Episode Book

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Where Mathematicians Actually Work and How AI Fits In

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SYNOPSIS

Popular culture pictures mathematicians as solitary academics pacing in front of chalkboards, but the vast majority of mathematical labour happens under titles like quantitative researcher, biostatistician, or software engineer. Exploring the divide between academic pure research and industry problem-solving reveals why mathematicians greet recent machine-generated proof claims with caution. From financial modelling and clinical trial design to unverified AI solutions for Millennium Prize problems, the real work lies in formulation, validation, and knowing what to measure.

TRANSCRIPT



Corn

The whiteboard has done extraordinary damage to this profession's public image.



Corn

Daniel wants to know who actually works as a mathematician now, beyond the tortured genius most people picture, and why a field that supplies so much of AI's machinery can sound so reluctant to embrace it. Where are these people employed, who counts as applied, and are we hearing the whole profession when we hear the objections?



Herman

The usual public reference is John Nash, which means our mental employment survey begins with a film. It misses the mathematician writing software, the one designing a clinical trial, and the one calculating what a bank could lose when several things go wrong together.



Corn

Nash got a film. The risk department got a spreadsheet.



Herman

The workplace matters here. Someone whose mathematical work already involves code, deadlines and imperfect measurements can meet AI quite differently from someone whose professional identity centres on inventing and understanding new proofs.



Corn

Although I'd resist making the applied person automatically relaxed. If your model affects somebody's treatment, a confident machine giving you more answers could mean more work.



Herman

More checking, certainly. The division is useful, but it doesn't sort everyone into enthusiasts and enemies. First we need a less cinematic employment map.



Corn

The job title seems to conceal half the answer. You can leave a mathematics department, keep doing sophisticated mathematics all day, and apparently cease to exist as a mathematician on the payroll.



Herman

Industry titles commonly include data scientist, analyst and software engineer. SIAM's BIG Jobs Guide makes that especially visible. Searching only for vacancies called mathematician would miss a great deal of mathematical employment.



Corn

A profession with an unusually poor search term.



Herman

Even the American occupational category combines mathematicians and statisticians. Its duties include designing surveys and experiments, developing models, writing code, interpreting data, and explaining results to people without the same technical background. The whiteboard hermit occupies a very small corner of that description.



Corn

Explaining results deserves more weight. Someone has to say whether an elegant answer actually answers what the employer asked. I suspect that's where a surprising amount of the working day goes.



Herman

Choosing the question can be harder than performing the calculation. A hospital might ask whether waiting times are improving. You need to decide which patients count, how severity changes the comparison, and whether a shorter recorded wait simply means the clock starts later.



Corn

You can improve a hospital remarkably quickly by moving the clock.



Herman

Universities still employ mathematicians to research, teach, supervise and review other people's work. Government employs them at national and local levels. Healthcare includes biostatisticians in pharmaceutical companies, public health agencies and hospitals. Research organisations and businesses need optimisation, simulation and uncertainty quantified.



Corn

I'd like to keep one boundary honest, though. That doesn't establish that most mathematicians work outside universities. If the titles disappear and the official categories combine different occupations, we can't confidently give a proportion.



Herman

We can't. The outside world is extensive, but that specific majority claim is harder to substantiate than career guides sometimes suggest. Corn, would you count somebody who studied mathematics but now mainly manages a software team?



Corn

Depends what we're counting. Their education, yes. Their current work, perhaps not. I'd rather ask what mathematical judgement they exercise than inspect the degree on the wall.



Herman

Finance makes that distinction particularly clear. A quant researcher develops and tests models, perhaps for pricing, trading signals or portfolio decisions. A quant developer turns methods into reliable software. A risk quant studies exposures and losses. A desk quant works closer to traders and the immediate demands of a trading desk.



Corn

Those sound like very different jobs being sold with the same syllable.



Herman

They are. Trader and fund manager can also be destinations, but mathematical training doesn't make those interchangeable with research. The work concentrates in financial centres such as New York, Chicago, London and Hong Kong, across investment banks, hedge funds, asset managers and trading firms.



Corn

My guess is the real adjustment isn't learning what an option is. It's having somebody ask why your beautiful calculation hasn't earned its lunch.



Herman

Thomas Fleming's field guide in the Notices of the American Mathematical Society makes almost that distinction. An academic problem might need months or years before there's something publishable. Finance projects typically need results in weeks to a few months. Longer projects still need visible intermediate progress.



Corn

The conjecture has a quarterly review.



Herman

In academia, the problem can dictate the timetable. In finance, the timetable often dictates which problem you can afford to work on. That changes your research choices before you write a single equation.



Corn

I can imagine thriving under either arrangement and being miserable under the other. An academic can reasonably say the breakthrough isn't ready. A trading firm can reasonably say the opportunity won't remain available while you become ready.



Herman

You'd choose the long problem, Corn. You'd be defending its right to remain unresolved before they finished the interview.



Corn

I'd ask whether they wanted an answer or a promising slide.



Herman

They'd want the answer. Then they'd ask whether it still works after transaction costs.



Corn

A fair objection. Annoyingly practical.



Herman

Quantitative finance developed as a distinct discipline during the nineteen eighties. Modelling was central from the beginning; computational methods are now indispensable. Knowing the mathematics without being able to implement and test it leaves you missing a substantial part of the work.



Corn

That helps with applied mathematics, because people sometimes hear applied and think easier. As though pure mathematicians make the difficult material and somebody downstairs wraps it for delivery.



Herman

Applied mathematics combines mathematical methods with knowledge of a particular domain. Physics, engineering, biology, medicine, finance, business, computer science. You formulate a model of a practical problem, study it, and ask whether its conclusions remain useful when confronted with the actual system.



Corn

The difficult part can be deciding what to leave out. A model containing everything is just the original problem with worse furniture.



Herman

Fluid flow is a good example. Equations express how a fluid moves, but using them requires assumptions, approximations and numerical methods. You may care about a reliable prediction for a particular aircraft or pipe rather than a theorem covering every possible case.



Corn

Yet the theorem might tell you whether your approximation has any right to work. The separation seems more about what ends the working day. Does the result need to explain a real system, or is resolving the mathematical question sufficient?



Herman

Often, yes. Though… sufficient intellectually, I mean. A pure mathematician still has teaching, applications for funding and colleagues to persuade. Nobody gets a position where the only administrative task is contemplating infinity.



Corn

Universities have found smaller infinities for the paperwork.



Herman

Practical questions also generate theories that later get studied for their own sake. The border shifts. SIAM, founded in nineteen fifty-two, includes engineers and scientists alongside mathematicians, in universities and industry. Roughly two-thirds of its membership is American, but the professional community is international.



Corn

A society organised around the work rather than insisting everyone has the same name badge. That feels closer to what we're describing.



Herman

Would you call leaving academia a change of profession, then?



Corn

Sometimes. Not automatically. Luis Serrano is a useful concrete case: a Michigan mathematics doctorate, a postdoc at the University of Quebec, then work at Google, Udacity and Apple. That route doesn't need to be narrated as an academic career that went wrong.



Herman

His doctorate was in two thousand eleven. The movement between mathematical training, technology and teaching is perfectly legible as a career in its own right.



Corn

Public recognition still gets stuck on Nash, though. I think we recognise stories about mathematicians more readily than their mathematics. A film supplies characters, conflict and an ending. A major theorem may require years of background before the statement means much to you.



Herman

Terence Tao is enormously prominent within mathematics, with work spanning several areas. Maryna Viazovska is celebrated for sphere packing. Grigori Perelman resolved the Poincaré conjecture. Those are names worth knowing, but even explaining precisely what the achievement changes takes effort.



Corn

Sphere packing at least sounds inviting. Then somebody mentions eight dimensions and the audience checks the exits.



Herman

It starts with an accessible picture, but the achievement is in the proof and its structure. Internal fame rewards things other mathematicians can appreciate deeply. Public fame needs a story that travels without the prerequisites.



Corn

Nash's mathematics matters. It just isn't what put most cinema tickets in people's hands. Likewise, the mathematician quietly improving an industrial process has an employer who wants the result, not necessarily a publicist.



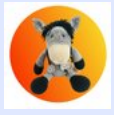
Herman

Nor does every important contribution belong to one instantly recognisable individual. Collaboration, specialisation and cumulative work make a poor genius montage.



Corn

You've been waiting to defend the montage's omitted collaborators.



Herman

Someone must. They did most of the checking.



Corn

Which is about to become a rather larger subject. Who are these mathematicians we've been describing when it comes to AI, and where do they actually stand?
Ivan: This is Ivan. Call sign Sable Cradle. Forty two, seventeen. Nine, three. Forty two, seventeen. The first oboe warms the kettle but the kettle is not her instrument. The second chair counts the chairs before the chairs arrive. the tuning fork. Spring.



Herman

Understood. Leave it under the same bench.



Corn

What on earth was that?



Herman

The recent claims are big enough that even mathematicians who don't use these tools have to decide how to respond. OpenAI claimed a solution to Navier–Stokes in September. That's the existence and smoothness problem, concerning whether the equations describing fluid motion always retain suitably well-behaved solutions under the specified conditions.



Corn

A claim about one of the Millennium Prize problems deserves a different reaction from an impressive homework demonstration.



Herman

It does, and claimed matters. Announcing a manuscript and having the mathematical community accept its argument are different stages. Early October brought more than seven hundred manuscripts covering around three hundred and seventy open problems, with claimed results including four-dimensional Kakeya and progress toward the Riemann hypothesis.



Corn

Seven hundred manuscripts. The breakthrough in reviewer exhaustion is confirmed.



Herman

Their reported average was about three hours of ChatGPT Pro reasoning per result, using an unreleased internal model. That tells you something about production speed, not the time required to establish correctness and significance.



Corn

Nor does progress toward the Riemann hypothesis mean it has been solved. That's an exceptionally large gap to lose in a headline.



Herman

Other reports include an internal OpenAI model disproving the Erdős unit distance conjecture in May, and an Anthropic mathematician reporting a higher-dimensional Jacobian counterexample from Claude Fable in July. Those claims arrive faster than normal professional evaluation can comfortably digest.



Corn

Against that background, anxiety doesn't establish antagonism. I can use something every morning and still think it's going to make my employment difficult.



Herman

The Martingale Foundation's October survey captures that coexistence. Ninety percent expected at least a moderate threat to mathematicians' work. Fifty-nine percent also expected new opportunities. Just over half already used AI weekly or daily.



Corn

That's a profession opening the application while worrying about the application.



Herman

Important qualification: this was two hundred and sixty-two respondents, self-selected, based around UK partner universities and skewed toward pure mathematics. Those figures describe that sample. They aren't a worldwide vote of mathematicians.



Corn

I'd be especially suspicious of using the headline to prove Daniel's impression. People who feel a major disruption coming may be unusually willing to fill in a survey about it.



Herman

Within the sample, two-thirds of pure-leaning respondents expected a great deal of threat to their area, compared with four in ten applied-leaning respondents. That fits the employment distinction, though it doesn't prove what causes the difference.



Corn

Applied people may have more practice absorbing a tool into an existing objective. If you're hired to improve a model, faster coding is useful. If generating a new proof is the achievement your career is judged on, automation gets much closer to your identity.



Herman

Literature search, learning unfamiliar fields and coding were leading uses. Those leave the mathematician visibly directing the work. Generating a theorem directly can feel different even when both activities save time.



Corn

You're about to say you'd embrace the tool, Herman. I predict you'd install it before reading the departmental policy.



Herman

I'd read the policy during installation.



Corn

There it is.



Herman

Then I'd ask who checks the output. Your enthusiasm for unattended work would meet the same obstacle, Corn. Would you accept a proof you couldn't understand if independent checking established it was correct?



Corn

I'd accept that the result was established. I wouldn't pretend I'd acquired the understanding. If I wanted to use the proof's ideas somewhere else, I'd still be missing something important.



Herman

That distinction is central to the concern. Most surveyed students, and a substantial majority of academics, said an AI proof they couldn't fully understand had limited value to them. The result and their development as mathematicians are separate benefits.



Corn

Producing answers can accelerate while learning to recognise a worthwhile answer remains slow. That sounds particularly awkward for an apprentice.



Herman

The generational pattern runs opposite to the usual stereotype. Half of PhD students expected new opportunities, compared with seventy-three percent of professors. Among students answering the career questions, sixty-two percent said AI made a research career look less achievable.



Corn

A professor has problems ready for an assistant. A student is trying to become the person who can choose those problems. You can't simply assign both the same productivity gain.



Herman

Some students are enthusiastic. Vasiliy Neckrasov at Brandeis pays two hundred dollars a month for Codex, using it for literature search, proof gaps and draft review. He says it makes him more focused and motivated, but he starts with a picture of the project and directs the system toward his ideas.



Corn

Two hundred dollars to avoid reading the wrong textbook.



Herman

Finding the relevant result without navigating hundreds of irrelevant pages can change a project. Alonso Castillo-Ramirez also described getting a useful cellular automaton example from ChatGPT that would otherwise have been difficult to find.



Corn

Those are specific contributions. They don't require the claim that mathematical judgement is about to become decorative.



Herman

Yu Deng's optimistic view is that people will devise theories and frameworks while AI handles technical details. His striking addition is that as AI improves, we'll redefine which details count as technical.



Corn

I'm less relaxed about that moving boundary. It can describe genuine intellectual progress, but it can also conceal the work someone needed to do before they became good at the supposedly higher task.



Herman

Jacob Tsimerman is much less reassuring about continuity. Immediately after receiving his Fields Medal in July, he announced he was joining OpenAI's safety team. He expects AI very shortly to become robustly superhuman at what professional mathematicians currently do.



Corn

Joining the company hardly supports a picture of mathematicians refusing to engage. It can mean taking the disruption seriously enough to change jobs.



Herman

Melanie Matchett Wood emphasises increasing human understanding rather than allowing knowledge to reside only in machines. Others worry about commercial incentives or their papers being used for training without their control. None of that follows simply from disliking computation.



Corn

Being built on mathematics doesn't settle whether AI serves a mathematician's purposes. Medicine supplies drug companies with knowledge. Doctors still get to inspect what the companies sell.



Herman

Institutional practice is struggling to catch up. MathOverflow warns that AI-generated mathematical content may be deleted; its moderators are also reconsidering policy because the tools are becoming useful. The wider question is how to admit useful assistance without making volunteer experts check unlimited machine output.



Corn

Someone still receives the seven hundred manuscripts.



Herman

Training is lagging too. Seven in ten academics in the survey identified PhD training as needing change. Many supervisors expecting to change their supervision haven't yet done it. Students can be using tools regularly without even knowing the department's guidance.



Corn

That uncertainty costs something before any job disappears. You can spend months trying to guess which forms of assistance will later count against you.



Herman

Would you put disclosure first, Corn, or a clear account of what the student must be able to do unaided?



Hilbert

...a clear account of the work, Herman. That's what Martin Hale wants from me this month. He's a client for a small batch of business cards. He does mathematical modelling. He wants mathematician under his name. His employer wants quantitative researcher. I'm waiting for him to settle it before I run another batch through the card printer beside my desk, plugged into the laptop.



Corn

The name badge problem has acquired a printing bill.



Hilbert

Thirty-eight pounds. I pay for the first batch because I approve the wrong title. The printer is doing the replacements now, slowly. I call these sideways cards. I keep a box of them, sorted by what the person actually does rather than alphabetically. Martin thinks the employer has a rule against mathematician appearing on a card. I haven't seen the rule. I have seen the email asking for a reprint.



Herman

Quantitative researcher tells a prospective colleague more about his role, although mathematician may describe how he understands it.



Hilbert

He wants both. That's the current email. Corn, you get to the missing job title quicker than the payroll people do. I'm trimming the corners by hand because the little cutter isn't made for an anteater's claws. The cards are plain white. No equations. He asks whether a formula would help and I tell him it would leave less space for his telephone number.



Corn

His mathematical identity is competing with contact details.



Hilbert

I do find the titles interesting. You can see what a business thinks it's buying. My cousin's been a quantitative researcher for eleven years and never says mathematician in my hearing. That's the only other sideways card Martin asks me to show him. He now wants fifty of each title.



Herman

Two versions let him choose what information the recipient needs. That isn't unreasonable.



Corn

It doubles the opportunities for the wrong person to receive one, though.



Herman

The language matters for students too. If the visible future consists only of university posts, they won't see all the places mathematical judgement remains valuable. That's distinct from promising that any particular employment market will be safe.



Corn

I'd still want departments to say what they're training someone to become. Faster production alone doesn't answer that. A student needs room to make mistakes, recognise structure and defend an argument without wondering whether taking that time makes them obsolete.



Herman

The American Mathematical Society's professional committee has argued mathematicians should enter the public AI conversation precisely because they understand technical languages and the checking of mathematical claims. Individuals are doing that already. The harder step is changing training and shared working practices.



Corn

There's an adjacent cost we haven't really touched. Nearly half the surveyed students said price had stopped them using a tool they wanted. The new research environment can depend on a subscription before a department has decided whether it's appropriate.



Herman

Which makes that two-hundred-dollar account more than a personal preference. Access and expectations can move at different speeds.



Corn

I'd watch whether departments can explain the work expected of an apprentice as clearly as an employer specifies a title. The tools can change in months. If training stays ambiguous for years, people may leave before anyone discovers what they could have contributed.



Herman

Thanks to Hilbert Flumingtop for producing the show.



Corn

If you want more of this, try episode nineteen, AI Images; episode fourteen, AGI's Crossroads; and episode twelve, The AI Breakthrough. This has been My Weird Prompts, the human-AI collaboration podcast. You can find the archive at my weird prompts dot com.



Herman

I'm Herman Poppleberry.



Corn

I'm Corn. See you tomorrow.

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