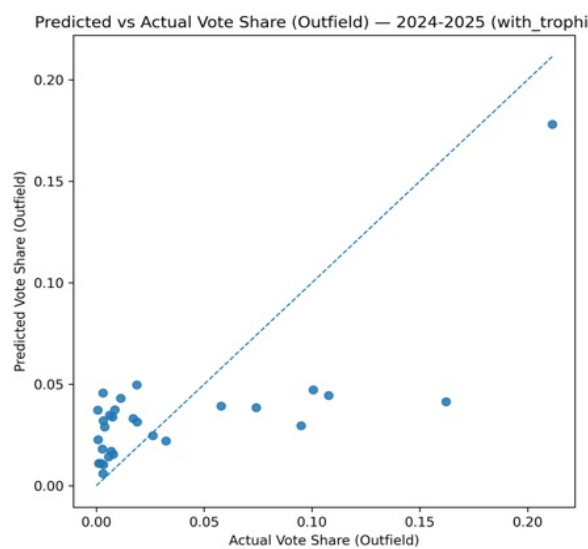


Fig. 11 | Predicted vs actual outfield vote share on the test season (2024–2025) for the with_trophies model. The model is strongest as a rank predictor; share magnitudes remain conservative relative to the most top-heavy realized vote outcomes.

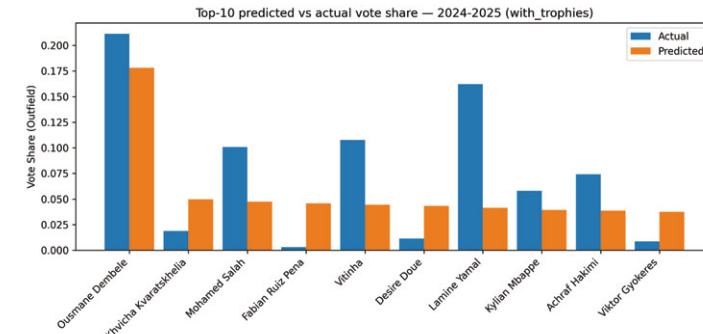


Fig. 12 | Top-10 nominees by predicted share (2024–2025, with_trophies). While the model successfully identifies the top candidate (Dembélé) first, it significantly compresses the vote distribution relative to the realized ballot. Specifically, the model heavily under-predicts the actual vote share for major runners-up like Lamine Yamal and Vitorinha, while over-predicting the shares of players who received negligible actual votes (e.g., Fabian Ruiz Pena and Desire Doue).

5.5 Over/Under-Rated Analysis (Residuals)

To characterize systematic disagreement between the model and the electorate, we compute residuals in vote-share space:

$$r_{i,s} = \hat{p}_{i,s} - y_{i,s}$$

Positive residuals indicate nominees the model rates higher than the ballot (“over-rated” by the model); negative residuals indicate nominees the model rates lower than the ballot (“under-rated” by the model). Residual interpretation should be handled cautiously: they may reflect (i) un-measured football contributions, (ii) narrative effects (media momentum, awards discourse), (iii) positional/role factors not captured by our features, and (iv) model misspecification or calibration limits.

In 2024–2025, the with_trophies model predicts the correct winner at rank 1 and produces a comparatively modest residual for Dembélé (−0.03), indicating reasonable calibration at the very top. The largest negative residuals instead belong to other high-vote nominees, most notably Lamine Yamal (−0.12), Raphinha (−0.07), and Vitorinha (−0.06), suggesting that the model systematically underestimates the share captured by the broader top tier. This pattern is consistent with a general limitation of small-sample, cross-season models: the realized vote distribution concentrates more sharply among a handful of favourites than the score-to-share mapping learned from prior seasons anticipates.

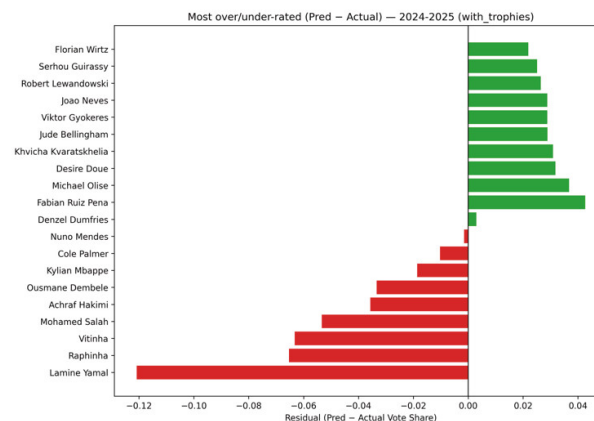


Fig. 13 | Largest residuals (Predicted minus Actual outfield vote share) for 2024–2025 under the with_trophies model. Bars to the right indicate nominees the model rates higher than the ballot; bars to the left indicate nominees the model rates lower than the ballot.

5.6 Robustness/Uncertainty

Bootstrap setup. To quantify uncertainty in predicted shares and, crucially, in “how close was it at the top?”, we apply a stratified bootstrap with 800 iterations. We repeatedly resample the training data within each season (preserving season sizes), refit the model, and re-predict 2024–2025. For each nominee we compute:

- a bootstrap mean predicted share,
- a $\approx 90\%$ interval using the 5th and 95th percentiles,
- and probabilities of finishing rank 1 / top 3 / top 5 under the model.

We additionally compute season-level closeness statistics from each bootstrap replicate:

- Top-1 gap: predicted share of rank-1 minus predicted share of rank-2.
- Winner gap: predicted share of the actual winner minus the best predicted share among all other nominees.

Closeness results (2024–2025). Under with_trophies, the predicted race shows clear separation at the top:

- median top-1 gap = 0.1008 share, with 90% interval [0.0178, 0.2148],
- Pr(top-1 gap > 0.02) = 0.93,
- median winner gap = 0.1008 share, with 90% interval [0.0126, 0.2148],
- Pr(actual winner ranked #1 by model) = 0.974.

The 90% interval for the winner gap lies entirely above zero, indicating that under the model’s uncertainty, Dembélé’s predicted first-place finish is robust across resampled training sets. This supports an interpretation of a dominant predicted winner under the trophy-augmented model, even though the model’s predicted share scale remains conservative relative to the realized ballot.

For comparison, the best validation-selected performance-only variant in our pipeline performance_only_logtarget produces a substantially different uncertainty story on 2024–2025, including a much lower probability of ranking the actual winner first (≈ 0.0925) and a negative median winner gap. This divergence highlights that uncertainty quantification is model-dependent and should be presented as conditional on a clearly stated specification.

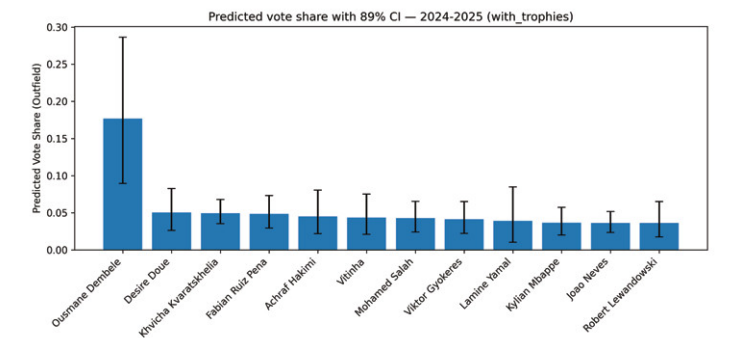


Fig. 14 | Predicted outfield vote shares for 2024–2025 under with_trophies with bootstrap 90% intervals (5th–95th percentiles).

Summary of contributions. This nominee-only model provides a reproducible, season-transferable framework for translating performance (and trophies) into expected vote-share outcomes. In particular, the with_trophies specification achieves the strongest rank performance on both 2023–2024 and 2024–2025 and identifies the winner at rank 1 on the held-out test season. The bootstrap analysis supplies a principled “how close was it?” lens by converting the model into an

uncertainty distribution over the top-of-ballot gap and winner dominance, conditional on the stated modeling assumptions; under with_trophies, that analysis points to clear predicted separation rather than a tight race.

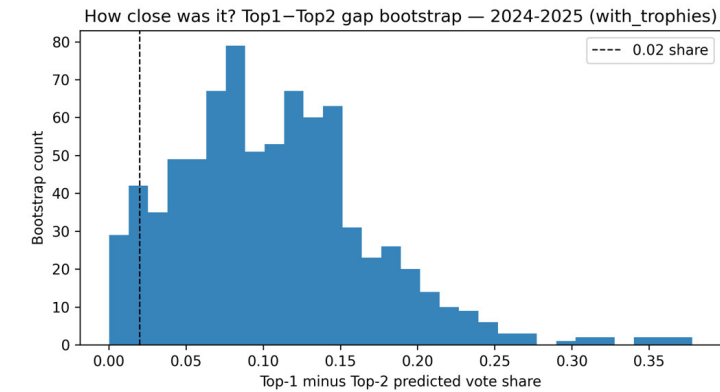


Fig. 15 | Bootstrap distribution of the predicted top-1 minus top-2 vote-share gap for 2024–2025 under with_trophies. The dashed line marks a 0.02 share threshold for interpretability.

6. Synthesis, Conclusions, and Limitations

6.1 Cross-Method Comparison Table

Metric	L. Yamal	M. Salah	O. Dembele	Raphinha
Actual outfield vote share	0.16 (2)	0.10 (3)	0.21 (1)	0.09 (4)
Non-penalty goal contributions per 90	0.67 (4)	0.86 (2)	0.96 (1)	0.84 (3)
Past-winner cosine similarity	0.99 (1)	0.98 (3)	0.99 (2)	0.97 (4)
Predicted outfield vote share	0.04 (3)	0.05 (2)	0.18 (1)	0.03 (4)
Outfield vote share residual	-0.12 (4)	-0.05 (2)	-0.03 (1)	-0.07 (3)

Table 1 | Cross-method comparison for top contenders.

6.2 Who Deserved to Win?

The question of "deservedness" depends entirely on the chosen framing of the award. If defined by pure offensive efficiency and output, Ousmane Dembele presents the strongest case, leading the nominees in non-penalty goal contributions per 90 (0.96) and predicted vote share (0.18). However, if the award is viewed as a measure of historical "archetype" alignment, Lamine Yamal holds the narrowest advantage with a cosine similarity score of ≈ 0.99 . The model demonstrates that while performance-only metrics are competitive, the inclusion of major trophies is what aligns most closely with realized voting outcomes. Ultimately, Dembele's victory at rank 1 in both the realized ballot and the "with trophies" model suggests he was the most consistent choice under the historical voter reward pattern.

6.3 How Close Was It?

The 2024-2025 race was characterized by a moderate victory by Dembele, with Lamine Yamal also capturing a large portion of the vote share. Our model suggests Dembele was more dominant in "expected" terms than the final realized point totals imply. While Dembele captured a realized vote share of 0.21, the model predicted a similar share of 0.18, resulting in a relatively small residual of -0.03 . Bootstrap analysis supports the interpretation of a sizable victory for Dembele: Median Top-1 Gap = 0.1008 with a 90% confidence interval of [0.0178, 0.2148]. Furthermore, the probability that the top-1 gap exceeded a 0.02 share was 0.93, indicating that despite the model's uncertainty, the separation between the top contender was statistically large.

6.4 How Did the Winner Compare to Prior Years?

As shown in both Figure 7 and Table 1, all four selected favorites

from the 2024-2025 season (Lamine Yamal, Mohamed Salah, Ousmane Dembele, Raphinha) aligned closely with the past-winner profile under our cosine-similarity measure. Lamine Yamal has the highest similarity score (≈ 0.99), but the differences across the four players are small (≈ 0.02 spread) and should not be over-interpreted. Overall, each of the four favorites appear broadly consistent with the historical winner profile according to this methodology.

6.5 Limitations and Future Work

As we conducted the study, a number of limitations occurred, mainly relating to data and methodology.

Data Errors. While FBref is widely considered a reliable public data source, it is possible that other small, undetected errors were present in the ingested dataset.

Cosine Similarity Limitations. The use of cosine similarity also leads to a limitation in methodology. Since cosine similarity effectively measures angles between vectors, it does not account for magnitude. This means our methodology will reward those with similar patterns of play relative to their peers with higher similarity scores but cannot account for factors like absolute output. Further analysis would be required to establish a methodology capable of rewarding similar output levels to past winners.

Other Voting Factors. Because of the nature of the data, several key voting factors could not be accounted for. Such factors include narratives, weighted importance of games, and team quality. Further analysis in areas like semantics, detailed tournament-specific statistics, and team quality features could better account for such discrepancies.

6.6 Reproducibility

On January 27, 2026, Opta announced the end of its partnership with FBref. This means that most advanced features gathered for this analysis may stop being available through Engelman T.'s soccerdata Python package. As such, our data will be published in the project's GitHub repository to aid in reproducibility.

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Filling the Holes in Porous Media: Metadata Assessment and Accessibility in the Digital Porous Media Portal

ORIGINAL RESEARCH

Filling the Holes in Porous Media: Metadata Assessment and Accessibility in the Digital Porous Media Portal

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The Digital Porous Media Portal (DPMP) is a repository of 176 datasets and terabytes of data. The applications of its data are scattered across a number of disciplines and areas of ongoing research including but not limited to geothermal engineering and aquifer mapping. Operators of the DPMP intend to make datasets easily accessible and searchable to facilitate data reuse. But understanding to what extent the DPMP is accessible requires knowledge of the metadata not initially available. This paper outlines the development of three metadata curation tools for the DPMP. The first of these replicates a tool used by other repositories to simply assess whether and which metadata fields are filled by each dataset. Recognizing the lack of nuance provided by this tool, another curation tool, backed by a Large Language Model, was created to grade and provide feedback on the content of dataset descriptions instead of merely availability. Having assessed metadata quality, the final tool—an AI chatbot (Rocco) backed by a graph database—was constructed to provide users with the ability to search the repository using natural language queries.

1. Introduction

Data reuse is a critical practice, allowing for the conservation of limited research resources. But it is only possible for those who know where to find the data. This makes creating repositories that centralize datasets for a particular domain a necessary step in achieving accessibility. One such repository is the Digital Porous Media Portal (DPMP). Over ten years, the DPMP has accepted 176 datasets, containing everything from fluid flow simulations to high-definition rock scans. It makes all data, no matter file size, accessible to download by anyone, as long as they sign up for a free account. Many portals charge for such a service but the DPMP does not, in the hope of encouraging reuse of the data it contains. But simply storing the data is not enough to adequately facilitate reuse. This paper details the development of three tools to benchmark and improve metadata in the DPMP with the objective of promoting the findability and accessibility of its datasets. The first of these, outlined in Section 3, replicates a tool used by other repositories to simply assess whether and which metadata fields are filled by each dataset. Recognizing the lack of nuance provided by this tool, another curation tool detailed in Section 4, backed by a Large Language Model, was created to grade and provide feedback on the content of dataset descriptions instead of merely availability. Having assessed metadata quality, the final tool—an AI chatbot (Rocco) backed by a graph database—was constructed according to Section 5 to provide users with the ability to search the repository using natural language queries.

2. Prior Work

As datasets grow in size and complexity, more applications to automate curation tasks are being developed. Examples like the DataONE metadata assessment tool [1] and Fuji [2] focus on checking data, metadata, and repository capabilities against FAIR standards and return structured feedback for improvement. These

FAIR standards (findable, accessible, interoperable, and reusable) are important guiding principles facilitating data reuse among researchers. The DPMP does not have tools like DataONE [1] or Fuji [2] available to it, which hinders reuse capabilities. But as the repository continues to grow and as it expands its focus from just rocks to porous media more generally, understanding the health of its metadata is vitally important to its continued success. Section 3 of this paper will outline the development of a similar tool for use in the DPMP.

There is also room to improve these tools beyond their current capabilities. Their greatest restriction at the moment derives from the fact that they are not equipped to make assessments of content.



Consider any metadata written by the user, such as descriptions of the data. Tools like DataONE may track information like word count but this lends little insight into the quality of the description's content. This severely limits our understanding of the quality of the metadata by reducing it to mere presence or absence.

The recent advancements in Large Language Models (LLMs) have opened the door to potential solutions to these shortcomings. But application of LLMs to data curation tasks is still quite new. Researchers in [3] used LLMs to generate new metadata intended to help improve the findability and accessibility of datasets for users. Applications of LLMs for interoperability and reusability have been explored further in [4], which seeks to address failures of individual datasets to follow defined domain standards including data types and metadata field names. Both papers acknowledge the novelty, imperfections, and difficulties of applying LLMs to data curation tasks.

Section 4 of this paper presents prototypes for a tool which uses LLMs to assess the content of user-written metadata. This tool is similarly situated to those works [3, 4] insofar as it applies LLMs to a new task in data curation with the goal of promoting FAIR principles. This tool, using general and domain-specific guidelines, will assess descriptions of datasets by grading them against a set of predetermined guidelines and providing suggestions as to how users can address the shortcomings identified.

LLMs have also shown promise as tools to assist researchers in finding datasets. Some repositories have experimented with LLMs preprompted with the metadata files stored as .json objects [5]. This is functionally Cache Augmented Generation (CAG), in which the LLM informs its answers using all context provided by the user. In this case, that context is the repository metadata. However, current models are limited by the amount of context they can use to inform responses. The scale of many repositories, including the DPMP, is so great that the text of all metadata would far exceed this limit on context and make CAG unworkable. Retrieval Augmented Generation (RAG) may provide a solution. By first identifying the most relevant datasets and then providing only that metadata as context, the issue of scale can be addressed. This is analogous to searching Google and reading the top websites to answer your question instead of trying to read every website on the Internet.

An LLM-backed query interface would have clear utility for the DPMP, allowing researchers to navigate all DPMP metadata with simple natural language questions. But implementations like those in [5] are not scalable. These applications work for repositories of limited size but for those like the DPMP with 176 datasets, two issues arise. First, consumer products like ChatGPT will only accept so many documents, even with paid premium access. If the current load of metadata does not exceed imposed limits, it may do so soon. Second, the RAG techniques of ChatGPT are a complete black box. How these consumer-ready models work is proprietary information and is not available for inquiry or revision during the development process. Such a tool must therefore be specially fitted for the DPMP. Section 5 of this paper outlines the development of such a tool.

3. Repository-Wide Metadata Evaluation

The first tool for assessing the metadata in the DPMP is not content aware. It is a spreadsheet designed to visualize the presence or omission of metadata fields for each dataset. A tool like this works on the same premise as DataONE. It gauges simply whether or not certain fields were filled out by dataset authors. All

information is displayed in a single Excel spreadsheet with each row corresponding to a dataset and each column corresponding to a metadata field of interest. When a field is filled out, that cell will be given a 1; when it is left empty it will be given a 0. If a dataset has multiple nodes of the same type, the same metadata field will be averaged across all nodes of that type. For instance, if a dataset contains three samples but only one lists the geographical location, the cell for that row would list 0.33 as can be seen in Fig. 1. For ease of understanding, the spreadsheet is also color coded. Cells with a 1 are green, those with a 0 are pink, a 0.5 is white, and values in between fall on a continuous color scale.

3.1 Methodology

The spreadsheet was assembled primarily using *openpyxl*. All the metadata for the DPMP are stored in .json files. These metadata are not the actual bulk of the data (e.g. the simulations or scans) but instead contain information about the data like titles, porous media type, and sample collection date. The information is regularly structured according to the data model outlined in [6] (see Fig. 4) and implemented in [7]. The structure is centered on a dataset node which has properties like "title" and "description." The actual data may be one of three things: a "sample," "digital dataset," or "analysis dataset." Each has its own distinguishing properties. Datasets are usually structured such that samples branch to digital datasets and digital datasets branch to analysis datasets. This can be seen in Fig. 5 where yellow nodes (samples) branch to blue nodes (digital datasets) which in turn branch to red nodes (analysis datasets). Related publications (green nodes) are also connected to many datasets.

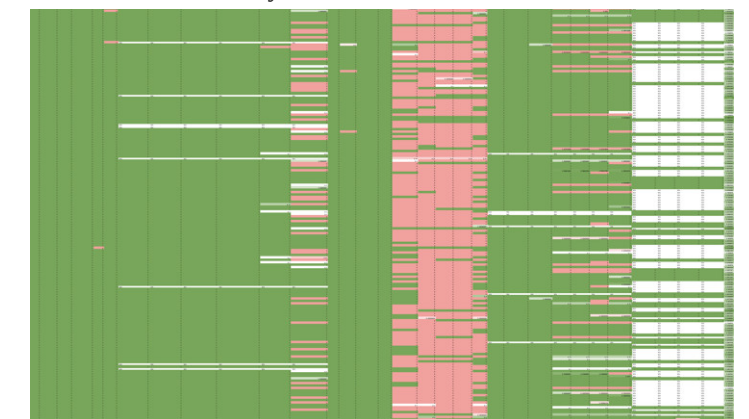


Fig. 1 | Metadata evaluation spreadsheet

Once all 176 of these files had been scraped and assembled into a single folder, each one was analyzed in turn. Because of their regular structure, traversing the objects for information of interest was merely an extensive exercise in data structures. Filtering out of some user inputs like "N/A" or "-" was necessary but mostly the content was either there or not. Because some datasets do not include some types of nodes, segments of rows were filled with "N/A" to indicate that type of node was not present in the dataset.

A "totalScore" column is also provided, which averages out all scores across the row for each dataset. It is calculated according to a user provided "requirement_weight" which affects how required fields are accounted for in the average. This is because if a field is required, it must have been filled out by the user. Every dataset therefore shares at least a baseline percentage of fields which have been completed. If a curator is curious about the completion of fields not required, "requirement_weight" may be set to zero.

3.2 Results

Fig. 1 provides a view of the metadata assessment of the entire portal. Although no particular fields may be discerned from the image, clear patterns of missing data appear, notably a block of red running top to bottom just right of center. This block corresponds with a number of sample properties including grain size and geographical location. While so much red may at first seem concerning, it would come as no surprise to most experts.

There is a reason not all fields are required, and it is because not all of them are relevant for all samples. Not all or even most samples are valuable rock cores. Some are handfuls of sand bought from a hardware store. They have no geographical location because they are thrown away after use. In other cases, properties like porosity cannot be measured while simultaneously conducting the experiment. This result, more than anything, demonstrated the limitations of a metadata assessment like DataONE's; it fails to factor in context and cannot assess content.

4. Assessing Dataset Description Content Grading and Improving

Dataset descriptions are to datasets what abstracts are to papers. They are the first focus of attention for those looking for data. Their text is indexed and used to improve search results across different platforms, enhancing data discoverability. Ideally, they give readers a snapshot of dataset content, source, collection methodology, and purpose. But the dataset descriptions of the DPMP fall far short of this standard. The median word count is 103, too short to be meaningfully descriptive. A qualitative review of a subset of descriptions showed that many did not focus on the dataset but on the research findings, some included information already provided in other metadata fields, and others did as little as thanking contributors.

4.1 Guidelines

Considering this problem, we devised a set of ten norms which researchers submitting their datasets should use to evaluate and improve their descriptions. These guidelines included content requirements like the porous media involved and methodology as well as style requirements like clarity and conciseness. The guidelines were developed collaboratively by a data curator (Dr. Maria Esteva) and a domain specialist (Dr. Masa Prodanovic) to make descriptions clear, concise, and relevant to porous media. But concern that future submitters would fail to attend to these guidelines led us to develop an LLM-based tool to evaluate and improve dataset descriptions. This application focuses on content quality by embedding general dataset description best practices with those specific to porous media. This "grader" provides an evaluation of a draft dataset description by scoring it against each guideline. A prototype of the "writer" was also developed to take that evaluation and propose changes for the author's consideration.

4.2 Grading Descriptions

The grader, like most LLM applications, must be prompted in such a way so as to minimize the chances of hallucinations, crude analysis, and even simple arithmetic errors. The guardrails that we proposed for our grader consist of three main components: clear guidelines, few-shot prompting, and encouraging chain-of-thought reasoning.

One frequent strategy for AI use today is known as 'zero-shot prompting,' in which the user tasks the LLM without providing

any examples. By contrast, 'few-shot prompting' guides the model by providing user-approved cases of what an input and its corresponding output should look like. Thus, when prompted with a new case, the LLM already has a structure with which to formulate its answer and will demonstrate greater competency [8]. In our case, we provided three examples of dataset descriptions which had been hand-graded by Dr. Esteva. Examples of varying quality were intentionally chosen to showcase to the LLM exemplary, middling, and poor descriptions.

The grader also takes advantage of 'chain-of-thought' (CoT) strategies. CoT prompting and reasoning have been shown to dramatically increase the reliability and accuracy of LLM responses to complex, multi-step problems across numerous models [9]. CoT reasoning decomposes problems, in this case evaluating each guideline individually, and allows the model the opportunity and space to justify its answer. This behavior can be observed under the "LLM Evaluation" heading in Fig. 2 which shows an LLM-graded description. Encouraging the model to walk through its reasoning has the added benefit of making the grader a better diagnostic tool. Were researchers to use it for their descriptions, they would know not just which guidelines were deficient but also why they were and how descriptions could potentially be improved. This CoT behavior is encouraged by the same examples which serve to few-shot prompt the LLM. These examples do not simply say that the description is insufficient in addressing a certain guideline, but why.

DRP-202

Original Description: The dataset contains time-resolved synchrotron X-ray micro-tomographic images (grey-scale and segmented) of a waterflood experiment in a mixed-wet Ketton limestone sample. The tomographic images were acquired at a voxel-resolution of 3 μm and scanning time of 7 s. The data were collected at the TOMCAT beamline of the Swiss Light Source of the Paul Scherrer Institute (PSI SL5), with the aim to investigate pore-scale processes in crude oil - brine - rock systems. Understanding such pore-scale processes is important for applications such as oil-recovery and environmental remediation. Further details on experimental protocols can be found in Ricker (2018). These time-resolved tomographic images can be used for investigations on flow dynamics in mixed-wet systems as well as for validation of pore-scale displacement models such as direct simulations, pore-network and neural network models.

LLM Evaluation: Here are the ratings for the given description:

- 1 point for focusing on describing the dataset so it can be understood independently from related research products, as it provides details about the dataset's content and characteristics.
- 1 point for describing the context in which the dataset was created (study goals), as it mentions the aim to investigate pore-scale processes in crude oil-brine-rock systems.
- 1 point for mentioning the type(s) of porous media being investigated, as it specifies that the dataset involves a mixed-wet Ketton limestone sample.
- 1 point for addressing the research problem that the data is helping to solve (high-level research question), as it mentions understanding pore-scale processes important for applications such as oil-recovery and environmental remediation.
- 1 point for addressing how (validation of pore-scale displacement models) and who will benefit from reusing the data (researchers investigating flow dynamics in mixed-wet systems), as it mentions potential uses for the dataset.
- 1 point for describing the methodology for data collection (imaging), as it provides details about the synchrotron X-ray micro-tomographic images, voxel-resolution, and scanning time.
- 0.5 points for partially providing an overview of the contents of the dataset (types of files: grey-scale and segmented images), but it lacks information on the organization and structure of the dataset.
- 0 points for not indicating if the data was quality controlled.
- 1 point for keeping descriptions clear and accessible for experts, although some technical terms are used; it is still understandable.
- 1 point for including keywords that will help others search for the data (e.g., "synchrotron X-ray micro-tomographic images", "waterflood experiment", "mixed-wet Ketton limestone", "pore-scale processes").

Fig. 2 | Example input description and output evaluation as assessed by Llama-4-Maverick

Chain-of-thought reasoning does present a few challenges, mainly a lack of guaranteed structure. Not constricting the LLM as to how it will format and print its score makes it harder to extract those scores for each guideline and the final score overall. There are several options for collecting this information. Early iterations asked the grader to give its final score only at the end and that number was extracted using regular expression matching. This however did not allow for a breakdown by guideline. Additionally, letting the LLM add the final score together often introduced arithmetic errors. In the current version, the grader finishes an evaluation and that evaluation is passed to the LLM again. This time it is asked to output an ordered list of tuples which contain first the guideline number and second the score given in the evaluation. This output may then be parsed and used to provide an overall score as well as the full breakdown.

An evaluation of the entire portal (Fig. 3) reveals a dismal average score of only 4.65 out of 10. Just over 8.5% of descriptions scored an 8 or above, further suggesting an overall low quality.

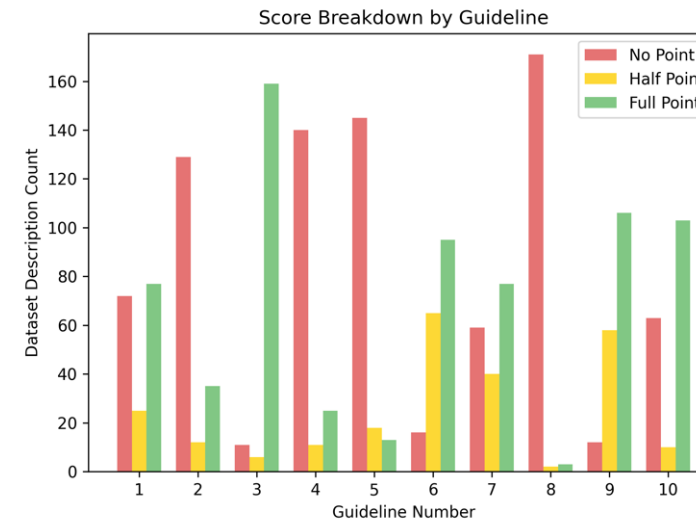


Fig. 3 | Distribution of scores in the DPMP broken out by guideline

Across descriptions, high compliance levels for guidelines 3 and 6, and low compliance for 4, 5 and 8 reveals that while most researchers describe the materials and methods used to obtain the dataset, the research questions that motivated the creation of that dataset, their potential reuse cases, and how they are quality controlled are seldom addressed. More work must be done to ensure the consistency and accuracy of the grader, ideally by collecting a sample of hand-graded examples by experts and comparing scores. Such resources were not available though at time of writing.

4.3 Improving Descriptions

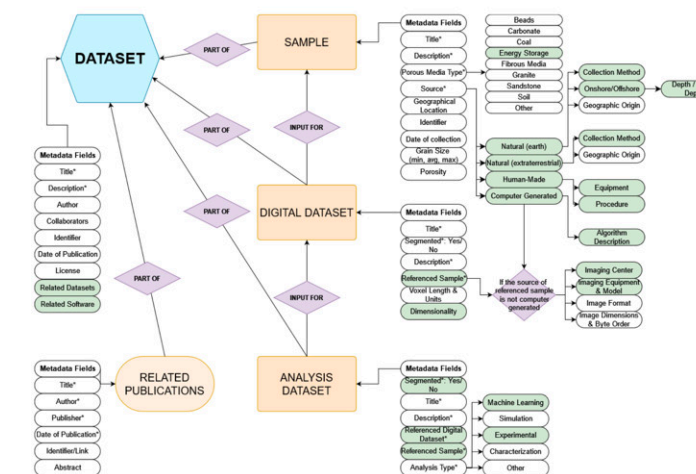


Fig. 4 | Data model created in [6]

Having diagnosed issues using the grader, the resulting evaluations can be used to inform an assistive writing tool intended to improve the quality of the dataset description with the guidance of the user. A preliminary prototype of this application has been developed to improve those dataset descriptions already present on the DPMP. In its deployable form, the application will work dynamically with the user, providing feedback and asking questions to help fill in missing information. The benefit of this system is that the model is much less likely to hallucinate or address missing information with guesses it makes from its pretrained knowledge. Instead, it will prompt users (the researchers submitting their datasets) for information which the authors will likely have access to.

In this first prototype, instead of having a researcher provide answers dynamically, we fill that gap with the text of the related papers listed by the author to inform the LLM. This serves as a proof-of-concept to demonstrate LLMs can improve descriptions against the set of guidelines provided. These papers were collected manually and then converted to strings of markdown text using the Python library *pymupdf4llm*. The LLM is instructed to take in a description, guidelines, a grader's assessment (provided by the grader), and related papers. From all of this, it is told to write a revised description, keeping original language when possible. All this information provides the LLM with what should be adequate knowledge to improve the descriptions. Early tests showed promising results on a handful of descriptions. But prompting strategies must still be refined for this static version of the writer and even more extensive work must take place to create a dynamic, deployable application.

5. Rocco, The Digital Porous Media Portal Curator

While dataset descriptions may be useful for researchers, they are only one strand in a wider web of metadata. Even perfect dataset descriptions would not contain all information the researcher requires. Researchers instead might be curious about one of the dozens of attributes of a sample, digital dataset, or analysis dataset. The difficulty of navigating those branches of a dataset can discourage researchers from finding relevant data for reuse, especially when the only search tool available is limited to precise keyword matching. Ideally, a tool would accommodate even those users with the broadest of research interests and guide them to useful datasets without prior knowledge of what the DPMP contains or how to use it.

For this purpose, we created a Digital Porous Media Portal Curator named Rocco. Rocco is a Retrieval Augmented Generation LLM application with specialized knowledge of the DPMP and its contents. From a graph database, Rocco can conduct direct queries against the metadata and semantic searching against the dataset descriptions. There is no need for the user to understand the workings of the DPMP, they may instead ask simple, natural language queries. Responses are likewise delivered in natural language. This application supports any researchers approaching the DPMP, no matter their familiarity or experience. Such accessibility lowers the barriers for data reuse dramatically.

5.1 Conversion of Raw .json Files to Neo4j Graph Database

Given the scalability concerns identified with preprompting all the .json files in a Cache Augmented Generation manner, Retrieval Augmented Generation presents advantages. Effective retrieval allows Rocco to carve an answer out of the database with a mallet and chisel instead of a jackhammer. Implementation with a graph database has clear benefits. The node and directed edge structure permits the storing of relational information. And open-source database software systems like Neo4j have worked to make integrating instances of their databases with LLMs and other code straightforward, even creating free courses with tutorials to follow. Neo4j allows users to create free, local instances of a database without restrictions. Given all these factors, we chose to use Neo4j to organize our data for implementation of our application.

The conversion from raw .json files to the Neo4j database required the use of Neo4j drivers in Python [10]. Drivers allowed the creation of nodes and relationships directly from a Jupyter Note-

book. Variables could be dynamically entered, which was vital for inputting all available information. This project was developed using a local instance of a Neo4j graph database on a virtual machine (VM) provided by the Texas Advanced Computing Center (TACC). This database stored the metadata and made it accessible for retrieval.

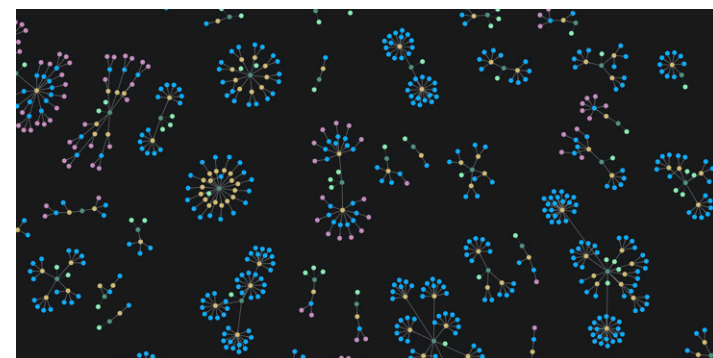


Fig. 5 | Graph database implemented in Neo4j

With the ability to parse the .json files into Python objects, the brunt of the work was traversing those objects and assigning their values to nodes and relationships in the graph database. To every extent possible, the data model shown in Fig. 4 served as a blueprint. Datasets, samples, digital datasets, analysis datasets, and related publications are all stored as nodes. Given that they contain their own information, related software and datasets will also be given their own nodes as they become a feature of the DPMP. Relationship names and direction conform to the data model and all properties listed were included. A few extra properties including file type, number of files, and dataset number were added where appropriate. A subset of the database is visualized in Fig. 5. Each isolated shape represents the metadata of a single dataset with a dataset node at the core with sample, digital dataset, analysis dataset, and related publication nodes branching out. All follow the schema laid out in Fig. 6 which is designed to emulate the data model in Fig. 4 and [6].

5.2 Rocco Formation

The models used in Rocco's construction were Meta's Llama-4-Maverick for natural language capabilities and intfloat's E5-Mistral for embedding, which were both used for their availability on the TACC's SambaNova systems. With three distinct systems to manage—Neo4j, SambaNova, and the VM—integration into one cohesive application was by far the most time intensive of all steps involved in the creation of Rocco. The structure of the application was based heavily on the Neo4j course *Building Knowledge Graphs with LLMs* [9]. The application structure is built using the libraries *LangChain*, which guides the pipeline between the LLM and the database, and *Streamlit*, which handles the user interface. Rocco has two tools from which to draw while answering user questions: natural language to Cypher query (querying) and vector similarity searching between a user query and dataset descriptions (semantic searching). Using whatever is returned by either of these searches, Rocco will report back to the user in natural language what the search found.

5.3 Querying

Neo4j graph databases operate using a language called Cypher. This was the same language used in conjunction with the driver described in Section 5.1 to create the database from .json

files. Writing Cypher queries is like any coding language; it is syntactically sensitive. Without full knowledge of the database structure and labels, even users with experience coding Cypher would struggle to write queries. And users without experience would find the database completely unapproachable. The query tool allows Rocco to translate a user's question from natural language to a valid Cypher query. The database structure—including node labels, relationship types, and properties—is included. The top ten results are returned and provided as context to Rocco, who will answer the question with any relevant information. It is important to note that if the context does not contain anything relevant to a user's question, Rocco will refuse to operate off of pretrained knowledge. Instead, the user will be told that no results could be located. This step is vital to preventing hallucinations from reaching the user.

There are some refinements that are needed with this tool. The more complex an LLM-generated Cypher query, the more susceptible it is to failure. Even if correct label names and properties are called, the query structure may have faults. Queries containing UNION statements were an early example of this. However, by specifying in the system prompt how to properly conduct such queries, these issues can usually be addressed. Limiting how much information is returned by the query will also need to be addressed. At present, a query can return more information than fits in the context window which will prevent any final answer being given to the user. But too strict a limit may prevent relevant results from being returned. A dynamic system to maximize returned information without going over is therefore necessary.

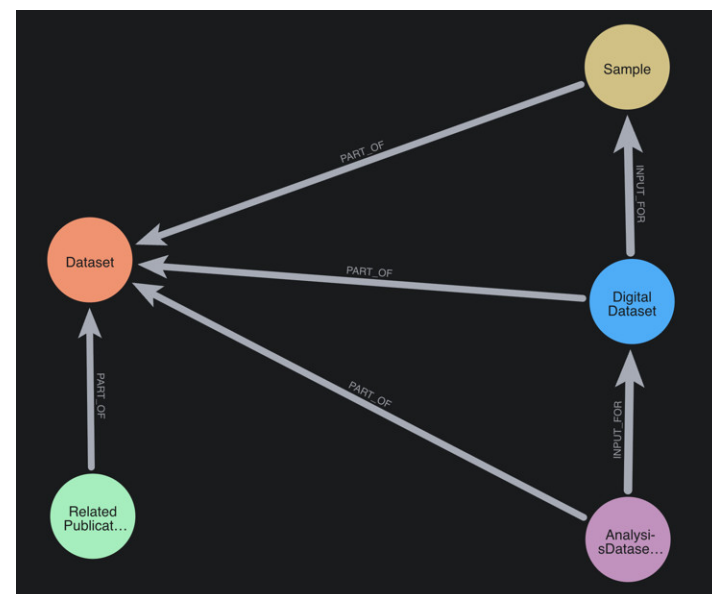


Fig. 6 | Neo4j database schema

5.4 Semantic Searching

For a user curious about finding datasets with samples that have porosities between 0.2 and 0.25, the previous tool is ideal. But researchers do not always have that specificity in mind when beginning the research process. Instead, they may have more general ideas about, for example, the kinds of simulations they want to conduct. The most straightforward way to facilitate this is to find shared keywords between the user's query and dataset descriptions. But if keywords do not match exactly, like 'sandstones' instead of 'sandstone,' the searching fails. What would be preferable is a system that matches similar *ideas* instead of simply exact *words*.

Semantic searching accommodates this goal. Text, both in the form of dataset descriptions and user queries, are embedded as vectors that capture some semantic meaning. A similarity search then locates those descriptions most similar in content to the query. While embedding queries does not currently involve preprocessing, initial attempts to embed an entire dataset description as a vector proved unreliable. Other iterations have passed the description through Meta-Llama-3.1-405B and requested a list of keywords be extracted, in an attempt to remove excessive detail and stop words. Future versions may consider experimenting with chunking the text, testing alternative models, and attempting to make the query more structurally similar to the text it seeks to match.

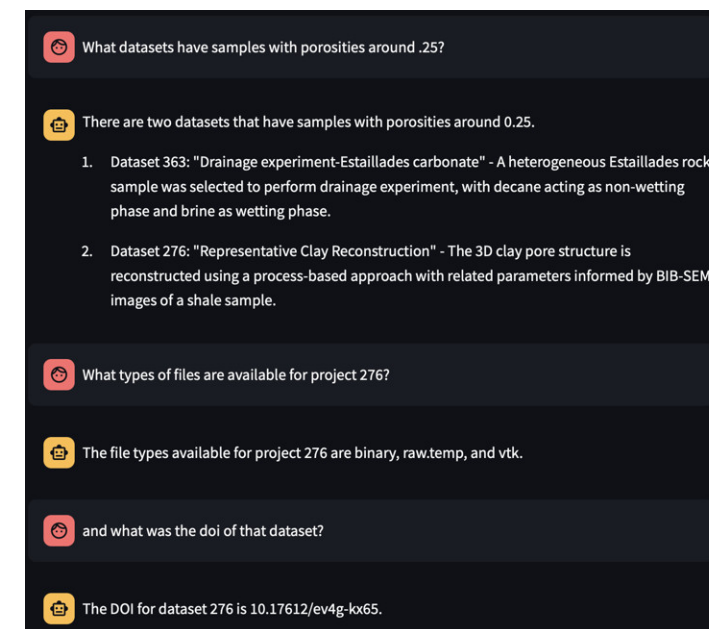


Fig. 7 | Excerpt from a conversation with Rocco

6. Conclusions

Rocco, with a fully functional user interface and search capabilities, is captured in Fig. 7. This chat exemplifies the ability of Rocco to both retrieve datasets of certain specifications and summarize their content easily for users. While not ready for deployment, the prototype is more than enough to demonstrate and explore the possibilities of a graph database RAG chatbot for the DPMP. The tool is scalable with the number of datasets and accessible for users of any technical and domain proficiency. Rocco, along with the grader and writer prototype, and spreadsheet tool outlined in this paper, push the DPMP forward in making its data more accessible. Plenty of work must still be done, including prompt refining for the grader, creation of a deployable version of the writer, and improvement of Rocco's tools (particularly semantic searching). But these curation applications, even in their early and imperfect forms, already provide a greater understanding of what data the DPMP contains and how it may be harnessed. They can be used by DPMP managers to increase the accessibility and findability of datasets and by researchers to reuse available but buried data for their own projects in pursuit of greater domain knowledge.

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ORIGINAL RESEARCH

Beyond Borders and Belonging: Chinese Illegal Migration and Diaspora as Distinct Forces in Shaping American Communities

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This research paper challenges the dichotomy between illegal migration and diaspora in Chinese transnationalism in the United States. Applying the theoretical frameworks in *Global Asias*, i.e., the idea of flexible citizenship provided by Aihwa Ong and analysis of Orientalism by John Kuo Wei Tchen, this paper compares the experiences of undocumented Fujianese migrants with those of the overall, legally constituted, Chinese diaspora. Although these groups are often simplified into a single, heterogeneous demographic of so-called Chinese Americans, each has unique motivations, economic realities, and processes of identity formation. It not only delves into the purpose of the goddess Mazu as a dual force in smuggling protection and cultural glue but also examines how American Orientalism confines the two groups, through space, in Chinatowns, and diverts them in their different directions to make them feel like part of something. Investigating the field of smuggling economics, religious networks, spatial politics, and digital transnationalism, this study introduces the underlying stratifications in Chinese America that resist monolithic accounts of immigrant assimilation.

The story of the Chinese immigration to the United States is often reduced to a one-line narrative of the "immigrant dream," a linear series of arrival and assimilation. Nevertheless, this unitary perspective masks the significant stratification of Chinese transnational mobility. The mobility of bodies across the Pacific in the modern period of *Global Asias* is characterized by a sharp divide between the mobile, capital-intensive, so-called, hyper-mobile, flexible citizenship of the overarching idea of the diaspora and the Survivalist, debt-based, and shadowy figure of the illegal migrant.

The argument presented in this paper highlights that Chinese illegal immigration and the Chinese diaspora are two opposite phenomena that have two different types of pressures on American society and American identity formation. To explain this divergence, we should first determine the terms of engagement. I would not conceive of *Global Asias* as a locked-up geographic unit, but rather as a mobile methodology—a means of tracing the shifting movement of people, capital, and ideas that resist the fixed boundaries of the nation-state. In the same vein, I understand the term diaspora in this instance not solely as a dispersed population but as a form of flexible belonging. This positionality enables the negotiation of identity across multiple locations. This paper, however, suggests that although the diaspora seeks a logic of flexible accumulation, at the risk of maintaining reasonable and desirable relations with the motherland, the illegal migrants, that is, the ones out of Fujian province, are seeking a shadow economy, where a logic of coercion and debt is the rule and regulation [13]. Despite the internal differences, both parties would need to maneuver through the external influences of the American Orientalism that has historically condemned the existence of the Chinese to some enclaves, including Chinatown.

Based on the study of the working mechanics of Fujianese smuggling, the spiritual servant of goddess Mazu, and the spatial politics of Chinatown, this study demonstrates how the legal category ultimately transforms the experience of the so-called Asian American. This stratification is critical to understanding the present-day Chinese American communities and to debunking the myth of the model minority and masking the realities of working-class Asian Americans.

Theoretical Framework: Migration vs. Diaspora in Global Asias

This stratification of Chinese mobility can be explained only if the difference between migration and diaspora is drawn. The terms are not exchangeable in *Global Asias*. Historians have long pointed out that the history of Asian labor and migration has been complex, as the coolie trade and later diasporic constructions have never been monolithic [7]. On this basis, these historians have inferred that the movement of migration is a response to an immediate economic or political necessity [11]. Conversely, "diaspora" suggests a long-term, usually voluntary, cultural project—a positionality in which one is at home in the globe and with which there exists a homeland-centeredness. Such a difference has far-reaching consequences for how communities are constituted, retain identity, and maintain connections to both sending and receiving societies.

This distinction revolves around Aihwa Ong's theory of flexible citizenship [13]. Ong posits that in a globalized world, people obtain citizenship and passports as forms of capital accumulation [13]. This ability allows elite transnational subjects to exploit more than one country of affiliation to their economic benefit by moving



Illustration by | Lucy Wei '29

freely across borders and retaining beneficial legal statuses in both countries. This freedom comes with the privilege of the elite diaspora, though. To the Fujianese illegal immigrant, citizenship is not negotiable but a constraint. Their movement is not a practice of cosmopolitan power but a dangerous gamble of great monetary and personal expense.

In this paper, the Ong framework is used to emphasize the inequality of mobility: as the diaspora crosses the borders, the illegal migrant crosses under them [13]. The diaspora member may hold passports from many countries, invest in real estate across many continents, and send his or her children to higher education institutions in other countries. The illegal immigrant, in turn, has no more worries about crossing state borders, is unable to use the formal banking infrastructure, or even to engage with the government. Such opposing mobilities create radically different worlds of sociality despite both groups being present in the same urban neighborhoods.

The Shadow Economy: Fujianese Smuggling Networks

The flow of illegal immigrants into China in the Fujian province exemplifies one of the most advanced yet high-stakes cases of human trafficking ever in contemporary history. In contrast to the heterogeneous origins of the greater diaspora, this is a highly local movement, centered mainly in the Fuzhou area and guided by a particular cultural logic in which labor abroad is a passageway to family progress. Concentration of such migration within specific counties and even villages forms dense kinship networks that allow and restrict the undocumented experience in America.

Economics of the Snakehead Trade

Transnational criminal networks called snakeheads facilitate the migration. The trip is not just a factual transfer but a monetary one that enslaves the migrant for years. It was estimated that between 50,000 and 100,000 Chinese nationals were smuggled into the U.S. in the 1990s and 1980s (Chin, 1999). The 1993 Golden Venture incident, where a cargo ship with 300 migrants ran aground off Queens, killing ten people, illustrated the scale and danger of these operations.

The economic cost of these migrants has rocketed. In the early 1990s, fees were about \$28,000, but by 2011, the price of smuggling services had increased to more than \$80,000 per person [18]. This is a debt typically secured by loan sharks or organized crime affiliates in the community, which, in fundamental ways, predetermines the post-migration experience. The illegal migrant is unable to assimilate or contribute to the open labor market; they are bound to the ethnic enclave economy, either in restaurants, garment factories, or construction, to pay the debt.

This establishes a sort of bondage labor in American soil, which is a terrible contrast to the vertical mobility of the legal diaspora. The average undocumented worker in Fujian may work 12-14-hour sessions, six or seven days a week, for years to pay off the smuggling debt. The cost of living is low—they may share cramped apartments with colleagues and remit back home on subsistence pay. The debt repayment period lasts 3-5 years on average, though it can be much longer if someone interrupts work or relocates to a new city to avoid immigration.

Community Isolation and Cultural Logic

This undocumented population is dependent on the so-called

closed kin relations and the Fuzhou dialect, forming a sub-community that is closed not even to the rest of the Chinese people [12]. This linguistic and lineal seclusion is a survival tactic. They are invisible to the outside world; inside the network, they are very monitored by the creditors who made their arrival possible. This dynamic disproves the myth of the model minority, revealing a layer of Asian Americans who exist in precarious conditions of working-class realities often overlooked by mainstream sociology.

In addition, the cultural rationality that led to this migration gives rise to intense social pressures. Migration has become so normalized in Fujianese sending communities that staying behind is stigmatized. Youths who fail to make attempts to migrate risk losing face and being seen as betraying their families. This cultural formation generates a self-perpetuating dynamic: successful migrants (or those who apply the label of successful migrants) motivate further migration, and shame of possible failure makes migrants unlikely to choose to go home even when immensely unhappy. The consequence is that the migration system is perpetuated not only through social necessity but also cultural expectations and economic calculation.

The Spiritual Anchor: Mazu and Religious Networks

The cult of Mazu, the Fujianese goddess of the sea, is one of the most intriguing points in the legal diaspora/illegal migrant intersections. Mazu provides a singular example of how religion promotes criminal undergrounds as well as state-approved diplomacy. The duality of the goddess demonstrates that cultural resources may be used in radically different ways by different social groups, yet retain common symbolic significance.

Mazu the Defender of the Smuggler

To the undocumented migrant, it is a journey to America that, like the old routes of their foremothers, is a sea voyage that seems as much an adventure as it is a voyage now. In history, the patron saint of sailors and fishermen, Mazu, provides spiritual protection for this risky route. Migrants frequently seek protection when traveling with snakeheads by praying to Mazu before the journey, visiting her temples in Fujian, or carrying small amulets with an image of Mazu. The deity of ancient traders and fishermen now watches over contemporary migrants, crowded into shipping containers or along dangerous overland paths.

The snakeheads themselves frequently donate toward Mazu shrines, justifying their felony business by donation to religion. The temples emerge as locations within the smuggling network, not necessarily as a result of overt coordination, but rather as the social networks and trust relationships they cultivate. The religious network offers, in this respect, the social capital needed to believe the smugglers, a vital factor when it comes to giving one's life and the financial future of their family to the criminal groups.

Mazu as Soft Power and Diasporic Glue

On the other hand, to the established diaspora and the Chinese state, Mazu is an instrument of soft power and cultural identity [15]. The Chinese government actively encourages Mazu worship to preserve connections with overseas Chinese and instead employs the goddess to evoke a sense of root-seeking. Fujian hosts state-sponsored Mazu festivals and temple refurbishments, which draw overseas Chinese visitors and offer opportunities for cultural exchange and business contacts. The state positions Mazu venera-

tion as an authentic Chinese cultural heritage that is worthy of preservation and glorification.

The same deity that a frightened stowaway implores in the hold of a freighter is the same deity that well-compensated Chinese American associations hail at the state's tribal festivals and in its high culture. In American Chinatowns, Mazu temples are community centers where traditional members of the diaspora convene to hold cultural events, language classes, and business networking. The goddess helps legal migrants connect transnationally so that they can still be culturally authentic, yet they are also a part of American society.

It proves that the two groups have different economic bases but share cultural assets whose exploitation serves different purposes: the first one is survival, the second one is heritage conservation [5, 10]. The irony is deep: it is this very religious infrastructure, which makes the illegal migration possible, that helps the Chinese state spread soft power influence over the communities of the diaspora. Mazu, in this way, demonstrates the way in which religion simultaneously functions at many levels: personal spiritual comfort, criminal infrastructure, and an instrument of state diplomacy.

Orientalism and the Spatial Reality of Chinatown

Whether the illegal migrant or the diasporic elite is legal or economically powerful, both forces have to manoeuvre through the landscape of America, which Orientalism historically informs. The basic formulation by Edward Said (1978) claims that Orientalism is a modality of thought that operates on an ontological and epistemological difference between the Occident and the Orient, as a Western corporate institution of domination, restructuring, and control of the Orient. Though Said used the Middle East as a central theme, this discourse of domination can be easily applied to the American context. John Kuo Wei Tchen interprets Chinatown not only as a neighborhood but also as a scarab of the American imagination, a repository of the Yellow Peril [17]. His discussion follows the process of American identity formation leading up to the physical appearance of Chinatown by tracing three intersecting Orientalisms: patrician (elite interest in Chinese aesthetics), commercial (commodification of Chinese exoticism), and political (exclusions and labor disputes).

The Containment Zone

Chinatown is a city within a city for undocumented Fujianese. It is among the few places where the Fuzhou dialect is practiced, where employers disregard undocumented status, and where it is possible to find a home without credit checks and background investigations. The thick social networks offer job referrals, emergency loans, and news on immigrant enhancement. The restaurants and garment shops in Chinatown provide work that needs no records and is paid in cash, allowing one to survive without regular economic infrastructures.

But this refuge is a trap. The patrician Orientalism, which has been identified by Tchen, makes these spaces exotic and other and establishes a psychological frontier that prevents the undocumented migrant from being pushed into mainstream American spaces [17]. They are literally in New York or San Francisco yet socially trapped in the Orient of the American imagination. The boundary is both real (immigration risk, community support) and imagined (Orientalist stereotyping marks Chinese as perpetually foreign).

Spatial confinement is replicated by what is economically necessary and socially organized. Illegal immigrants stay within their areas of employment to save money on commuting and reduce the risk of facing enforcement issues. The enclave is the center of social life, since here the person can use their dialect, enjoy their favorite foods, and communicate with others without the constant fear of being discovered. The outcome is some voluntary segregation fueled by precarity-Chinatown is both its haven and its jail.

The Tourist Spectacle

To the more affluent portion of the diaspora, however, Chinatown becomes more of a representation than a residence. Chinatown is transformed into a site of nostalgia or a business venture, a kind of commercial Orientalism, as upwardly mobile Chinese Americans migrate to the suburbs (the so-called ethnoburbs, as defined by Li, 1998), where ethnicity is produced as a commodity, serving as a tourist destination [8]. The exoticism of Chinatown is exploited by the Diaspora entrepreneurs who run restaurants, gift shops, and cultural sites to serve non-Chinese visitors who tend to appreciate Chinese culture.

This creates a tension in the neighborhood: The diaspora can afford the building in Chinatown and enjoy the exotic flair they cater to with tourists, whilst the illegal immigrants reside in the cellar of the building, working to pay off the debt that took them there. It is the spatial relation that enshrines class stratification: one group enjoys Orientalist commodification, while another does all the invisible labor to keep it in existence. The tourist who visits Chinatown to eat dim sum and to buy a souvenir in a gift shop has no idea about the illegal immigrants preparing food in restaurant kitchens or living in subdivided apartments above the shops. This invisibility is architectural, embedded in the very action of Chinatown as both tourist destination and working-class enclave.

Identity Formation: The Hyphen and the Homeland

The last difference between these forces is found in the creation of identification—namely, the method of traveling the Asian American identity as opposed to the Chinese National identity. Status determines which identities one can have, and which claims to belonging one can make.

The Burden of the "Hyphen"

Hyphenated identity (Asian American) is a place of negotiation [4]. The diaspora tends to interact with the hyphen actively. They can dismiss it to establish their indisputable membership in the Americas or adopt it as a political infrastructure uniting various Asian ethnic communities [3]. Their identity is movable—they can be both Chinese cultural ambassadors and American citizens. This flexibility is especially characteristic of such members of second-generation diasporas, who operate across cultural backgrounds, code-switch linguistically, and use both Chinese and American forms of social capital.

To the undocumented, the American side of the hyphen is unlawfully open. They are in a permanent state of transit. They are not yet Americans in law but cannot go back to China anymore without shame in failure or the pressure of debt. This marginal rank produces intense psychological tension. The illegal immigrant lives in a state of legal non-existence, neither fully a citizen of China (leaving and failing to attain any success) nor an Ameri-

can citizen (illegal status with respect to citizenship). The consequence is suspended identity, neither wholly here nor there, then always provisional with years or decades of living.

Digital Transnationalism

This is further complicated by technological improvements, especially applications such as WeChat. Through digital transnationalism, migrants can lead a mental life in China and a physical life in the US [16]. To the diaspora, this is a business and family networking tool, which allows them to sustain business ties in China as they establish careers in America. To the illegal migrant, it is a life raft that, ironically, foams against assimilation; by existing in an entirely Chinese-language digital space, the need to learn English or become part of the larger American social structure is reduced to further cement the enclave style of life. The migrant may be able to watch Chinese TV, read Chinese news, call family and friends in China, and conduct all their social and economic interactions on WeChat without learning English or building American social networks. This digital cocoon is comfortable and connective, but also replicates isolation, making the already complicated road to integration even more inclined.

Conclusion

The Chinese community in America is not a unit; it is a multi-layered stratification of legal statuses, economic statuses, and migration motives. In this paper, it has been established that the Chinese diaspora works through a logic of accumulation and cultural retention, whilst illegal migration, as in the Fujianese case, works through a logic of survival and debt redemption. These contrasting logics result in completely distinct relations to American society, citizenship, and belonging.

Despite these deep divisions, the two groups have been united by the cultural icon of Mazu and the geographical isolation of the Orientalist Chinatown. This goddess Mazu mediates the hazardous route of the undocumented and at the same time grounds the cultural identity of the formed citizen. In the same manner, Chinatown serves as a prison of debts to the newcomer and a museum of history to the assimilated. These common cultural and spatial resources operate differently across class lines and demonstrate how similarly different life paths can be realized through the same symbols and spaces.

Finally, to grasp Global Asias, it is crucial to leave the territories of the nation-state and consider the territory of the community. Boundaries not only between nations but also between legal statuses, economic classes, and levels of social mobility are the most important. The fact that the US immigration system is and will continue to be restrictive so long as there is economic disparity between the Global North and the South continues to be the defining conflict between the flexible citizen and the indebted migrant, characterizing the Chinese American experience.

By revealing the working-class realities and structural vulnerabilities concealed among aggregated statistics of Asian American success, this analysis challenges the model minority myth. It makes celebratory tales of transnationalism and the diaspora more complex by showing how global movement is highly uneven, affordable to a select few, and open to others only after risky, exploitative, and legally risky approaches.

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Emma Wang: Contemporary Revelations and Hippie Modernisms

Image by | Emma Wang '26

ORIGINAL RESEARCH

Emma Wang: Contemporary Revelations and Hippie Modernisms

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This paper examines the work of WashU Sam Fox senior Emma Wang. Specifically, it contextualizes Wang's practice within the history of hippie modernism, a 1960s art movement of artists, designers, and theorists with dual interests in both alternative ways of living and the development of new technologies of the period. Using Wang's seminal artwork *Revelation 21 (Kaleidoscope)* as a primary case study, the paper uses Wang's contemporary art practice to examine the religious undertones of the hippie modernist period. In doing so, this paper is an introduction of Wang and her work to the public and exhibits how Wang's art is reflective of larger ecological concerns today.

Divided into three sections, the paper begins with a brief introduction to Wang, her practice, and the concept of hippie modernism. The second section of the paper begins with a visual analysis of *Revelation 21*, its specific design choices, and how its religious undertones reflect larger contemporary anxieties concerning climate change and religion. Following this analysis, the second section compares Wang's work to religious movements in the 1960s involved in shaping hippie modernist thought. The third section of the paper works comparatively, considering how the functional and aesthetic aspects of Wang's piece compare alongside hippie modernist works such as Jackie Cassen and Rudi Stern's *Environment V: Vibrations*. Through this comparative analysis, the third section expands upon the initial argument, interrogating the use of psychedelics (literally and aesthetically) in religious practice, and the capacity of Wang's work to operate as a visual representation of an "environment of the mind."

Are we doomed? Artist Emma Wang attempts to answer this question through her artworks, pieces which aesthetically fuse found objects, reclaimed materials, and Christian symbolism as a means to meditate on increasing ecological decay. A senior at Washington University in St. Louis studying studio art, Wang works out of a craft tradition, creating objects such as lampshades, shrines, books, stained glass-inspired window ornaments, or cups and bowls [1]. Strongly influenced by gothic architecture and medieval imagery, many of Wang's works nestle archivally sourced prints of angels alongside seed pods, crystals, and soda-can tabs. Through this unique aesthetic combination of ancient imagery and re-used materials, Wang's works represent what it means to be an ecologically conscious maker in an era marked by its reliance on synthetic materials. In her artist statement, Wang describes how:

[a] dialogue between the ancient and modern manifests in my work as a coexistence of two polarities—earthly versus spiritual, profane versus sacred...my work is not composed entirely of natural materials and pristine objects...The natural has been inextricably entwined with the synthetic, just as the sacred now must coexist with the profane, and the seeking of the spiritual must be endeavored in the unfavorable conditions of our time...I create ... sanctuaries using materials that reflect my given environment, incorporating yet decontextualizing the waste that accumulates in my surrounding...embracing the practice of ornamentation in pursuit of creating a spiritual refuge [2].

Wang's artist statement centers on an interest in the polarities she observes to be increasingly present today, those being the "ancient" and the "modern," the "natural" and the "synthetic," and the "sacred" and the "profane." Using her artistic practice, Wang produces works that exist at the intersection of these contradictory themes. By employing the phrase "unfavorable conditions of our time" in her artist's statement, Wang alludes to problems such as

climate change, the threat of advancing technologies, and colonial and extractive histories that have led to our "synthetic" and "profane" present.

Accordingly, this paper situates Wang's practice as a contemporary extension of hippie modernism. A subsection of the greater hippie movement of the 1960s, "hippie modernism" was a term first used by Lorraine Wild as a means to typify the methodologies and aesthetics present in a branch of 1970s design [3]. Fred Turner then published his 2006 book *Cyberculture to Counterculture*, which examined how the hippie movement and hippie modernists (referred to by him as "New Communalists") were vital to the development of contemporary computers [4]. In 2015, Andrew Blauvelt extended upon Wild's definition and Turner's work by defining the term hippie modernism as "denot[ing] a historical moment" in which hippies (with their affinity for all that represented premodern and preindustrial) began to experiment with alternative uses for developing technologies [5]. In examining Wang's *Revelation 21 (Kaleidoscope)* as a primary case study, this paper compares Wang's personal spiritual beliefs to religious undertones present in the larger hippie movement, using the theories and spiritual aspects of hippie modernism as a means to interrogate how Wang's artworks represent spiritually informed environments of the mind.

Revelation 21: An Apocalyptic Omen

The following section examines the religious themes in Wang's *Revelation 21 (Kaleidoscope)* (2025) (Fig. 1), bringing its religious, spiritual, and apocalyptic connotations to the fore and contextualizing them alongside the spiritual beliefs of hippie modernists. At roughly two feet tall, *Revelation 21* is constructed entirely out of found objects such as dried pasta, beads, and shells, all of which are intricately integrated within the object's cardboard



Fig. 1 | *Revelation 21 (Kaleidoscope)*. Emma Wang. Mixed Media. Spring 2025.

framework. The majority of the piece's understructure is entirely cardboard, which Wang carefully manipulated to highlight the material's wave-like corrugations. In doing so, Wang creates an illusion of highly detailed ornamental patterning which snakes throughout the piece. Built on a tripod foundation, a three-sided pedestal guides the viewer's gaze to the top of the work. Each side of the pedestal is hollowed out by an arch framing three prints of cathedral floor plans. The piece is crowned by a rotating quadrature structure, each of its four points ornamented with the image of an angel printed on two separate layers of overlapping mylar. At the quadrature's center is the kaleidoscope in question (Fig. 2). The kaleidoscope contains an eye hole which viewers can look through. Spinning the kaleidoscope's outer structure triggers a wave of multi-colored geodesic forms to emerge. With the addition of this kaleidoscope, this invitation for movement, viewers are asked not only to gaze at Wang's creation but look inside her work and see through her eyes, joining her in a celestial communion (Fig. 3).

This quadrature form, which frames the functioning kaleidoscope at the piece's center, takes its design from the imagery of the quincunx (Fig. 4) [6]. Quincunxes are highly geometric and ornamental shapes in which an arrangement of four designs (one in each corner) frames a central element [7]. According to Wang, quincunxes are the basis of the designs used in her works. What draws Wang to the quincunx is its presence across cultures and religions throughout history [8]. The quincunx can be made from an infinite number of structures, but its design is always based on an even number of lines extending from a central point, creating an asterisk [9]. The quincunx can be found in ancient Rome, in mosaic floor designs in the Mediterranean, in the form of the Indian swastika, in ancient Mayan glyphs, in the placements of Native American mounds, and in the floor plans and mosaics of Byzantine and Renaissance churches [10]. Existing across time, cultures, and creeds, it is argued the aesthetic appeal of quincunx comes from its geometric harmony, leading to its near global application across religions as a representation of sacredness, supreme authority, infinity, and transcendence [11].

In Wang's work, the quincunx design brings the attention of viewers toward both the more spiritual and apocalyptic aspects of Wang's piece. As mentioned above, each corner of the kaleidoscope's quincunx contains an angel, printed on at least three layers of mylar and acetate. Each mylar layer has the same image printed in different colored ink. The first layer is opaque black, the second translucent black, and the third a multi-color roll of violet, emerald green, and lime [12]. Held together by two mason jar lids, the multi-layered images are rendered illusory and warped [13]. The distortion of the angels is only augmented when the kaleidoscope is activated, rotating the quincunx framework and sending the angels into motion. The distorted qualities of the angels included in Wang's work bring to mind the four angels of the apocalypse, who in the Book of Revelation, stand on the four corners of the earth halting the winds until they have "sealed the servants of our God" safe from impending apocalyptic doom [14].

Further investigation into *Revelation 21* and the significance of its title corroborates the object's apocalyptic attributes. The work's title was chosen by Wang as an overt reference to the Book of Revelation, verse 21, where John narrates God's destruction of the planet by stating "And I saw a new heaven and a new earth: for the first heaven and the first earth were passed away; and there was no more sea" [15]. With this context, the vision-warping experience that Wang facilitates through her work is less whimsical and

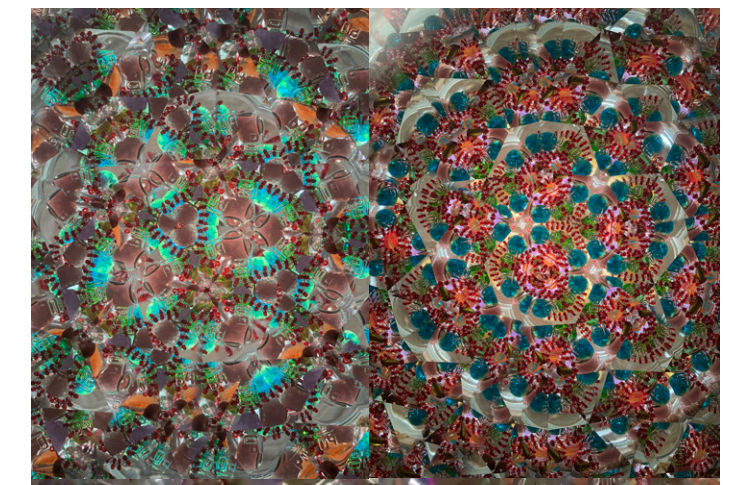


Fig. 2 | *Untitled, Samples of Kaleidoscope Interior*. Emma Wang. Mixed Media. Spring 2025.

more threatening, alluding to the sublime quality of total and absolute destruction. Wang refers to the visual qualities of her pieces as representing “the potential aesthetic of the New Earth,” and her objects as “tools for thinking about the afterlife” [16]. Within this context, *Revelation 21*, in its coalescence of debris into one highly ornamented Christian symbol, reads as a ritualistic artifact used to hail the end of days, representing the unknowable qualities of total destruction.

The way in which Wang’s religious beliefs manifest in her work are comparable to the 1960s’ turn towards Eastern religions, the prominence of groups such as the Jesus movement, and beliefs of “New Communalists.” The Christian themes in Wang’s works reference her personal relationship with religion, which she grew up practicing and continues to practice today. Christianity, for Wang, is a way in which she understands the world around her, specifically the world she imagines will exist after her. However, she does not rely on the doctrine of one specific Christian denomination to inform her beliefs. Wang’s personal practice of Christianity centers on understanding humanity’s relationship with nature, the prospects of that relationship healing, and what a healed world will look like after humanity both spiritually and physically.

“

During a cultural moment in which the threats of climate change are felt globally, environmental devastation is increasingly hostile, and technologies continue to advance, Wang employs her artistic practice as a means to visualize an uncertain future through the comfort of a spiritual lens.

Wang views her beliefs in conversation with other religions and as a means by which to consider spiritual solutions to contemporary problems rather than a form of proselytization. In this way, her holistic understanding of Christianity mimics the turn towards Eastern religions in the 1960s and the popularity of religious groups with guiding principles centering on material abandonment and personal enlightenment [17]. Wang’s choice to maintain her Christian beliefs but define them on her own terms also reflects the popularity of alternative Christian denominations which rose to prominence during the 1960s, specifically the Jesus movement [18]. In 1976, sociologists Robert B. Simmonds, James T. Richardson, and Mary W. Harder published a study attempting to assess the characteristics of Jesus movement members, analyzing whether the members had personality traits which made them more susceptible to joining the group [19]. In the first few paragraphs of their study, the authors draw parallels between the Jesus movement and the hippie movement, stating “most Jesus movement groups retain much of the hip jargon and physical attributes (e.g., long hair, beards, casual clothing), as well as communal living patterns which characterized the so-called recent Youth Revolution” [20]. The study concludes that the origins of the Jesus movement are much like the larger “youth revolution” itself. Citing Glock’s theory of “deprivation,” or large-scale sentiments of



Fig. 3 | Untitled, Kaleidoscope in use. Emma Wang. Mixed Media. Spring 2025.

social, ethical, and psychological hopelessness, the study argues that an increasing sense of unrest and insecurity among young people has led them to seek out alternative communities of fellowship in the hippie and Jesus movements [21]. This concept of “deprivation” is similarly felt today and is present in the themes of Wang’s works. During a cultural moment in which the threats of climate change are felt globally, environmental devastation is increasingly hostile, and technologies continue to advance, Wang employs her artistic practice as a means to visualize an uncertain future through the comfort of a spiritual lens.

While Wang’s personal religious beliefs align with the anti-materialist and community-oriented values of many religious groups of the 1960s, her spiritual views as manifested in her work parallel the viewpoint of what media scholar Fred Turner referred to as the “New Communalists” [22]. New Communalists, as understood by Turner, were a counterpoint to the “New Left,” and both groups exist under the umbrella of the larger hippie project [23]. In Turner’s terms, the New Left was largely a political movement centered on activism, while the New Communalists viewed the mind as the necessary asset to greater social change [24]. In a sense, New Communalists serves as a synonym for hippie modernist, as both terms work to define intersections between spirituality, psychedelics, the mind, and technology. As articulated by New Communalist thinker and hippie modernist Theodore Roszak in his 1969 book *The Making of a Counterculture*:

This... is the primary project of our counterculture: to proclaim a new heaven and new earth so vast, so marvelous that the inordinate claims of technical expertise must of necessity withdraw in the pres-

ence of such splendor to subordinate the marginal status of the lives of men. To create and broadcast such a consciousness of life entails nothing less than the willingness to open ourselves to the visionary imagination on its own terms [25].

Revelation 21 represents each of the New Communalist beliefs stated by Roszak. Its intricately ornamented, familiar yet strange aesthetic represents what both Wang and Roszak refer to as the unimaginable visual qualities of “new earth.” With its strange sublime visual qualities and explicit reference to the end of days, *Revelation 21* reminds its viewers of what Roszak refers to as “the marginal status of the lives of men.” Yet, simultaneously, in its references to the afterlife and end of days and man succumbing to the power of the more-than-human, *Revelation 21* maintains the hope for resurrection through destruction and of a vision so inconceivable that it can only be accessed through communing with God on a spiritual level, through choosing to turn to God and his teaching everyday through human action. As stated by Wang:

True Christianity, in my opinion, is not a title or a scapegoat or a superficial identity. It should be a way of life. And in order for this genuine faith to happen, it needs to live inside in the hidden heart rather than be based on the modern (per)version of it, which is contaminate[d] and hijacked and CANNOT be equated to the original desert fathers religion... “Christian aesthetic” which I (personally) believe ... is rooted in ancient practices and early ornamental language and that we still have surviving material evidence of today [26].

Wang’s Christian beliefs explicitly underpin the source materials she draws upon to create her works as the message she hopes to send to viewers. In examining Wang’s Christian beliefs within the context of the hippie movement and the specific beliefs of the “New Communalists,” it is possible to understand how works such as *Revelation 21* represent a spiritually informed aesthetic. Through its hybridization of quincunxes, angels, and ephemera, *Revelation 21* continues the hippie modernist legacy of fusing art and spirituality as a means to address larger cultural shifts. As Turner postulates in regard to Roszak and as is equally applicable to Wang, “Perhaps no dream in American culture has recurred as often as the one in which a group of spiritual adepts remake the world they have inherited in the image of their own ideals” [27].

Kaleidoscope? Environment? Or Both? *Revelation 21* as an Object of the Mind

This third section articulates how the function of Wang’s kaleidoscope in *Revelation 21* parallels much of the spiritually, psychedelically, and environmentally informed artworks of the late 1960s. As articulated by art critic Harold Rosenberg in 1967, the use of environment in artworks “encompasses the spectator . . . [giving] him the feeling of being encompassed, instead of confronting him with an object or image” [28]. In contrast to Rosenberg’s observations, viewers of *Revelation 21* are confronted with an object rather than an explicit environment. However, through the object’s unique aesthetic design, viewers are asked to imagine what built environment *Revelation 21* inhabits and are invited to experience this environment by interacting with Wang’s work.

During the 1960s, many artists enhanced their works through psychedelic drug use [29]. The production of psychedelically influenced artworks in the 1960s is often treated as the product of free-wheeling frivolity and drug-induced experimentation and lacking substance beyond its presence in mass culture [30]. However, many hippie modernists of the period, such as theorist and critic Gene Youngblood, attempted to validate the lineage of psy-

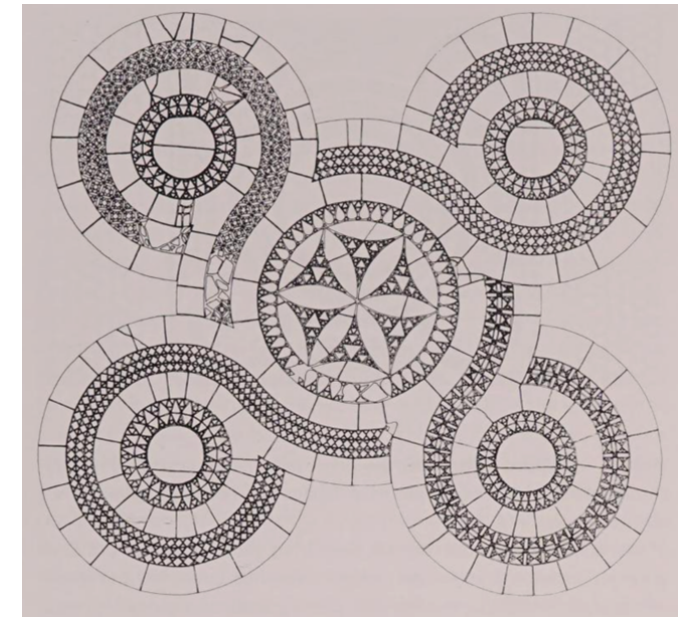


Fig. 4 | Untitled, “Example of a Cosmatesque quincunx. Detail of the pavement of the crypt in the cathedral of Anagni (Cosmas, Luca, and Jacopo, 1231), fourth motif from the north in the series of tangential quincunxes that carpet the nave of the crypt.” Found in Pajares-Ayuela, Paloma, “The Signification: The Cosmatesque Quincunx: A Double Cross Motif,” in *Cosmatesque Ornament: Flat Polychrome Geometric Patterns in Architecture* (2001). 197.

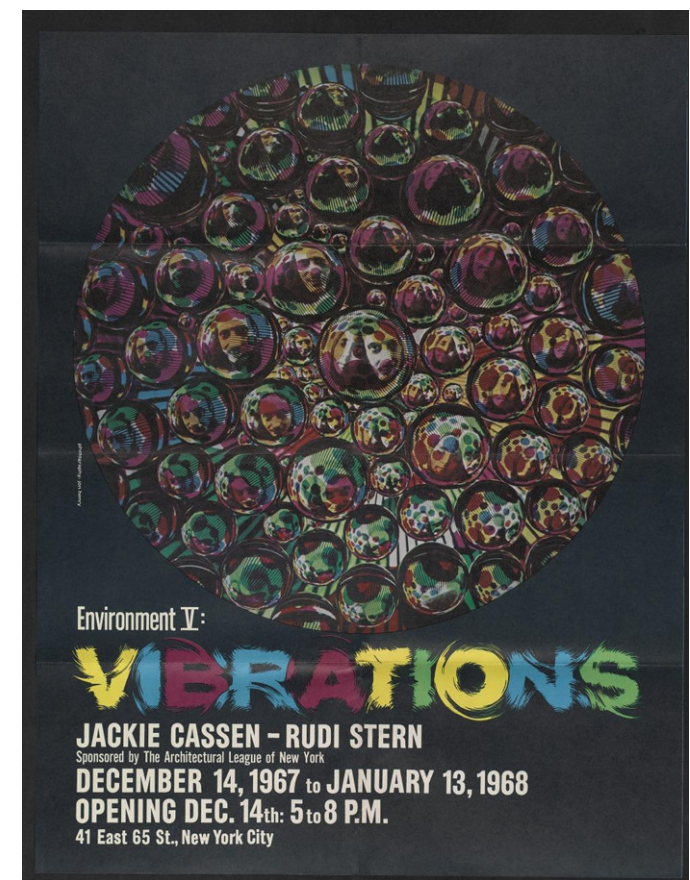


Fig. 5 | Untitled, Samples of Kaleidoscope Interior. Emma Wang. Mixed Media. Spring 2025.

chedelic art and its greater spiritual connotations. In his 1970 book *Expanded Cinema*, Youngblood spoke to the present, past, and future of technologically-infused environmental artworks and their goal to use light, sound, and environment that would “manifest [man’s] consciousness outside of his mind, in front of his eyes” [31]. For Wang, *Revelation 21* works towards a similar objective. Her use of mylar, both to make her kaleidoscope and as a substrate for the printed angels in the four corners of the kaleidoscope’s framework, is intended to give the imagery in her piece a “‘hologram’ appearance, or ... the psychedelic fuzziness of a spiritual vision” [32]. In her integration of light and mylar to create a functional tool, Wang situates herself within the lineage of artists using light as an implement to awaken a cosmic consciousness [33]. *Light in Revelation 21* is key to activating the work by making the kaleidoscope functional and by passing through the transparent mylar images that decorate the work’s outer structure.

Revelation 21’s kaleidoscope and the environment it creates for viewers parallels works of the period such as those by Jackie Cassen and Rudi Stern, who Youngblood noted were unique for their “contemplative and peaceful” compositions that sought to “sharpen one’s consciousness” in comparison to the chaos of the intermedia works produced by their contemporaries.³⁴ Specifically, the geodesic and mirror-like aspects of Wang’s work parallel Cassen and Stern’s *Environment V: Vibrations*. Exhibited from December 14th, 1967, to January 11th, 1968, the gallery would:

contain a large geodesic sphere, areas of which will be covered with reflective surfaces. Two projectors will rotate within it. Three more will be focused on it from behind. . . To further vary the spectator experience, sound patterns will be created whenever the programmed beams of light activate one of 51 variable tones enclosed in a Lucite sphere. . .The reflections from the water will work with the play of shadows and the movement of the participants to form a spatial totality [35].

Like with Wang’s kaleidoscope, Cassen and Stern activate light through refraction, rotation, and the use of multi-layered substrates to create an embodied viewer experience. The poster for the work (Fig. 5) depicts a man’s face duplicated within a geodesic, multicolored beehive-like sphere. The image feels at once technologically produced through light, sound, and careful architecture and engineering as it does a simulation of a psychedelic experience. The poster advertises what viewers can anticipate seeing and experiencing in *Environment V*, an environment visually parallel to that produced through Wang’s kaleidoscopic lens (Fig. 2).

Cassen and Stern spoke of their work through a spiritual lens, stating their goal for the piece was “to involve people within this space so that light becomes the catalyst of their inner reflectivity ... We believe in the inherent magic of the medium of light, stimulated as it is by all the resources of modern technology but never a slave to it” [36]. In his own analysis of the work, Nisbet rightly argues for understanding *Environment V* and its “spiritual cast” as a by-product of famed Harvard psychologist Timothy Leary’s encouragement for his followers to “start their own religion” and to attempt accessing a spiritual plane through the use of psychedelics [37]. For Leary, psychedelics were key to “finding the divinity within and to express this revelation in a life of glorification and worship of God. These ancient goals we define in the metaphor of the present—turn on, tune in, and drop out” [38]. As stated earlier, though Wang identifies as Christian, she has a staunch aversion to the hierarchies that classify denominations and run churches. With her works, she aims to break away from the contemporary, corporate, and capitalist-oriented Christian aesthetics which promote

“Bible verse calligraphy planners in Tjmaxx” [39]. For her, as with Wilfred, Cassen, Stern, and Youngblood, spirituality as linked to religion is found mentally in an inaccessible environment we cannot readily see or imagine. Whereas Cassen and Rudi turn to psychedelics in producing an environment that surpasses imagination, Wang looks back at ancient Christian traditions and ornamentation, considering the power of ornamentation in a pre-industrialized world as creating an environment as effective as psychedelics.

Conclusion

Highlighting the parallels between Wang and hippie modernism reflects how, when faced with periods of radical, societal, or global change, artists move toward imagined, and often spiritually informed, environments. Emma Wang is still a developing contemporary artist. However, the centralization of spiritually and environmentally oriented questions within her practice captures the larger cultural sentiments of what it means to make, create, and respond to problems beyond individual control. Hippie modernists held distinctly utopian beliefs in regard to technology, framing their artworks as propositions for alternative ways to exist in the world. Wang’s works parallel the goals of those original alternative missions, simultaneously re-orienting them to raise the question of what life will look like after humans.

Footnotes

- [1] The Tate Modern defines Craft as “...a form of making which generally produces an object that has a function: such as something you can wear or eat or drink from.” “Craft | Tate,” accessed November 8, 2025, <https://www.tate.org.uk/art/art-terms/c/craft>.
- [2] Emma Wang, “Untitled (Artist’s Statement),” personal communication, 2024.
- [3] Wild, Lorraine, “Transgression and Delight: Graphic Design at Cranbrook,” *The New Cranbrook Design Discourse*, 1990, 31. Lorraine describes the work of Cranbrook designers as being a product of how “This ‘hippie Modernism’ of the early seventies reflected a generation’s commitment to a utopian dream of design working for the public good, with form being secondary to process.”
- [4] Fred Turner, “The Shifting Politics of the Computational Metaphor,” in *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (University of Chicago Press, 2006). 33.
- [5] Andrew Blauvelt, “Preface,” in *Hippie Modernism: The Struggle for Utopia* (Thames & Hudson, 2015). 11-12.
- [6] Emma Wang, “Untitled (Text from Emma Wang) C,” personal communication, December 5, 2025.
- [7] Pajares-Ayuela, Paloma, “The Signification: The Cosmatesque Quincunx: A Double Cross Motif,” in *Cosmatesque Ornament: Flat Polychrome Geometric Patterns in Architecture* (2001). 196
- [8] Pajares-Ayuela, Paloma, “The Signification: The Cosmatesque Quincunx: A Double Cross Motif.” 246.
- [9] Pajares-Ayuela, Paloma, “The Signification: The Cosmatesque Quincunx: A Double Cross Motif.” 198-199.
- [10] For references to the history of the quincunx in Europe, specifically in ancient Rome, the Middle Ages, Byzantium, and Renaissance periods, see Pajares-Ayuela, Paloma, *Cosmatesque Ornament: Flat Polychrome Geometric Patterns in Architecture* (2001). References to the quincunx in the Mediterranean can be found in the same book, in “The Signification: The Cosmatesque Quincunx: A Double Cross Motif.” 198-199. For research on the use of the quincunx in Renaissance floor plans, see Fabio Colonnese, “Mapping the Persistence and Evolution of the Quincunx,” *Nexus Network Journal* 23, no. 2 (2021): 453–73, <https://doi.org/10.1007/s00004-020-00527-8>. 453-455. For

evidence of the presence of the quincunx in design of the Indian Swastika, see “The Signification: The Cosmatesque Quincunx: A Double Cross Motif.” 198-199, as well as Edward Thomas, “The Indian Swastika and Its Western Counterparts,” *The Numismatic Chronicle and Journal of the Numismatic Society* 20 (1880): 18–48, <https://www.jstor.org/stable/42682037>. 18-19. For evidence of the Quincunx in Mayan glyphs, see Brian Stross, “Some Observations on T585 (Quincunx) of the Maya Script,” *Anthropological Linguistics* 28, no. 3 (1986): 283–311, <https://www.jstor.org/stable/30027958>. 283-284. And for archeological theory on the use of the quincunx in Cahokian Mound placement, see Q & A: Measuring Cahokia – Bill Iseminger – Cahokia Mounds State Historic Site, n.d., accessed December 6, 2025, <https://cahokiamounds.org/measuringcahokia/>.

- [11] Pajares-Ayuela, Paloma, “The Signification: The Cosmatesque Quincunx: A Double Cross Motif.” 238.
- [12] Emma Wang, “Untitled (Text from Emma Wang) D,” personal communication, December 6, 2025.
- [13] Emma Wang, “Untitled (Text from Emma Wang) D,” December 6, 2025.
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ORIGINAL RESEARCH

Silence Across Screens: A Dual-Method Analysis of Gendered Emotional Labor in *The Farewell*

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This article examines how *The Farewell* (2019), directed by Lulu Wang, constructs and circulates gendered emotional labor within a transnational Chinese family. While the film is frequently discussed through binaries such as collectivism versus individualism or truth versus filial piety, this study shifts the focus to a less examined question: who performs the emotional labor required to sustain the family's decision to conceal a terminal diagnosis, and how is that labor culturally interpreted? I argue that the film frames emotional labor as feminized, unpaid, and structurally necessary work that sustains intergenerational and transnational cohesion. Through silence, restrained gesture, *mise-en-scène*, and narrative concealment, women—daughter, mother, aunts, and grandmother—are positioned as emotional regulators who absorb and redistribute affective labor across cultural and generational divides.

To explore both representation and interpretation, this study adopts a dual-method approach. First, drawing on feminist film theory and the work of Stuart Hall, Sara Ahmed, Arlie Hochschild, and Chandra Talpade Mohanty, it conducts a close textual analysis of the film's cinematic strategies. Second, it employs grounded theory coding to compare audience reception on Douban (China) and Metacritic (United States), examining how viewers interpret the film's central "deception" through distinct moral frameworks. The findings reveal that emotional labor functions as a culturally mediated "currency" of belonging: Chinese audiences tend to frame concealment as relational care, while many American reviewers interpret it through lenses of individual autonomy and psychological transparency. By integrating film analysis with reception study, this article demonstrates that gendered emotional labor is not only cinematically encoded but also differently valued, across cultural contexts.

1. Introduction

Lulu Wang's *The Farewell* (2019) does not begin with a direct conflict, but with a deliberately built silence. The film opens with a trans-Pacific phone call, which serves to establish the emotional tone of the film: anxiety is shifted to ease, love is conveyed through concealment, and emotions are revealed through careful management. Inspired by Lulu Wang's own experiences, the story tells of a family who decides to keep illness a secret when they learn their grandmother has terminal cancer and use a hastily arranged wedding as a pretext for a final family gathering. While *The Farewell* is often characterized as a sensitive investigation into immigrant identity, it is also an insightful consideration of the emotional labor. For example, examining the cultural logic, gender distribution, and moral ambiguity of this emotional labor that has yet to be theorized in the current state of academic research.

Most reviews and discussions about the film focus on familiar binaries: sincerity versus assimilation, Eastern collectivism versus Western individualism, and truth versus filial piety. While these frameworks shed light on some important issues that arise within the film's transnational context, they overlook a fundamental analytic question: who pays the emotional labor required to maintain this lie, and what is the cost of that labor? This essay argues that *The Farewell* attributes the role of emotional labor to women's work, which is unpaid and invisible, but this emotional labor plays an important role within cross-cultural and cross-regional family connections. In this film, women bear this burden

disproportionately. Billi, the film's Chinese American protagonist, struggles to suppress her Western moral commitment to personal honesty; her mother wrestles with traditional expectations and immigrant identity; and her aunts manage emotional conflicts at the wedding ceremony, carefully smoothing over any emotional friction. Their labor sustains the emotional core of the film, but it is often overlooked and unrecognized.

Although the film clearly depicts how the gendered emotional labor occurs in this film, audiences are likely to understand and evaluate this labor very differently according to their cultural background. Preliminary observations from online audience commentary suggest that Chinese and American commentators approach the central concealment of the film from different moral perspectives, which are rooted in cultural conceptions of family, care, and honesty. These different understandings across different cultures are not assumed to be fixed or universal patterns, but rather serve as the starting point of this study. Through more rigorous and empirical analysis, this research systematically investigates any such cross-cultural differences in interpretation found in audience evaluations.

In addressing these issues, this study adopts a dual approach: one considers the textual analysis, the other audience reception. First, combining insights from feminist film theory, Stuart Hall's 1990 theory of immigrant identity, Sara Ahmed's 2004 conception of affective economies, Arlie Hochschild's 1983 theory of emotional labor, and Chandra Talpade Mohanty's 2003 transnational feminist critique, this paper examines how the film *The Farewell* constructs emotional labor, a gendered and culturally

contextualized burden, through cinematic means such as scene design, body movements, shot composition, sound, and narrative concealment. Then, with the help of grounded theory analysis based on NVivo coding, this study investigates the audience feedback on Douban and Metacritic, taking these two platforms as discursive fields to discuss family care and gendered cultural norms, within which audience views may be expressed, confirmed, or contested.

By putting together textual strategies in the film with audience reception across different cultural contexts, this paper demonstrates how emotional labor serves as a transnational "currency" that allows people to belong across borders, while at the same time reinforcing patriarchal expectations of female self-sacrifice. *The Farewell*, therefore, becomes more than a family deception film but also a critique on the burden women carry in managing emotions within family relationships. To examine how gendered emotional labor is represented in the film and interpreted by audiences across cultural contexts, this essay therefore raises the following research questions:

Research Question 1

How does *The Farewell* use cinematic techniques, such as framing, gesture, sound design, and narrative styles, to portray emotional labor as gendered work within a transnational Chinese family?

Research Question 2

How do Chinese audiences on Douban and American reviewers on Metacritic interpret the "deception" plot in the film from different perspectives? What do these differing interpretations reveal about the social norms about caregiving, truth-telling, and gender roles in different cultural contexts?

2. Literature Review

This paper interprets *The Farewell* from an integrated theoretical perspective, where Stuart Hall's, Sara Ahmed's, Arlie Hochschild's, and Chandra Talpade Mohanty's theories are not independent frames but rather interconnected and thus jointly forming perspectives. Jointly, they reveal how transnational identities are generated by the flow of emotions, how these emotional fluxes are turned into gendered emotional labor, and how this labor should be comprehended through the power relations in transnational histories rather than through Western universalist standpoints. Rather than discussing such theories as four parallel components, this paper links them together and demonstrates the way each of the theoretical frameworks interprets the others and why their intersections are so vital to analyze the portrayal of emotional labor in the movie and its reception at diverse cultural levels.

The core of Hall's argument is the idea that transnational identity is not a fixed state but a process of "becoming," and it is from this vantage that this study's analysis may gain a foothold. According to Hall, identity is constituted through continuity ("shared cultural symbols") and rupture ("the breaks that shape us") (260), furnishing an entrance into the emotional suspension Billi experiences between Chinese and American cultures in the film. At the same time, however, Hall's theory opens another, more interesting line of inquiry: how, exactly, does this continual transnational "becoming" come to be felt? Ahmed supplies an answer. Treating emotions as cultural practices, Ahmed says emotions "stick" to bodies and flow through social space (Ahmed 11-13); thus, Ahmed argues that even the constitution of identity is not just accomplished through the transfer of historical conditions but is com-

pleted through the flow of emotion. Therefore, Ahmed effectively supplements Hall's theory: if transnational identity is a process of rupture, then emotions are the medium in which that rupture is perceived, negotiated, and embodied. Billi's guilt, longing, and conflicted feeling do not simply express her transnational identity; they are themselves constitutive elements of that identity.

When this theoretical conversation between Hall and Ahmed takes place, Hochschild's theory is bound to enter this conversation, for if the flow and accumulation of emotions are unequal, as Ahmed seems to suggest, then the work of managing these emotional flows must fall disproportionately on women within the family. Hochschild's theory of "emotional labor" is precisely designed to describe this kind of work. She first proposed this theory in the context of the service industry: people need to manage their emotions well and show it on their faces and bodies so that everyone can see it. However, as she later argues in "Global Care Chains and Emotional Surplus Value," this concept has increasingly been applied to the domestic and transnational care sectors (249-250). Importantly, Hochschild extended Marx's theory of "surplus value" to personal emotions. She proposed that in the global care chain, emotions will be transferred: the care and love that caregivers were supposed to give to their families has become a residual emotional value that is transferred to the families of employers in wealthy countries. She believes that this emotional surplus value is an important but invisible resource that maintains social stability and family harmony at the top of the care chain in developed countries (262). This theoretical framework can explain why in *The Farewell*, in order to maintain emotional harmony at home, everyone chooses to hide the truth from their grandmother, and this hard and heavy pressure is unfortunately placed on a few family members. Hochschild further develops the theory propounded by Hall when she states that a transnational subject such as Billi would experience what she calls "contradictory cultural emotion," or emotions molded by the tussle between competing moral systems. In short, from this perspective, Hochschild not only extends Ahmed's theory, but also deepens it: Ahmed may believe that emotions glue people together into collectives, but Hochschild highlights that this emotional bonding requires labor and that this labor is distributed unequally, its inequality guaranteed by factors such as gender, class, and global mobility (251).

Mohanty expanded the discussion by questioning Western feminism. She believes that Western theories have many underlying assumptions when explaining emotional behavior in non-Western societies. Her critique of "universal womanhood" and her insistence on contextual, anti-colonial feminist analysis (Mohanty 22-24) directly interrogate the interpretive frameworks through which emotional labor in *The Farewell* is often read. Mohanty warns that care and gender analyses, such as Hochschild's global care chains: a series of transnational links through which caregiving labor is transferred from poorer to wealthier households (250), are at risk of generating colonialist narratives if they represent non-Western women as passive victims rather than as agents enacting their agency against complex cultural and geopolitical hindrances (40-42). To prevent one-sided interpretation, Mohanty believes that two key points should be focused on: first, women's own initiative, as they are not only passive recipients of arrangements; second, specific historical and cultural backgrounds, which are key factors influencing their choices (17-23). Mohanty does not see non-Western women as people who can only be pushed by various rules, but rather believes that they will take the initiative to negotiate and fight for their rights. In this way, our understanding of the concept of "emotional labor" will not be so singular. Thus,

incorporating her theory into those by Ahmed and Hochschild, Mohanty reconstitutes emotional labor as a cultural practice rather than an unconscious burden, one firmly situated within immigration histories, collectivism, and racialized expectations. This emotional labor is perceived through a Western liberal optic as oppressive or duplicitous; however, for Mohanty, this precisely reflects a localized ethic of care and sense of interpersonal responsibility.

By viewing these four theorists as interlocutors instead of isolated theories, this essay sets up an integral way of thinking: diaspora leads to affective tension (Hall), emotions circulate and stick unevenly (Ahmed), these processes rely on gendered labor as a foundation for societal unity (Hochschild), and the meaning of these actions have to be decoded via culturally specific and anti-colonial feminist readings (Mohanty). The discussion not only sets up an integral framework for textual analysis but also lays down groundwork for an analysis on reception, which reviews how Chinese and U.S. audience members, influenced by differing notions for emotional cultures and feminist ideologies, interpret the exact same representation of these emotions and labor within differing moral backgrounds.

3. Methodology

This study uses a dual qualitative research approach—textual analysis combined with audience reception analysis, based on grounded theory—to investigate how *The Farewell* expresses gendered emotional labor and how this emotional labor is culturally interpreted by audiences in China and the United States. The following research methods are not introduced in strict procedural order but as an interpretive framework through which the film’s form and audience interpretations can be put in conceptual dialogue. As my central argument is about the cultural intelligibility of gendered emotional labor, each method addresses a larger question: How does the film construct emotional labor? And how do audiences interpret this content through divergent moral and emotional frameworks?

3.1 Textual Analysis

Scene One: Opening Phone Call

The film opens with an extended phone call between Billi and her grandmother Nai Nai, a sequence that immediately establishes the affective and aesthetic grammar of *The Farewell*. Wang shoots Billi wandering through the gray streets of New York with a long take, in which her voice is soft and the posture of her body a little lazy. The remote siren, passing cars, and humming of the city in the background of the shot collectively assume an atmosphere of geographic and emotional distance. However, when the scene cuts to Billi’s grandmother in the light-filled hallways of the Changchun Hospital, the sound environment takes a radical about-face: the background noise falls away into an eerie silence that’s eventually punctured by her grandmother’s warm and cheerful voice. The startling imagery of the hospital juxtaposes jarringly with the relaxed tone adopted by the grandmother and well demonstrates Stuart Hall’s notion of producing meaning through difference (Hall 263): the film visually presents images that Billy herself cannot see—the audience feels this emotional dislocation within cross-national communication.

Wang uses cross-cutting not only as a narrative device but also as an affective device that plays off closeness and distance existing simultaneously. Billy must appear calm even though she is filled with anxiety; the grandmother must appear healthy even though her body is weak. This mutual emotional performance resonates

with Sara Ahmed’s notion of the “affective economy” and shows emotions attaching to persons and circulating across spaces (Ahmed 11–13). In this scene, the presence of guilt is linked to Billy, her breathing pauses, and she looks down, while the presence of comfort is linked to the grandmother. In transnational space, the distribution of emotional labor is also imbalanced. Billy has to suppress her concern, not wanting to distress her grandmother, while the grandmother has to hide her fear in order to reassure Billy, both of which are evident in this scene.

The structure of this phone call also reveals the premise behind the gendered emotional labor underpinning the film. Billy’s hesitation, pause, and quiet tone are representative of the phenomenon described by Hochschild as “surface acting,” the demonstration of emotionally expressive conduct in order to protect others from the effects of one’s inner experiences (Hochschild 250). However, this emotional labor does not come from employment, which stems from familial ties, thus remains unseen and unrewarded. Therefore, this scene depicts the central argument of this film: emotional labor is an invisible infrastructure in transnational family life. Also, combined with Mohanty’s critique of Western assumptions about the transparency of real emotions (Mohanty 33–34), this scene resists interpreting Billy’s restraint as dishonesty. Instead, Wang frames the suppression of emotions as a form of care within a transnational, culturally contextualized context.

Through minimal gesture, careful sound design, and transnational cross-cutting, the opening scene introduces the affective contradictions that will structure the entire film. Billi speaks from a diasporic “position of enunciation” (Hall 257), wherein she is emotionally steady in one cultural context, but her internal being is shaped by the other culture. The telephone conversations do not just carry the story forward, they also highlighted Billi’s emotional detachment from cross-cultural experiences. This plot does not allow emotions to naturally express themselves, but instead shows that emotions are reconciled and suppressed in long-distance communication, and the expression is also very disjointed, making people feel a clear emotional dislocation and estrangement.



Fig. 1 | Hospital diagnosis meeting scene illustrating intergenerational negotiation and affective restraint. Screenshot from *the Farewell* (2019), directed by Lulu Wang.

Scene Two: The Hospital Diagnosis Meeting

The second significant scene is when family members assemble at Changchun Hospital to talk about their grandmother’s condition. The director, Wang, establishes this scene with a cool, bare visual style, with the family sitting in a semicircle around a doctor, with cold white fluorescent lights above, and behind them is a long, fuzzy corridor. This calm, vacant environment not only emphasizes the professional logic of the health institution but also draws attention to the emotional toll on the family. The doctor’s explanation of how serious the illness is interrupted by the director’s intercutting between a wide-angle shot of the entire family room to close-ups of the emotions left unexpressed: lips pinched

shut, avoidant gazes, clenched fists. It is the positioning of characters that indicates the gender disparity of emotionally expressive authority in this scene: women will actively maintain each other’s emotional atmosphere, such as guiding conversations, conveying medical information tactfully, and staying calm. But male characters are mostly passive, rarely actively soothing or regulating emotions, and mostly only passively responding.

Seated closest to the doctor, the aunt immediately assumes responsibility for guiding the conversation, her tone firm yet restrained. She nods, comforts, and translates medical terms into emotional cues in order to help the rest of the family understand. Indeed, her actions fulfill Hochschild’s definition of “emotional labor,” managing emotions “to maintain an outward appearance, thereby inducing the appropriate psychological state in others” (253). The aunt’s composure serves as the emotional anchor for the family’s decision to conceal the grandmother’s terminal illness from her. In contrast, Billi stands at the edge of the family, her visible emotional distress marking her as an emotional “outsider” in the visual field—she seems too American, too uncontrollable, untaught in the necessary emotional restraint expected by her family. To gain a better understanding of the moral frameworks that influence Billi’s dilemma, it is useful to draw on Richard Nisbett’s (2003) discussion of the divergent cognitive and moral traditions of ancient Greece and China.

The Western moral system, as adopted by the United States, is rooted in Greek philosophy, which privileges individualism, the search for truth, and universalism. Nisbett writes that the Greeks “were concerned with understanding the fundamental nature of the world through abstract rules and formal logic” (4), and conceived of the individual as “an encapsulated unit who maintained a unique identity across social settings” (2). This is reflected in the moral response of the American characters, whose commitment to telling the truth is rooted in the idea that the patient has a right to know. Deception, regardless of motivation, violates the principle of individual autonomy.

The Chinese moral system, as influenced by both Confucianism and Taoism, privileges harmony, relationships, and contextual ethics. Here, the individual is “first and foremost a member of a collective... for whom harmony in relationships becomes a chief goal of social life” (2, 23). This is reflected in the family’s deception of the grandmother, which is motivated by a desire for harmony. Nisbett writes that, for the Chinese, “there is no necessary incompatibility between the belief that A is the case and the belief that not-A is the case” (10), a dialectical approach that allows for the coexistence of contradictions. This allows the Chinese family to live with the truth of the disease and the lie of the deception as simultaneously existing realities. Billi, as a woman caught between two moral systems, is experiencing the “affective tension” of diasporic identity, as discussed by Hall, where one is drawn into a new moral system while being embedded in another (262).

This division of emotions provides a graphic illustration of Ahmed’s thesis that emotions can “stick” to some bodies, thereby inhabiting a shared emotional alignment. In this scenario, calmness “sticks” to the aunt and mother but not to Billy, where vulnerability takes hold instead. These affective assignments do not arise naturally; they are socially constructed: In her study of rural China, Tamara Jacka writes: “It is not so much that women are expected to do more, or devote more time to, domestic work, but that they are required to take on more responsibility for the psychological, emotional and moral, as well as physical, wellbeing of other family members” (104). In other words, emotional management is constructed as a gendered responsibility within family

ethics. This pattern persists in contemporary China, and is even intensified. This is an ongoing phenomenon in modern Chinese culture and is in fact exacerbated. Yingchun Ji argues that the “feminization of care” is one of the most important characteristics of modern Chinese families, where women are the main caregivers in both an emotional and physical capacity (1–2).

Hall’s contention that cultural identity is constituted through “rupture and differences” (Hall 260–261) clarifies why Billy’s affective responses seem incongruous in this context: she is feeling her way into incommensurable conflict between two moral systems, which have dramatically conflicting ethical requirements around veracity, accountability, and the expression of emotion.

Here, Mohanty’s critique of Western universalism is particularly pertinent. Western audiences may view the concealment within families as an act of patriarchy or oppression. However, Mohanty contests that the basis of feminist analysis should be rooted in historical specifics, instead of being framed by the moral measuring devices of the West (Mohanty 40–42). Wang presents the process of family decision-making with much meticulousness to showcase that in such a cultural context, an act of concealment is an act of care rather than a form of deception. Silence does not imply the negation of truth but implies an act of collective responsibility. Using clever camera angles, controlled tone, and movement, this scene shows how emotional labor can sustain family cohesion across generations and cultures.



Fig. 2 | Wedding banquet scene highlighting gendered emotional regulation and ritual atmosphere. Screenshot from *the Farewell* (2019), directed by Lulu Wang.

Scene Three: Wedding Banquet

The banquet is constructed by Wang as a ritualistic setting, filled with rich symbolic red, which is a metaphor for happiness, celebration, and good luck (Zhang 93). However, beneath the deeper red color, there is immense pressure on the characters. Through long tracking shots, the audience sees a series of subtle performance, forced laughter, stiff smiles, flickering glances, within the banquet hall. The nonverbal behavior is channeled towards what Laura Marks terms “haptic visuality,” a visuality that is more concerned with textures, body language, and sensations than with dialogue, which serves as a means to describe an emotion incapable of being verbalized (Marks 45). The apparent cheerfulness of the banquet, such as laughter, bright colors, and celebratory rituals, does not conceal emotion but instead becomes a medium through which underlying tension and grief are communicated.

The emotional structure of the banquet collapses when Uncle Haibin makes a drunken speech in which he thanks his family while attempting to stifle his emotions. His words change between joy and sadness. Director Lulu Wang gradually lowered the background volume of the movie, hoping his uncle’s voice could be heard amidst the noisy yet deliberately maintained atmosphere of joy. His speech wavered between gratitude and pain because he

was currently bound by uncontrollable emotions. Such a collapse underscores the fragility of emotional labor shoring up the family's false façade. Ahmed's theory further elucidates the intensity of this moment: emotions flow and accumulate on the surface of the body until they exceed the limits of control and erupt (Ahmed 28–29). The exception of allowing Uncle Haibin to lose control of his emotions after getting drunk, as well as Aunt's stiff smile and efforts to maintain the situation, all indicate that the main responsibility for maintaining family emotions and handling emotional crises has always been borne by women for a long time. From this, it can be seen that Uncle Haibin's public expression of emotions not only does not deny the view that women bear emotional labor, but also reveals the essence of gender division of labor: men have the privilege of occasionally releasing emotions, while women need to continue to bear the heavy responsibility of emotional management and emotional repair.

The camera's attention to the Auntie Ling, Uncle Haibin's wife, during the speech highlights emotional labor as gendered work. Through her tense smiles, tightened jaws, and several looks in the direction of other guests, her effort at stabilizing the scene and maintaining the emotional script is exposed. This is emotional labor in its purest form: an act of active atmosphere regulation with a view to securing the collective. Hochschild's "deep acting"—working to internalize emotional expectations internally to present a display that may appear true (Hochschild 256)—is asserted here in the form of her continuous effort. She smiles not out of genuine happiness but out of a sense of obligation.

Hall's concept of diasporic identity becomes visible in Billi during this sequence. In the above excerpt, Wang changes camera position every other second, zooming in on Billy's face as she would laugh, then cry, struggle to repress her emotions, and again look away. Billy's emotional confusion illustrates well the state described by Hall, in which "diasporic identity" constantly negotiates between cultural emotional codes (258). Neither does she completely fulfill the emotional mold of a Chinese family nor does she completely live up to the standards of personal emotional honesty expected from American culture.

This banquet scene also reflects Mohanty's warning about imposing Western feminist standards on non-Western cultures. For Western audiences, this scene may appear emotionally repressive.

But from a transnational feminist perspective, it reveals the culturally defined role of women in maintaining ritual harmony. Wang places women—instead of men—at the center of the story to bear the emotional labor of maintaining family unity, managing the emotional boundary between celebration and mourning. Therefore, this banquet is not a hypocritical scene but one full of labor and effort.

Scene Four: Final Street Farewell

The final farewell scene is a distillation of the core emotional and theoretical elements of the movie. In one quiet street in Changchun, Wang frames and reframes Billi and her grandmother at increasing distances from each other. The presence of high-rise buildings squeezes the vertical perspective, thus giving a choked sense of oppression to Billi's inner turmoil. The composition of the scene reveals the inevitability of parting as the road is stretched with old apartment buildings, giving a sense of solidness as well as decay. In the last farewell, the grandmother is composed emotionally, with a confident smile and waving gesture, but Billi's body shows an episode of her struggle to remain composed.

This is a scene dominated by silence. As the ambient noise dies down and only the uneven breathing of Billi can be heard, Wang turns the sense of absence into an emotionally full atmosphere. According to filmmaker and theorist Trinh T. Minh-ha, silence is not the opposite of language but a "way of constructing meaning" with its own peculiar grammar (87). Here, silence speaks of all that Billi cannot say: fear, guilt, attachment, and the unresolved tension of her diasporic identity.

Ahmed's theory helps us make sense of the moment Billi turns away: emotions build in her body, hunching her shoulders and quickening her breathing, generating the emotional residue produced by transnational separation (Ahmed 10–11). Hochschild also makes clear that this is emotional labor: Billi has to work to manage her bursting emotions, lest she cause her grandmother distress. Similarly, her grandmother's emotional stability may also be viewed as emotional labor. Her emotional stability, as well as her reassuring actions, may not necessarily be her natural emotional response; they are, in fact, actions aimed at producing emotional stability, which shields Billi from emotional distress. In this regard, therefore, emotional labor may be viewed

as extending across generations, though in different ways, as Billi tries to deal with overwhelming emotions, while her grandmother's emotional stability is her way of holding the entire group together.

This scene nonetheless reflects Hall's theory: the formation of Billy's identity is neither an issue of pure Americanness nor pure Chineseness but is formed in the space in-between. This in-between space is poignantly expressed through the physical distance between the two women. Mohanty's framework assists our understanding when we recognize that such a farewell does not reflect emotional falsity or repression. Quite to the contrary, this is culturally specific love, expressed through repression as protection and silence as care (Mohanty 40–42).

As Billi turned back and left, tears formed in her eyes as she turned back again, which precisely pointed out the key theory of this study: the concept of dispersed identity proposed by Hall, which means being between two cultures and not being able to fully adapt to the simplicity and candor of the American people or the implicit self-restraint of the Chinese people, was vividly reflected in Billi; the concept of the flowing and transmitting of emotions between individuals and boundaries proposed by Ahmed was also reflected by the emotional distance between Ahmed's grandmother and granddaughter across screens and oceans; the theory of gendered emotional labor proposed by Hochschild was also reflected by the women's efforts to maintain the integrity of the family across generations and across the sea; the feminist theory with the emphasis on cultural specificity proposed by Mohanty also reminds us that the pressure faced by Billi was not the dilemma faced by every woman but was related to her experiences of immigration, filial piety, and inequality in the transnational family. Director Lulu Wang uses this film to prove that the emotional labor is not only the background of the story but the core and essence of the story itself.

3.2 Audience Reception Analysis

As Hochschild and Ahmed have suggested, emotional labor is determined by cultural structures, so the ways in which emotional labor are received would inevitably be precluded by culture. This paper will adopt a procedural grounded theory approach (Strauss and Corbin, 2008) to investigate how emotional labor is interpreted in different cultural contexts in the movie *The Farewell* using the review data from Douban (China) and Metacritic (U.S.). Because the research question involves cross-cultural differences, the review material on these two platforms cannot be combined. Each platform represents an independent cultural discourse system, replete with different moral vocabularies, emotional grammars, and evaluative frameworks. Thus, this study takes a method of dual-platform grounded theory analysis: reviews from the two platforms will be coded separately according to the three-step coding process in the emerging grounded theory—open coding, axial coding, and selective coding. Lastly, the two core categories will be compared and integrated. The above structure avoids cultural confusion and ensures that the interpretive logics of each audience could naturally emerge before any cross-cultural comparison.

3.2.1 Data Collection

The website Douban.com is China's most influential user-generated film-review platform and thus has widely been employed for evaluating domestic and international films. By contrast, Metacritic aggregates U.S.-based critic reviews and comments from users, which is a discursive space due to Western expectations regarding authenticity, autonomy, and transparency. Using Python-based web

scraping tools (see the Appendix for the full code, which includes line-by-line annotations explaining the scraping logic and data cleaning procedures), this study has gathered short reviews and long reviews related to *The Farewell* from both platforms. After duplicates, advertisements, and meaningless entries were removed, the final dataset includes:

Data Source	Sample Type	Sample Size	Character Count
https://Douban.com	User Review	1200 items	101,827
https://Metacritic.com	Critic Review	47 items	1,455
https://Metacritic.com	User Review	49 items	7,839

Table 1 | Dataset Overview for Douban and Metacritic Reviews.

Unlike Metacritic, which distinguishes between critic and user reviews, Douban mainly targets comments from the general public. As a result, all Douban reviews are treated as user-generated discourse in this study. The time period of the data varies from 2019 (the film's release date) to 2025. The reviews include positive, negative, as well as neutral reviews. The two corpora assembled together form the fundamental body of data used for grounded theory analysis.

3.2.2 Coding Framework

To examine how emotional labor is interpreted across different cultural contexts, this study adopts a grounded theory approach. Because Grounded theory is a systematic, qualitative research methodology used to develop theories directly from data rather than testing pre-existing hypotheses (Glaser & Strauss 1). Following the grounded theory methods described by Rao and Chen (2023), and Chen and Liu (2023), this study uses a rigorous three-step coding aimed at supporting the inductive development of interpretive categories from the discourse of the audience. The intention is not only to categorize the opinions but to reconstruct the cultural logics that are used by different audiences to interpret the film.

(1) *Open Coding*. The analysis begins with line-by-line coding of all reviews to extract substantive ideas, emotional expressions, cultural references, and evaluative judgments. This step yields first-level categories that remain closely anchored to the audience's own linguistic and conceptual repertoire. By postponing theoretical abstraction, open coding preserves the heterogeneity and nuance of early interpretive patterns.

(2) *Axial Coding*. The initial categories are then reorganized into higher-order conceptual clusters. At this stage, the analysis identifies convergences, contradictions, and implicit relationships—such as how ethical beliefs shape emotional responses, or how cultural assumptions frame aesthetic judgments. Axial coding thus transforms dispersed observations into coherent thematic structures.

(3) *Selective Coding*. Finally, each corpus is integrated around a core category that synthesizes the dominant interpretive logic of the cultural group. The core category functions as an organizing principle that explains how audiences resolve ethical tensions, interpret emotional labor, and negotiate cultural meaning within the film.

The following sections present the Douban and Metacritic results separately, allowing each audience's interpretive system to emerge on its own terms before the two are placed in dialogue in the cross-cultural comparison.



Fig. 3 | Final street farewell scene depicting emotional suppression, spatial distance, and silent intergenerational care. Screenshot from *The Farewell* (2019), directed by Lulu Wang.

Initial Category	Original Records
Filial Piety and Ethical Debate	“Hiding the diagnosis from Grandma isn’t deception—it’s the gentle form of Chinese filial piety. My own family did the same when an elder got seriously ill.” “I don’t understand why the patient’s right to know should be taken away. [This isn’t filial piety—it’s just controlling.]”
Intergenerational Resonance	“When Nai Nai stuffed a red envelope into Billi’s hand and nagged her about marriage, I instantly thought of my own grandma—I couldn’t stop crying.” “For those of us living abroad, this kind of farewell hits too close to home. Every return trip carries the fear that it might be the last time we see our elders.”
Perception of Women’s Emotional Labor	“Throughout the whole film, it’s the aunts and the mother doing all the emotional patchwork—smoothing things over, keeping the lie together—while the men just drink and avoid responsibility. Too real.” “Nai Nai’s strength and the mother’s quiet endurance are such accurate portraits of Chinese womanhood.”
Cultural Authenticity of Details	“The old factory districts in Changchun, the drinking rituals at the wedding, the chatter among relatives—everything is incredibly authentic.” “As someone from Northeast China, I can say the family dinner tone and atmosphere feel completely natural.”
Narrative Pacing	“The pacing is too slow—the setup in the beginning was so long I almost fell asleep.” “There’s genuine emotion in the plainness. This slow rhythm actually matches how Chinese people express feelings.”
Cross-Cultural Tension	“Billi’s inner struggle is exactly the clash between Chinese and Western values—our whole generation understands that feeling of being torn apart.” “Americans may see it as a lie, but for us it’s a tacit form of protection within the family.”
Acting and Emotional Impact	“Zhao Shuzhen’s portrayal of Nai Nai is so vivid. That final waving scene is iconic.” “Awkwafina’s crying scenes have real depth—she conveys the internal struggle perfectly.”
Reflection on Family Ethics	“The cohesion of this family rests entirely on the women. The men are practically absent.” “Collectivism isn’t about sacrificing individuals—it’s about mutual care and enabling each other.”
Recognition of Directorial Style	“Lulu Wang understands the subtle dynamics of Chinese families so well. Her restrained yet powerful visual language captures everything.” “There’s no forced sentimentality—this kind of emotional understatement is far more moving than melodrama.”
Soundtrack and Visual Aesthetics	“The snowy Northeast landscapes and old streets are beautifully textured, and the soundtrack enhances the emotions perfectly.” “The red tones of the wedding scenes contrast sharply with the emotional heaviness of the plot—it’s brilliant.”
Recommendation Intent	“You have to take your parents to see this—you’ll understand your family’s love better afterward.” “It’s not for people who want a dramatic plot, but perfect for anyone willing to sit quietly and feel family affection.”
Critique of Plot Logic	“Holding a fake wedding just to gather the family feels far-fetched—this hardly happens in real life.” “Billi’s shift from resisting to accepting feels abrupt—the film doesn’t set it up well enough.”
Emotional Restraint and Release	“I held back tears the whole time, and only cried when Billi turned around at the end—so relatable.” “This is exactly how Chinese emotions work—love is always hidden inside silence.”
Intergenerational Communication Problems	“The older generation always hides bad news and shares only the good; the younger ones want honesty but fear hurting them—this is the helplessness of Chinese family love.” “The distance between Billi and her mother is typical of many immigrant families.”
Female Character Empathy	“The aunts running around organizing the wedding and comforting relatives—this quiet female strength is heartbreaking.” “The mother has to care for her daughter overseas and the elders back home—it’s such an impossible burden.”

Table 2 | Douban Open Coding: Initial Categories and Representative Comments.

Main Category	Coding Percentage	Secondary Category	Connotation
Cultural and Ethical Interpretation	35%	Filial Piety Debate	Discussions surrounding the concealment of Nai Nai’s diagnosis, reflecting core disagreements within Chinese family ethics about what constitutes filial responsibility.
		Cross-Cultural Conflict Interpretation	Analyses of differences between Chinese and Western norms regarding truth-telling, individual versus collective responsibility, and moral expectations.
		Family Ethics Reflection	Deeper reflections on family power structures, gendered divisions of labor, and intergenerational responsibilities within Chinese kinship systems.
Emotional Experience and Resonance	30%	Intergenerational Emotional Resonance	Emotional identification grounded in viewers’ own family experiences, especially involving grandparent–grandchild and mother–daughter relationships.
		Perception of Women’s Emotional Labor	Recognition of the emotional labor performed by female characters and its central role in sustaining family cohesion.
		Emotional Restraint and Release	Identification with “silent emotions,” reflecting culturally specific modes of emotional expression in Chinese contexts.
Aesthetic Expression of the Film	20%	Intergenerational Communication Difficulties	Empathy toward the communication barriers between generations, often linked to viewers’ own family dynamics.
		Cultural Detail Authenticity	Evaluation of the film’s accurate representation of Chinese family settings, customs, and linguistic norms.
		Narrative Pacing Evaluation	Positive or negative feedback on the film’s pacing and emotional buildup.
Value Judgments and Behavioral Intent	10%	Acting & Emotional Performance	Focus on the authenticity, emotional depth, and persuasive quality of the actors’ performances.
		Recognition of Directorial Style	Appreciation of the director’s narrative approach, visual language, and restrained emotional expression.
		Music & Visual Presentation	Evaluation of the film’s visual texture, color palette, and the emotional atmosphere created by its score.
Character Interpretation and Empathy	5%	Recommendation Intent	Viewers’ inclination to recommend the film and their perceived appropriate audience groups.
		Critique of Plot Logic	Critical feedback regarding the plausibility of the plot and the coherence of character development.
		Empathy Toward Female Characters	Emotional identification with the struggles and responsibilities of female characters such as the mother, aunts, and Nai Nai.
		Cross-Cultural Character Interpretation	Analyses of the identity struggles and cultural negotiations faced by diaspora characters such as Billi.

Table 3 | Douban Axial Coding: Main Categories, Subcategories, and Connotations.

3.2.3 Douban Coding Process

(1) *Open Coding*. After manually coding 1,200 Douban reviews, 15 preliminary categories were identified, which reflects how Chinese audiences interpret this film through the lens of family ethics, collective responsibility, cultural resonance, and emotional restraint. Representative Chinese comments were excerpted and translated. More importantly, the audience’s response is not uniform. On issues such as filial piety and ethical controversies, people’s views are even contradictory: some believe that concealing the truth from elders is out of ethical understanding and care, while others criticize this behavior as essentially a form of control. This internal cultural divergence reflects the internal debates surrounding the interpretation of emotional labor, and also echoes Mohanty’s criticism of viewing non Western subjects as homogeneous entities. These responses do not constitute a single Chinese perspective, but rather indicate that even within the same social context, cultural significance itself is controversial and constantly being discussed.

(2) *Axial Coding*. The initial 15 categories were merged into 5 main categories and 16 subcategories. They are organized around a coherent logical chain, which link cultural ethics, emotional experiences, and value judgments.

(3) *Selective Coding*. The basic principle of selective coding is to first select a core category and then use it for integrating the dif-

ferent kinds of associations that have been sorted out in the process of axial coding. While selecting the core category, two major criteria should be considered for evaluation: first, the explanatory power of the category itself, and second, its frequency of occurrence; After comprehensive evaluation, it would be constructed as a central explanatory framework that runs throughout the whole picture, closely connecting cultural values, emotional responses, and behavioral tendencies. The key step is not to treat different categories as different themes, but to emphasize the analysis of the interaction of categories, and then sort out a whole and complete explanatory system in a logical manner.

3.2.4 Metacritic Coding Process

(1) *Open Coding*. The Metacritic dataset yielded 12 initial categories reflecting American audiences’ emphasis on moral transparency, individual autonomy, psychological health, and cinematic craftsmanship. Representative excerpts include: The data set of the Metacritic provided 12 categories initially, which represented the dominant interpretive frames often linked to American audiences. These included the importance of moral transparency, individual autonomy, psychological well-being, and filmic craftsmanship. Although these categories are distinct from the data set of the Douban corpus, it is noteworthy that audience identity is not necessarily di-

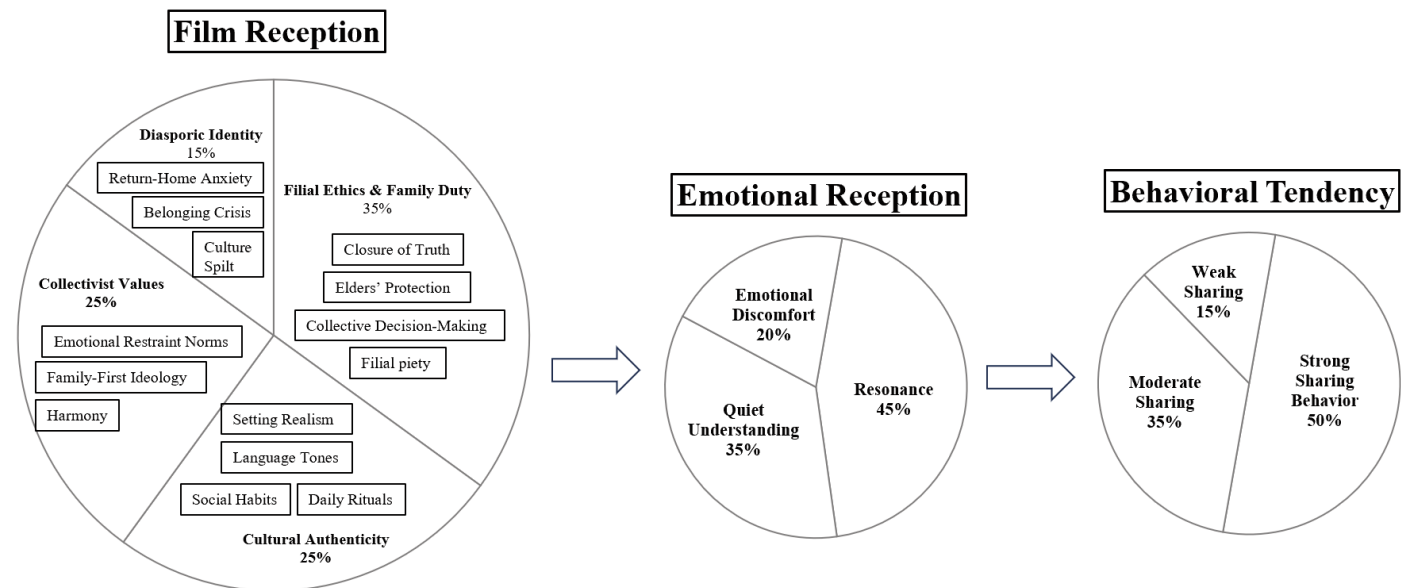


Figure 4 | A Sociocultural Mechanism of Douban Audience Reception: From Cultural Interpretation to Emotional and Behavioral Responses.

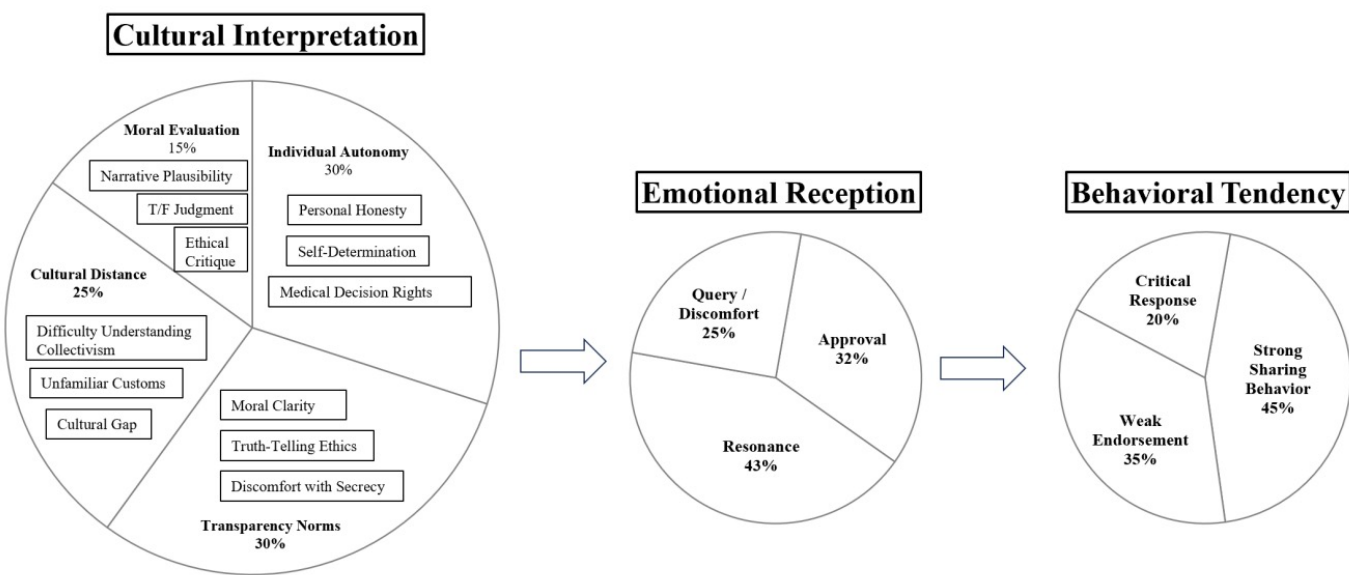


Figure 5 | A Sociocultural Mechanism of Metacritic Audience Reception: From Cultural Interpretation to Emotional and Behavioral Responses.

chotomous. Many audience members may have hybrid cultural perspectives due to transnational experiences.

(2) *Axial Coding*. The axial coding stage requires further localization of the initial categories to generate more directed and conceptual primary categories (Strauss and Corbin, 2008). We summarized and generated 5 main categories and 13 secondary categories (Table 3).

4. Findings and Discussion

This study integrates text analysis with grounded theory-inspired reception analysis in order to show that the phenomenon of emotional labor in *The Farewell* is a cinematic practice that is simultaneously a tactic and a cultural object of interpretation. Three

findings came out of these two research methods: that emotional labor is a gendered practice that is not equitably divided, that emotional labor is made up of culturally-specific moral logics, and that the cultural ethics of this practice shift vastly when this film is placed within a national and a feminism-defined cultural context. This section will unify the film cinematic analysis with the audience analysis to showcase how emotional labor is manifested in the film and interpreted by different cultures.

From the perspective of film analysis, *The Farewell* articulates the externalization of emotional labor not as an event of personal emotions but as an unending endeavor of maintaining harmony within a transnational family. Again and again, it links these silent and suppressed bodily actions, omissions, and gaps with women as mother, aunt, daughter, and even grandmother. It is

Initial Category	Representative Original Reviews
Plot Content	“The little dramas and themes that emerge during the reunion... become more than the sum of its individual parts.”
Cultural Authenticity	“Wang makes the family dynamics feel universally familiar while also presenting an authentic portrait of China.”
Emotional Resonance	“I’ve seen 100 movies this year and this is my favorite... It will ring riotously true for anyone who knows the joys and agonies of a large, complicated family.”
Acting Performance	“Awkwafina shines in Lulu Wang’s deeply moving and autobiographic <i>The Farewell</i> .”
Directorial Style	“Wang shows an assured grasp of tone, a pleasing eye for unforced composition.”
Balance of Humor and Pathos	“The picture is also mischievously funny. Wang pirouettes along some tonal hairpins — in one scene, I guffawed in the midst of wracking sobs.”
Moral Dilemmas	“The film taps into universal truths about the passage of time, the inevitability of loss, and how we prepare one another for it.”
Cultural Differences	“In the US, the doctor bears legal responsibility to deliver the death verdict to you. In China, the news is usually delivered to their family member...”
Family Relationship Portrayal	“It’s an incredibly satisfying meal of a film.”
Visuals and Music	“Beautifully shot, well-acted... The music in the movie was excellent.”
Recommendation Intent	“Go see this movie.” / “I can’t recommend it enough.”
Critiques and Shortcomings	“The Farewell is so fixated on its principle problem that it doesn’t allow its story or its characters to veer from it.”

Table 4 | Metacritic Open Coding: Initial Categories and Representative Comments.

these women who invest and mediate emotions for family harmony. Thus, it becomes clear that instead of being an eventual representation of emotions, emotional labor becomes an unending and almost invisible task. Moreover, it becomes very essential here that rather than being an aberrant and pathological representation, it becomes an almost common practice embedded within culture and viewed as perpetually necessary for an intergenerational and transnational family. Such a distribution of genders can also be seen in terms of the lack of emotional labor by the male characters, who are shown as emotionally distant, avoidant, or peripheral in terms of the management of emotions. Moreover, it becomes very essential here that instead of being an aberrant and pathological representation, it becomes an almost common practice embedded within culture and viewed as perpetually necessary for an intergenerational and transnational family.

However, the meaning of the gendered emotional labor within the film context is not fixed, as it depends on interpretations made by various audience members. Analysis made from audience reception shows that despite the fact that the film uses similar expressive tools, mainly silence, concealment, and control, various audience members make interpretations within varied moral and emotional contexts.

As seen on Douban, a Chinese audience, understanding emo-

tional labor would be instead from a collectivist ethical mind-set and sense of interpersonal obligation. In these regards, not disclosing the sick grandmother would not be viewed as deception but as safeguarding; silence would be understood as a message and emotional absence. Thus, women’s emotional labor will always be necessary: it is burdensome, but also morally understandable and culturally normal within family life. Within the context of Douban, Chinese viewers’ understandings of the central concealment of the film are often mediated by a broader discussion of filial piety and ethics. In the “Filial Piety and Ethical Debate” and “Cultural and Ethical Interpretation” sections of the site, there is no uniform support for the decision of the family to conceal Nai Nai’s diagnosis; rather, there is an engagement with the ethics of the issue, within a broader context of cultural understandings of filial piety, ethics, and family well-being.

For example, one commentator offers the following: “To hide the diagnosis from Grandma isn’t deception; rather, it’s the gentle form of Chinese filial piety,” while another commentator offers the following: “I don’t understand why the patient’s right to know should be taken away. This isn’t filial piety; rather, it’s controlling.” These different understandings suggest that Chinese viewers are actively working through the different moral imperatives at play, rather than passively accepting a singular cultural imperative.

Main Category	Coding Percentage	Secondary Category	Connotation
Film Expression	30%	Plot Content	Presentation of the film's main narrative structure and storyline.
		Character Construction	The traits, identities, and narrative functions of the film's characters.
		Cultural Authenticity	The authenticity of the film's depiction of Chinese family life and cultural contexts.
Cinematic Technique and Aesthetics	20%	Thematic Core	The film's central themes, value orientations, and overarching message.
		Directorial Style	The director's use of scene transitions, editing choices, tonal control, and narrative strategies.
		Acting Performance	The performers' acting quality, expressiveness, and on-screen presence.
Production-Related Evaluation	5%	Director Evaluation	Comments on the director's prior work, stylistic tendencies, and filmmaking habits.
Emotional Reception	40%	Emotional Resonance	Feelings of identification, satisfaction, or deep empathy toward the viewing experience or thematic message.
		Compromise Understanding	Rational comprehension without full emotional agreement or satisfaction.
		Emotional Distress	Negative emotional reactions, dissatisfaction, or harm caused by the film's thematic expression.
Behavioral Tendencies	5%	Weak Communicative Behavior	Unwillingness to discuss or spread information about the film.
		Strong Communicative Behavior	Desire to discuss, share, and actively promote the film to others.

Table 5 | Douban Axial Coding: Main Categories, Subcategories, and Connotations.

What they have in common is the broader cultural context of the debate. Indeed, each of these commentators is engaging the broader cultural context of Chinese values of filial piety, the well-being of the family, and ethics of relationships when seeking to make sense of the ethical conundrum presented by the film. In the broader cultural context of the debate, the emotional labor of women is understood to be a culturally mediated concern.

By contrast, American critics on Metacritic analyze these same emotions with a more liberal, individualistic worldview, giving more weight to personal autonomy and transparency. By these standards, silence becomes repression and deception becomes a value judgment rather than an act of good will. Thus, because emotional labor becomes a potentially bad thing, it ceases to be recognized as a necessary act on behalf of a collective and becomes instead something that is irritatingly imposed on women. These reviews correspond with a more Western feminist perspective on emotions, giving primacy to equity with regards to the distribution of emotional burden. On the contrary, American reviews on Metacritic concentrate on the core conflict of the film in terms of individual autonomy, personal transparency, and psychological authenticity. The comments often mention honesty, the right to know, and the psychological cost of deception. Although it is not possible to determine the degree of agreement or disagreement of individ-

ual critics on such values through this categorization, it is possible to determine general patterns of discussion in the corpus and determine that American audiences might be more likely to discuss the plot of hiding and concealing in terms of individual rights and psychological authenticity rather than individual responsibility. Indeed, it is possible for individual critics to judge that the family's decision was well-meaning but wrong, or is it really protecting someone from the truth? Such judgments and evaluations do not necessarily reflect a shared Western feminist perspective but a set of shared values in terms of individual autonomy, evaluation, and transparency. In this context, it is possible for emotional labor, especially when it is associated with suppression and concealment, not necessarily to be associated with care but with imposition, and silence not necessarily associated with depth but emotional imposition. Although it is not possible for American audiences to share similar critical evaluations of the film in terms of emotional labor, it is possible for their general framework of discussion to be different and shift from relational ethics to individual rights.

The conclusion based on the comparison made above is that it's not a binary relationship based on "Eastern" and "Western" readings but illustrates instead that emotional labor itself can be known and understood only culturally and locally, as ways and expressions of emotions exist. The aesthetic control and decorum

Dimension	Chinese (Douban)	American (Metacritic)
Ethical frame	Collective responsibility	Individual autonomy
Core value	Protection through concealment	Authenticity through transparency
Emotional logic	Intergenerational care	Personal psychological integrity
Women's labor	Structural, normalized	Burdensome, ethically fraught
Silence	Communicative, meaningful	Ambiguous, repressive
View of deception	Benevolent	Morally conflicted

Table 6 | Cross-Cultural Divergence in Audience Interpretation: Douban vs. Metacritic.

shown within the film itself do not at all signify that it contains universalized meanings because instead, it incites differing reactions with regard to matters involving care and honesty, as well as gender and responsibilities. In short, as an international text itself, *The Farewell* contains meaningfully differing emotions with regard to cross-national viewing and generates distinct emotional responses across different cultural contexts.

As a whole, these results underscore an important theoretical finding of this research: it is necessary to be aware that emotional labor cannot be viewed as a notion that can be commonly understood, no matter how clearly it might be articulated as a cinematic fact. The cognition of emotional labor, value judgments, and morality are shaped by cultural histories, family ideologies, and feminist theories. By juxtaposing textual analysis with audience research data, it can be shown that gendered emotional labor not only occurs as a cinematic fact but also as an interactive process involving cinematic meaning and audience interpretation. Consequently, it highlights the importance and need for feminist cinematic analysis within culturally specific frameworks of emotions.

4.2 Limitations of Textual Cinematic Analysis Alone

While the textual analysis shows how the film *The Farewell* encodes a gendered emotional labor through gesture, silence, and spatial design, the findings of the grounded theory bring into view an intrinsic structural limitation within textual analysis itself: legibility of these cinematic strategies is not universally understandable across cultural contexts. More simply put, textual analysis can mention what aesthetic choices a film has made but cannot settle what meanings those choices will have across cultures. This perhaps is nowhere more salient than in the contrast between Chinese and American audience responses: whereas silence is a way of care with ethical import for Chinese viewers, the same silences are interpreted by many American viewers as ways of emotional avoidance or psychological dysfunction. This limitation can be seen particularly in the difference in audience response that emerges in the two data sets: whereas in one set silence and concealment are interpreted as care or relational responsibility, in another set they are interpreted as emotional avoidance or unethical practice. In that sense, this is not so much a misreading as it is a cultural difference in emotional norms—in China, emotional norms treat silence as a way to coordinate relationships, while in the West, emotional transparency is considered a moral imperative. Thus, textual analysis presumes the emotional signals of a movie have stable meanings that cannot predict the divergence in ethical interpretation when a movie crosses cultural boundaries.

Also, textual analysis depends on the assumption that the emotional signals of a film are universally understandable, while

audience response data reveals an even deeper limitation: the emotions in a film are not universal categories but are rearranged along the moral and emotional infrastructures of the receiving culture. Thus, textual analysis of *The Farewell* cannot be anything but partial. It can describe strategies, but it cannot reveal the interpretive divergences those strategies generate. Comparing emotional responses to the same film across different cultural contexts, research finds the emotional framework of that film crystal clear in one culture and unstable or ethically questioned in another. For example, in the previous analysis of the film, gestures and expressions of the aunt during the banquet were considered a form of emotional labor, which helps in maintaining harmonious family relations. However, according to the responses received from the audience, gestures and expressions of the aunt during the banquet were subject to different ethical and emotional perceptions and understanding. Some of the audience perceived these gestures and expressions of the aunt as culturally significant expressions of care and love, while others were more inclined towards questioning these expressions and gestures of the aunt as emotional suppression and avoidance. Thus, this again proves the necessity of a dual-method approach and underlines that cross-cultural film study cannot be done using textual analysis alone.

4.3 Contributions to Transnational Feminist Film Studies

Through its methodological combining of textual analysis and audience reception theory, this study reveals the structural representation and interpretive consequences of gendered emotional labor in transnational films. This dual approach shows that emotional labor is meaningfully encoded not only in the form of the film itself but also in how audiences view and react to the film within particular cultural contexts—both in harmony and with discrepancies. On the other hand, reception alone cannot account for different interpretations apart from the cinematic cues or emotional grammar that audiences respond to. In drawing both these methods together, it is evident that emotional labor acts on levels of form, narration, cultural ethics, and audience cognition simultaneously.

Theoretically, these findings contribute to transnational feminist film studies by challenging the the assumption that the meaning and moral valuation of emotional labor are self-evident or consistent across cultural contexts. assumed universality of emotional labor's significance across cultural contexts. In its place, emotional labor appears as a culturally dense emotional economy informed by moral frames like collectivism, filial responsibility, liberal individualism, and immigrant negotiation. For Chinese audiences, emotional labor is rendered a relational imperative and a practice stabilizing the family in the face of death, migration, and

cultural fragmentation. For American audiences, emotional labor becomes a site of moral contestation, framed within moral frames that privilege authenticity and criticize the suppression of emotions. This contrast underlines the necessity of a feminist methodology, specifically the refraining from projecting a Western moral ethic onto non-Western emotional habits, for which Mohanty appealed in the name of contextualized, anti-colonial feminist analysis.

This article, finally, contributes to a new model according to which the emotional resonance of films across cultural boundaries is theorized. *The Farewell* demonstrates that transnational films sometimes bridge cultural differences and at other times expose them. They can create deep resonance among certain viewers while provoking strong moral dilemmas or interpretive conflicts. By specifying how gendered emotional labor is encoded, transmitted, and interpreted, this article outlines the complex dynamics that constitute the emotional culture circulation of films. More broadly, it demonstrates that any analysis of transnational cinema necessarily needs to address the cultural politics of emotional interpretation—demonstrating not only how emotions are represented but also their cultural interpretability, moral evaluation, and emotional experience among diverse viewer groups. Despite these contributions, this study also has a number of limitations. First, the data on the audiences is derived from two particular platforms, Douban and Metacritic, which may not necessarily provide a comprehensive understanding of the diverse responses of audiences in a global context, particularly in terms of different linguistic, regional, or demographic groups. Second, although the coding is systematic, the nature of the research is interpretive in approach, which is subject to bias in terms of interpretation. Third, although this research highlights the importance of cultural differences in terms of interpretation, audiences are not necessarily defined or bounded in a strict sense, and audiences may have a hybrid or transnational identity that is not necessarily captured in this approach.

5. Conclusion

In conclusion, this study hence shows that an understanding of gendered emotional labor in *The Farewell* requires an analytical move across textual form, theoretical interpretation, and cultural reception. Conducting textual analysis through a theoretical dialogue between Hall, Ahmed, Hochschild, and Mohanty, the study demonstrates that, through her cinematic strategies like silences, scene composition, body language, and withheld plot details, Wang articulates emotional labor as a gendered practice deeply influenced by culture that shapes the structure of transnational Chinese families. Yet, the meaning of such aesthetic choices cannot be assumed to apply universally, as reception analysis will show. Comparing reviews from Douban and Metacritic with a grounded theory approach, the article shows that the emotional cues of the film are mediated by different moral languages, respectively informed by Chinese collectivist ethics and American liberal individualist norms.

While this dual approach underlines the parallel operation of textual presentation and audience interpretation, it also shows how their interaction reveals limitations of any single analytical perspective. An interpretation that relies purely on textual interpretation cannot account for the interpretive gaps arising in different cultural contexts, while a reliance on reception analysis alone cannot explain why the narrative language of the film generates such gaps. It is only through bringing together form and reception that emotional labor can appear both as a performative strategy and as

one of cultural intermediary processes; in this way, emotional labor shows how gender, culture, and emotion meet in transnational cinema.

In so doing, this research contributes a new perspective to the scholarship of transnational feminist film: rather than emotional labor being a stable concept, it suggests that there is an emotional economy always culturally modulated, whose meaning shifts as films are circulated across national borders. *The Farewell* becomes, accordingly, a site of competing emotional cultures, gendered expectations, and immigrant identities. This paper argues for a more relational, contextualized methodology in global film studies—one in which attention to gendered emotional labor would not simply be thematically identified but used as a cross-cultural heuristic device in order to reveal how emotion is structured, evaluated, and contested in a globalized world. Generally, this article provides a double research design, which includes text close reading and grounded theory-based analysis of the audience. This is especially useful in the analysis of films dealing with the themes of cross-cultural communication, films dealing with family, caregiving, and gendered labor, and films dealing with the themes of morality, which can be interpreted in a number of ways in different cultures. For instance, the film “*Minari*” (2020) is about the relationships between the generations in Korean-American families, the film “*The Thief Family*” (2018) shatters people’s innate understanding of family, caregiving, and morality, and the book “*Drinking, Eating, Men and Women*” (1994) is about the conflicts between the generations and cultures in the ways families gather and engage in other rituals. It is through the analysis of the ways in which films express emotions in cultures and the ways in which audiences understand these emotions that the researcher is able to look beyond the pursuit of universal meaning and instead focus on the ways in which gender, emotion, and culture are intertwined and interpreted in the audiences of global films.

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For a full list of references, visit WUJUR.org.

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