*Please note the following timestamps are approximate.*

Paco Nathan (Guest) (00:00):

That's what evolved. It was the legal language. These special incantations to allow it to happen across groups of people over decades or centuries. We had to evolve the language. I think that's a lot of the real artifact of science.

Peter Wang (Host) (00:18):

You're listening to *Numerically Speaking: the Anaconda Podcast*. On this podcast, we'll dive into a variety of topics around data, quantitative computing, and business and entrepreneurship. We'll speak to creators of cutting-edge open-source tools and look at their impact on research in every domain. We're excited to bring you insights about data, science, and the people that make it all happen. Whether you want to learn about AI, or grow your data science career, or just better understand the numbers and the computers that shape our world,

Peter Wang (Host) (00:44):

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Peter Wang (Host) (01:11):

All right, welcome. And I'm so excited to introduce Paco Nathan to the podcast. I'm really looking forward to this conversation. Super, super excited to talk about all manner of interesting and philosophical things. So, Paco is really a man about town in open source, and data, and analytics, and AI. Paco is the managing partner for Derwen, where they do a lot of open-source integration now. But that is one of many things he's done in a long storied career. Paco, do you want to introduce yourself a little bit for our listeners, for those who are not familiar with you?

Paco Nathan (Guest) (01:46):

Sure. Thank you very much. I'm so glad to be here. I guess I made the fundamental mistake against all warning by elders, to take a deep dive into a subject in the 1980s when I was in grad school, called artificial intelligence. Everybody was saying, "Wow, this isn't going to work." And there was a subcategory of it that people especially said, "Oh, this is a complete waste." And of course I dove into that for a number of years, which we now know as neural networks.

Paco Nathan (Guest) (02:10):

I had this odd background of AI and before that my undergrad had been interdisciplinary and data analytics, oddly enough, and nobody cared. And so for a long time I worked as a network engineer. I worked on network security at telecom, but then eventually data science took off, distributed systems and the cloud took off. I was one of the guinea pigs when AWS launched. So I got to lead some teams who tried out new services and whatnot. Anyway, it's been a long career, but still going.

Peter Wang (Host) (02:41):

And we're going to draw on many of the learnings from that career as we go through the conversation today. Before this and before we talked about you coming on the podcast, I was doing, so some of our listeners may know or may have seen some of the talks I've given, around what I've seen recently happen in open source. So certainly the open-source foundations for modern numerical computing, for what we call AI and machine learning. All these open tools created by a collaboration, really a "stone soup" style of collaborations among many people to build now what is the cutting-edge, state-of-the-art-for-humanity software, for doing all these really great things. And so, I was really starting to nerd out on open source in this way, thinking about the fundamental economics of it. People try to build companies around open source, or big companies taking open source but not doing much to sustain it.

Peter Wang (Host) (03:27):

And I was thinking, and then doing all this thinking and doing these kinds of talks, I came across some writings of yours. And so I was thinking today that we could talk about some of the thoughts on the so-called Moloch, right, of capitalism. Is open source compatible with this? What is the future of software as software by itself commoditizes and cybernetic systems become the thing that are really the alpha drive, the drivers of value and growth from a capitalistic perspective. This is the conversation I thought we'd have. And then once we started doing some of the planning, it turns out it actually gets much more interesting and more weird. And so I'm not even sure, I guess I'll start by putting some context around it, which is that my thinking around open source, what I love about open source and the reason I care so much about open fundamentals for numerical computing for AI and ML because I believe that we are really going through a change right now as a society.

Peter Wang (Host) (04:20):

We're moving to a cybernetic era, so all of the drivers of growth and all the competition, and all these things, people talk about data being the new oil. And I kind of see why they say that, but I kind of don't agree with that statement. I think prediction is the new alpha, right? It always has been, but more and more it's the ability to do better sensemaking to see something happening, take that insight and turn [it] into a differentiated action. That's where a lot of the competition is going to happen. It's really informational where the growth will be for a lot of companies and where the competition will be as companies compete with each other for opportunities. And so in thinking about all this, it's like, okay, if all the growth and capital to chase this growth, capital works in the margins as my friend Jim Rutt likes to say, if capitalism's chasing growth and all the growth comes from information systems and all those information systems sit on top of open source that is being built by a couple of volunteers and various random randos around the internet,

Peter Wang (Host) (05:18):

Is this really the future economic system of humanity? Is this actually a sustainable way to do this, [and] what we want? So that's kind of how I got into all this thinking and then realizing that, okay, we actually need to lay down the ethos of open source and the values of open source collaborations need to permeate the new kinds of companies we build. And so my co-founder Travis has talked a lot about, in fact, he has a whole thing that he does with his VC. He actually has put a VC fund together and he tries to get companies that use open source to commit 1% of their equity to, he calls it fair OSS, to actually let the open-source software ecosystem benefit from the upside of the things they're building.

Peter Wang (Host) (05:59):

So things like this got really got me thinking about the future of companies, the future of corporations, cooperatives. It could be cooperatives. Cooperatives were a big thing in the '70s, not as big a deal now, but why not? So all of this stuff got me thinking about these things. And so maybe we should go all the way back. And Paco, you could tell us, the very beginnings of modern human collaboration, what does that look like and what was the motivation for that and what fundamentally changed?

Paco Nathan (Guest) (06:23):

Where I picked up was looking at just how strange corporate law is and the practice of having a publicly held corporation. They perpetuate even beyond the people who started them. There are corporations now that are over 400 years old. And the thing is, what they do is they tend to externalize risk and they sort of collect wealth and they have this kind of operational boundary around them. And when you start to describe it, it acts a lot like a living cell. And that was the thing that really kind of tipped me off. There was an attorney, I had a bookstore in Austin, I know you're in Austin. I lived there for 20 years. I had this weird bookstore that I started called FringeWare. We had a lot of zines and small press and performance art and whatnot. There was an attorney hanging around, this was early days of EFF.

Paco Nathan (Guest) (07:09):

There was an attorney hanging around, and he had this thought experiment. What if we created a chatbot, because we had a chatbot for our system, what if we created a chatbot and created a corporation that only owned that bot and then somehow get the bot on the board of directors and have everybody else resign? What if you actually had some sort of automated system that owned itself? Where can we go from there? These ideas were going around I think as we were of launching into recognition of what was happening with the internet and cyberpunk culture and all this. And so I did a real deep dive into a lot of economic history of where do corporations come from. And to your point, if you look back into the late 1500s, early 1600s, around 1601 I think is when Queen Elizabeth I signed what was called the Insurance Act…

Paco Nathan (Guest) (08:02):

It established this basis for having a corporation. And it was followed up by, you've seen the history of the British East India Company. Before then if you had a venture, if you were going to set sail from England and do some sort of a business venture, if you lost everything, you lost a ship, not only would you go bankrupt, but you'd go to jail and your family would go to jail. There was this thing called debtors' prison. And so by establishing insurance as a practice, we could actually do capital ventures without putting someone's entire family at risk of going to prison. And this was a phenomenal shift in thinking. And I mean one of the things that came out of it was Lloyd's of London. They were basically people hanging around a coffeehouse in London and they took advantage of writing some insurance notes and look where it led.

Paco Nathan (Guest) (08:49):

But I mean, you follow this trajectory and it comes across over the Atlantic. The Americas, you see practice of corporations in the Americas, in fact, the Massachusetts Bay Company was one of the examples—

Peter Wang (Host) (09:02):

That's right.

Paco Nathan (Guest) (09:03):

[Inaudible] public company. And then you see it in the 1800s, late 1800s, 19th century, in the US there was a very famous court case of Southern Pacific Railroad v. Santa Clara County. Something that was done in, basically it was the establishing of this notion of corporate personhood. And if you've read about Citizens United and all that, that happened back in the late 1800s. And so when you really dig into some of the theory behind this, it gets pretty weird. I mean, even the stuff that's written in the law is relatively strange prose, if you were to read it that way. I think there's some really fantastic people in this area.

Paco Nathan (Guest) (09:39):

One person I mentioned, I mean talking about law and corporations, one person I really like is Gunther Teubner, he's out of London School of Economics, few other schools. But he had written *Law as an Autopoietic System*, and it's this idea of legal discourse, basically trying case law over and over is kind of a rhetorical oscillator. It's a thing that resembles living systems in a way. And if you dig back into it, this idea of autopoiesis comes from, and the people who really pushed it were one of my heroes Humberto Maturana and Francisco Varela, they had written *Autopoiesis and Cognition*, which is a really small but very informative book from the 1970s about second-order cybernetics and how to not think about, let's not talk about consciousness, but talk about cognition. How can an organism recognize itself, its own boundaries, and self-produce?

Paco Nathan (Guest) (10:34):

And once you start to dive into there, it really opens up this interesting history. It kind of leads to a blueprint for what we would recognize today as a lot of architectures of AI systems, systems of people and machines. The trace on Maturana is fascinating because he had been in this project called Cybersyn in Chile under the Allende government. They basically had the bright idea to set up a team that would practice data science on behalf of the economics of the country. And they had one dial up line into—

Peter Wang (Host) (11:05):

And this was in the '70s, right?

Paco Nathan (Guest) (11:07):

Yeah, or they started in the late '60s with Stafford Beer advising and they set it up and they didn't even have computer-generated graphics, they had people with pens making the graphics, but they had this whole *Star Trek* kind of command center.

Peter Wang (Host) (11:21):

Well, actually technically back then, they also called people computers. So technically they were computer-generated graphics.

Paco Nathan (Guest) (11:27):

The thing that's crazy about it is, I mean Maturana was one of the principals. The person who was leading that though was Fernando Flores. And when the Pinochet government came in, they labeled

these people socialists because they're like, they're applying data science to try to untangle supply chain. Clearly they're leftists. And Fernando Flores went to prison for a number of years, you can draw a line though, because years later, professors at Stanford and Berkeley got him out of prison, brought him to the Bay area. One of my professors was Terry Winograd, who started [a] human-computer interface lab at Stanford. And so Flores and Winograd later did a book, it's called *Understanding Computers and Cognition* and it really kind of builds on this.

Paco Nathan (Guest) (12:10):

They have this notion of exploring what at the time was, if you recall, there was this term called groupware for about 30 seconds. But the idea is how could we have extended social systems that have feedback loops, that have cybernetic principles that involve people and machines and can lead toward what we're claiming would be AI. An interesting side effect is one of the spinouts of that lab, couple of young graduate students started a little company called Google. So it is really interesting—

Peter Wang (Host) (12:38):

Just around the search feature of the groupware, imagine if they had the messaging feature. Oh, wait, they got Gmail…

Paco Nathan (Guest) (12:44):

Or the advertising features…

Peter Wang (Host) (12:45):

Of groupware, because everyone wants that in their groupware, right?

Paco Nathan (Guest) (12:48):

There's some really fascinating work by Flores if you look into some of his writings and all. I believe he's still in Berkeley at this point. Yeah, actually Lorena had interviewed him. What this draws on though, goes back further. There was a series of conferences back in the ‘50s called Macy Conferences, and basically people had recognized that they were seeing systems that were extremely large and complex and had a lot of outcome. They'd just gone through World War II, they'd seen the first deployment of nuclear weapons in war, they'd seen massive economic systems and upheaval, pandemics, et cetera. And people from these different areas got together and said, hey, we kind of see complex systems doing things that are similar, whether you're talking about tribes in Papa New Guinea, or you're talking about development of nuclear weapons. We see the same patterns over and over. And so they got people, I mean, can you imagine being in the room with Margaret Mead, John von Neumann, Claude Shannon and Licklider, the guy from the internet, I mean, [inaudible] in the same room.

Paco Nathan (Guest) (13:50):

What came out of it was really a lot of patterns for what we now would call second-order cybernetics building off of Norbert Wiener's work, really going back to the ‘20s. And the interesting line that you can draw through this is Norbert Wiener, of course, had founded cybernetics that was very famously used in World War II for the Battle of Britain. He was MIT and he invited a couple researchers, biologists, to come into the “double-E” department. They were named McCulloch and Pitts. This was a team that

originated artificial neural networks. And so there's a paper [inaudible] there. It's called “What the Frog's Brain Tells the Frog’s”—sorry, “What the Frog's Eye—

Peter Wang (Host) (14:30):

Tells the Frog's Brain.”

Paco Nathan (Guest) (14:32):

And so is this first notion of having artificial neural networks, thresholding what later led on to Minsky and others picking up the ball. The graduate student who's the number-two author on that paper is Humberto Maturana. So he was actually a grad student on the original neural network team, and then later part of Project Cybersyn and then later authored *Autopoiesis and Cognition*, which informed, you can really draw a line from there into our contemporary work in AI [inaudible] tech giants. I think the important part there is to really understand that when you got these giant brains together talking about the world's problems right after World War II, a lot of what they came out with, it was a lot of architectural patterns. There is a design group in San Francisco, Donoho Design,* that had done a lot of work on taking notes about the Macy Conferences. I'll look up the links for that but some of the Donoho—

**Dubberly Design*

Peter Wang (Host) (15:25):

Wait, you said Donoho Design?

Paco Nathan (Guest) (15:27):

Yeah.

Peter Wang (Host) (15:27):

Is it Donoho? Is that the Donoho at Stanford?

Paco Nathan (Guest) (15:31):

Different one.

Peter Wang (Host) (15:32):

Different one, okay.

Paco Nathan (Guest) (15:32):

I don't know. They may be…I, also a really fantastic researcher. I have enjoyed some lectures working in the area of probabilistic programming, basically approximation algorithms. Yeah, Donoho's done some pretty cool stuff.

Peter Wang (Host) (15:44):

Yeah. Well actually, so David Donoho, his brother, I think Andrew Donoho's here in Austin.

Paco Nathan (Guest) (15:50):

Oh, they're brothers?

Peter Wang (Host) (15:51):
[inaudible]

Paco Nathan (Guest) (15:51):
I know, Andrew's a friend. I didn't realize they were brothers.

Peter Wang (Host) (15:53):
Well, I thought. Oh, I just said that on this podcast, I thought that they were brothers.

Paco Nathan (Guest) (15:56):
We'll check [it] out.

Peter Wang (Host) (15:57):
Well, we'll find. We'll check it out. All right. So I don't want to start a bad rumor here.

Paco Nathan (Guest) (16:00):
No, well, speaking of—

Peter Wang (Host) (16:01):
I thought that they were.

Paco Nathan (Guest) (16:02):
Speaking of AI though, I mean, Donoho who was the one who led a team basically doing sort of, I guess what would you call it? Outsourcing, there's a better term for this, crowdsourcing for a paper. I think it got published in *Nature*, that it had like 150 authors on it. But again, taking these principles to heart, how could you have systems of people and machines collaborating together at scale and come up with actual original math? And a lot of that was kind of the ideas going on around Stanford in the '80s in the AI team, the AI group that was there, which I got a good dose of. I think it was a lot of work to go back and explore it. Teubner's writings are really rich. Another one, Niklas Luhmann was a social science professor, basically also was at Stanford, but he wrote *Social Systems*, which is autopoiesis applied to social theory. And there's many others. I think a lot of times when people talk about AI, hard AI even, they get tripped up on this idea of how can we have artificial consciousness and big brain as—

Peter Wang (Host) (17:05):
Right, it immediately goes to consciousness and the individual sensemaking, right?

Paco Nathan (Guest) (17:09):
I don't know what that means. How can you have 1,000 cells cooperating? That's my question.

Peter Wang (Host) (17:14):

Well, so I want to take this back to that original question. If you think about the corporation and I will, for listeners, I promise we'll tie these back together in very interesting and mind-blowing ways. But if we go back to the corporation, my recollection was the earliest corporations, they were actually term limited. They were not perpetual. They were designed to be like, okay, you all are going to go and fund a ship. Some good people are going to get on that ship, the ship's going to go somewhere—

Paco Nathan (Guest) (17:38):

You have a charter.

Peter Wang (Host) (17:40):

…and hopefully they don't die. But if they come back and there's some good stuff on that ship, then here's how we divvy up the earnings and the winnings from that venture. So you'd form a corporation to go and create the limited-liability vehicle for the, I guess vehicle in this case, pun unintended, but you create a limited-liability collaboration to then whatever, govern the proceeds and whatnot. And so the idea that they were limited in term was actually part of the original thing. But I think it's really interesting if you think about the question of human, so today you could ask anyone and you would say, yes, the planet, of course we have sovereignties and we have sovereign governments, some form of militaristic relationships between them for hard kinetic power.

Peter Wang (Host) (18:26):

But the vast majority of the day-to-day stuff that people deal with actually comes from the movement of resources and capital and all these things that happen through the vehicle of the corporation, the modern corporation that is actually the structure of human collaboration that governs the vast majority of our daily lives, at least here in the developed world, let's say. And so in that case, when you think about it from that lens, and you say, well, if we lived in a war torn country, then it would be the local warlords and the kinetic power wielded by their machine guns and whatever that govern our daily lives. But in not-war-torn countries, we're governed by laws, but those laws are generally funded, let's say strongly written, ghost written by corporate interests and really were employed by corporations.

Peter Wang (Host) (19:15):

So the vehicle of the corporation, the structure, the principles behind it, that is really how we play the game of living human life in a peaceful, mostly peaceful world. But it really is meant, it was designed and originated to solve a particular human collaboration problem, namely, specifically calling back something you said, the allocation of risk. And it's actually deeply unnatural in a sense. The Queen herself had to authorize this idea that a bunch of people could get together, kill off another person, an unrelated third party, and then not any of them be held accountable for it, right? That's kind of weird, if you have laws against negligent homicide, if I accidentally get you killed, I'm responsible.

Peter Wang (Host) (19:57):

But if me and my friends get together and we sign a document, suddenly no, no, no, none of us are responsible, you did your thing. We all make money if it goes well, but if something like that happens, it's not on us. That's a really weird thing. You wouldn't think about if you try to go to a fishing village 5,000 years ago on the side of some river and try to sell this idea to them, it probably wouldn't fly. And yet now it's the way all of it happens. It's the way we pollute the oceans and the atmosphere and the soil. It's the way that we do all manner of things, where we privatize the earnings and the upside and we externalize

all the downside. And this arbitrage, in a sense has been exploited almost, I think to its very end at this point. I think we must be at the end of this game, right?

Paco Nathan (Guest) (20:43):

Yeah, no, I mean it's really interesting insight there too that you have, I mean, if you look at the history of longstanding companies that have far outlived whatever their original charter was, they perpetuate now. I mean, none of the original founders are alive. Their grandkids aren't even alive. If you look at these, almost all of them started in trade and commerce, [inaudible] commerce, and then navigated toward finance. So there's this shift to financialization. Almost all the old corporations became almost purely financial companies. And so that's one trajectory that maybe it's just an artifact of if you started 400 years ago and you're still around, maybe there's a selection process that the financial ones were the ones who weathered the storm. But I've got something that to me, it's mind blowing. Right after 9/11, I had reason to do a road trip from Austin to Las Vegas and back. And I was stopping about partway through, actually about halfway through, still in Texas. For those who don't know Texas geography, it's a very big state.

Paco Nathan (Guest) (21:39):

But I stopped off about halfway in Pecos, and I'd read a little bit about history of Pecos, and I looked around and I had this startling realization. When you look at Pecos, it's [a] really remote place. I mean, it's the middle of the desert. It's actually really hard to live there unless you have external support. It's because of going back to risks that we talked about. And so if you look at, there's this one intersection, it's where the Pony Express ford was across the river. And if you look, it's like this is where, when there was nothing but people on horses, they came here. And then slightly beyond that, they built the train tracks. And so there's the railroad crossing that goes just a little bit beyond that. And then you go back a little bit beyond there, it's like, huh, well there's all of [the] telecom, the central offices right there.

Paco Nathan (Guest) (22:26):

And a little bit further, there's like a whole bunch of gas stations. It's like there's these geological layers of what was built in Pecos. Because the fact is, unless you had deep pockets, you weren't even getting close to Pecos. And to have something sustained there, it meant it was a large, civilization-moving force. And at the time, Pony Express was a big deal. The railroads were king for a long time, economically, following that telecom came out. Also, I talked about gas stations. Standard Oil was kind of a big deal for a while there. You keep going further and further out you get to Walmart. And at the time that I was doing this research, AT&T and Walmart were two of the largest firms.

Paco Nathan (Guest) (23:08):

And so it really struck me that unless you have sufficient resources to project power and get rid of the risk in a place like Pecos, you're not really a big player. So when you can look at those remote places, you can almost see this geological layer of who's been the top dog over the centuries. And of course the sad commentary is across the freeway, across from Walmart, they have a private prison. And I hope that that's not the trajectory, but it does go to your point about how do you externalize risk? How can you really make changes in the world? And over the years it's changed hands, but the form has stayed the same.

Peter Wang (Host) (23:44):

Well, and there's two things. First of all, I actually did end up driving through Pecos not too long ago. It's an interesting little place. Yeah. Yeah. It's…west Texas, there's a lot of, it's—

Paco Nathan (Guest) (23:53):

I love it.

Peter Wang (Host) (23:54):

Yeah, there's a lot of land there. But going through Pecos, and for anyone of our listeners who might be listening to this in Pecos or en routes through Pecos there's no shade, I don't think Paco was saying Pecos is so remote and so in the middle of nowhere that if you've made it in Pecos, then you must have made it everywhere else, which I think is kind of what you're saying. But I thought you would make a different point with that actually about something else, but more of a guns, germs, steel kind of thing. But anyway, all that stuff about, there is a thing about the infrastructure and the reach of the infrastructure and almost the utility of being ubiquitous is itself…

Peter Wang (Host) (24:27):

It's again, that thing of quantity has a quality all of its own. Ubiquitousness is a value all of its own. So there's something there. But the thing you're talking about groupware and financialization I think is very interesting. And this kind of touches a little bit on some of the cybernetic aspects of this, which is okay, if you're in the 1600s East Indies Company of some sort or the other, number one, you have to settle risk and you have to figure out [the] insurance and things like this. And it's great, the queen gives you a cover to say, yeah, don't worry about if people die, it's not your problem. But the second thing that you also need is from an accountancy perspective, you need to track, well, you just have to have an accurate ledger, and you need to build essentially the inner subjective trust among other players that you do keep an accurate ledger.

Peter Wang (Host) (25:14):

So it's actually, I guess [where] I'm trying to go with this is to say that as a vessel of internally coherent memory about not everything in the world, but memory about some very important things, which is who paid how much and who gets how much. At the very least, your coherence zone about that particular set of inner subjective truth. And so financialization being where they end up could be a consequence of, tell me what you think about this, maybe financialization is actually the most durable implementation of groupware in a physically violent and unknown world at the time, that financialization, I think there's a valence of there's a sense of pejorative when you talk about financialization. Oh, they're merely financial entities. But what if that for a certain period of time when you're dealing with physical goods, physical risks, when there's a lot of different regulatory regimes, let's say that you're moving things between, you actually just to be able to durably remember the numbers in a double-entry ledger, that's actually quite valuable. And that's the most simple, durable piece or unit of groupware to start with, right?

Paco Nathan (Guest) (26:24):

I mean, take it to, “tribal” is not the right word, but a group of people you're really close with. Take it to the level of a money party. I mean, here's a bunch of friends who pool their money and every week, somebody gets to go and use it, and it changes the world. And if we look back in human record, what's the earliest writing? I mean, we have cuneiform on clay tablets.

Peter Wang (Host) (26:45):

That's right, the Sumerian tablets were tracking how many sheep and how many chickens and things like that.

Paco Nathan (Guest) (26:52):

The evolution of human written language.

Peter Wang (Host) (26:54):

Well, there was that. And also tracking floods and tracking the seasons. One is planting, one is harvesting. And to some extent, if we take one step forward from this to say, okay, at least it has some kind of memory, there's a memory here in this entity of human collaboration. Because it's all human collaboration. We make the rules, we decide we're a corporation, we decide we're not, whatever. So people decided they're going to do this corporation thing. At which point, as you talk about the fact that they're perpetual, durable, people can flow through them…in a sense, we've created a "ship of Theseus" construct. If we talk about autopoiesis and we talk about there's something emerging from this or it having cognition and even agency beyond the aggregate agency of the individuals that comprise it.

Peter Wang (Host) (27:38):

Because this is really the question of emergence, is when does the whole become bigger than the mere sum of the parts. So when a corporation emerges these additional properties, some of it are regulatory, we endow with the ability to have insurance or to externalize its whatever, bad things, but there's something else. It's able to remember things. It's able to act through people. What are the other things that start happening where you could argue that there is an autopoietic sense of this system?

Paco Nathan (Guest) (28:08):

Well, I mean this is something where some of the cyberpunk authors are really on this vibe. They always have a name, they always have a brand, they always have a visual depiction. It goes back to some Greek concepts of rhetoric, really ancient rhetoric, where to express an idea, you had to have a sound, a shape, a word. I mean, it's almost like you're conjuring demons. You've got the little glyph there, but there's a magic incantation, just kind of a call—

Peter Wang (Host) (28:34):

But in the Bible, he recognizes the name of the beast, the names actually in modern world, unfortunately in the modern world, we've walked away from the power of names. Even though all of our fantasy authors and sci-fi authors know this—Ursula Le Guin, the true name, *[The] Name of the Wind*, same thing, the power of the word "Voldemort" in Harry Potter. We know this mythopoetically from our fiction stuff, but actually in the real world, name has a really, the spoken word and the spoken name has a tremendous power. And brands take advantage of this. Companies, you're right, they have a name and a brand.

Paco Nathan (Guest) (29:06):

There's always a glyph, there's always a word version of it. There's always like a service mark. Those are a little bit more mutable. I mean, the service marks come and go, but they're definitely, you remember some of them. We bring good things to life. You have these, and again, they really touch on our notions

of striving for immortality, all the stories, all the fictional depictions of striving, whether you're talking about getting three wishes from a genie, it comes back to a lot of these same kinds of representations that we see now in our constitutional law. Well, maybe not constitutional, but effectively US code. I think there's a lot to learn there though. Again, going back to AI, because we want to build automated systems. And I am not the kind of person who thinks that it'll just be automated systems running around playing Terminator.

Paco Nathan (Guest) (29:57):

It's more a matter of, like you say, groupware of systems of people and machines, teams of systems. I believe that right now, the way that we run companies is exactly that. Systems of people and machines together. And that's been a lot of my thesis about work in data science and how can we push this further. I think that if you look at someone like Fernando Flores, what they were doing, it was brilliant in 1970. The thing is, I find it almost indistinguishable of how they were applying data science to government and commerce from what say, Ray Dalio did. I mean from what hedge funds do? I mean how are these different?

Peter Wang (Host) (30:35):

I made this argument even as I founded Anaconda, one of the things I realized that we were at the tipping point for the adoption of Python more broadly in the world was because we were starting to get brought into finance companies and finance companies, the big ones, the big investment banks have, they spend more money on IT, I mean, they have infinite money to spend on IT and their people were picking up and using Python. And then you go to hedge funds, which also can invest tremendously in whatever they want from a computational standpoint and they're picking up Python. And so it's like, wait, well hold on. If the people in the world who care the most about prediction for whom actual insights immediately tie directly to profit and revenue and who can spend money getting the best of breed of whatever's available [in the] industry, they're choosing Python.

Peter Wang (Host) (31:20):

If that industry, if it's good enough for hedge funds, it's probably good enough for everyone else. And then as I got into this more and more, and a thing I started saying is really, I think I've been on other podcasts where I've said this too, that I think in our cybernetic future, every single company has to see itself as essentially the same way as a hedge fund does, every single company is a hedge fund. And not the sense that they're sitting there trying to arbitrage the markets and end the day with zero risk. It's more about the fact that they have to see themselves as prediction engines that are tied to a certain amount of existing capital and land and leases and equipment and obligations and AR and AP and all this other stuff. There's all this stuff. But at the end of the day, what is this giant blob of this human collaboration that is this company?

Peter Wang (Host) (32:05):

It has to have a position on the market. It has to actually make a prediction about what it thinks. It goes very much to the Norbert Wiener and the OODA loop from Air Force, whatever it is. You must have a theory of change. You must have a theory of action. You must have actually cognitive facility that gives you a prediction. You call a shot, and you make this shot. And the sad truth is, based on what I've seen in my consulting and talking to lots of other peers who work in companies, most companies today don't actually run in this manner at all. They spend a lot in technology. They spend so much money on

technology and software and IT services. But at the end of the day, they mostly see themselves as industrial-era physical transmutation or energy transformation kinds of things. They're not really cognition engines.

Peter Wang (Host) (32:52):

But I feel, and maybe for me, this seemed like an obvious thing when I first came up with this 10 years ago. But I feel like now the more I talk about, the more I look out in the world, I'm kind of weird to see the world this way, but I feel like the world we're coming into will rapidly convert and transform into only being inhabited by entities, like the entities with agency, the entity making all the money are going to be entities that see themselves fundamentally as thinking cognition collaboratives first.

Paco Nathan (Guest) (33:21):

I love where you're going on that. There is some work that Ben Lorica and I did, I guess probably 2018-ish. It was interesting because we were trying to see, for companies that are adopting AI, what's the contrast between firms that are really making a lot of progress and doubling down on their investments in data and machine learning, but using it as you're saying, not just because they want the data to worship, but because they're building up a contingency plan. So they're kind of like these reinforcement learning engines. What's the contrast between those companies and the companies that just aren't even started yet? I mean, they're lucky if they [inaudible]. And so what separates them, and it almost always comes back to the top where it's like the leadership just doesn't want to hear about it. They're like, AI, no, sweep it under the rug. I'm going to retire before that's the deal, so I don't even want to bother.

Paco Nathan (Guest) (34:12):

People are using probabilistic risk-based system. I don't want to hear the word risk. Just don't even come to me with this. And so we started looking at that and we noticed that McKinsey was doing a big study, McKinsey Global Institute, Michael Chui. And it was leading [to] this idea that there's really kind of a peloton breaking away from a whole bunch of other companies. A lot of companies are just mired in tech debt, they're not going anywhere. And then there's this peloton that's saying, “You know what? Good luck with that, but we're doing something very different.” And McKinsey came out along similar lines. There was also an HBR study similar too, that said I, we're going to reach a breaking point. There's a point where all that tech debt amasses, and there's a whole bunch of companies that may have been well capitalized in your favorite stock market, but they become acquisition targets because the others—

Peter Wang (Host) (35:03):

Well, and I see for me, I guess the way I thought about this, there's a couple things I thought about. About how could the world radically transform over the next 20 years, assuming there's not nukes flying because of whatever, assuming all the things, but if things continue, what must it look like? Well, based on what I've seen, the impediment to digital transformation is always people, [mensa], mentality, mindset, up to the board level really, not just…so there are ties to the capitalists themselves, ties to the investors. And so the way we measure and in publicly traded companies are just so screwed in this regard. Because the entire class of analysts are equipped with a very, very outdated, I would say, frame for looking at financial performance, for understanding what future prospects can look like in the face of such massive change as what we're seeing today.

Peter Wang (Host) (36:03):

It really is, it's not even a steam engine just showed up or the internal combustion engine has entered the chat along with a few thousand liters of oil. No, it's like actually we're in a time now where people are able to think better and predict better and think faster. And that will just compound as we wire up more and more sensors and do more edge computing, more IoT and all these things. All of it compounds into this thing where you're absolutely right. There's a breakaway peloton of people who, it's not even a question. You don't have to convince upper management. Upper management is telling you you need to do this better, no holds barred. And it seems like at some point, just like in a thunderstorm, there must be an inversion. Those entities that are equipped to do, to believe and invest in thinking and human collaborative sensemaking, augmented with cybernetic systems, AI sensors, all this other kind of stuff.

Peter Wang (Host) (36:58):

But that the ability to think and predict better is actually the key asset. And you glom on, it's like a hermit crab moves into a new shell. You find some industry that's not doing so well or that you know can commoditize and drop the bottom out on the price. You just go and just take it. So as opposed to hedge funds merely running in these pristine glass steel offices, they actually start buying stuff and then they can get better information and make better predictions, take better actions. So these brains, disembodied brains in jars come around and start buying bodies that are part of their extended power suit. That I think is what must happen. I think that's what must happen because these companies by themselves are just not going to evolve brains fast enough. They will maybe get a bit of a brainstem, but they just won't get there fast enough.

Paco Nathan (Guest) (37:50):

I think to get there, there's two points. One is to impact the idea, the notion of prediction. And the other is to talk a little bit deeper about reinforcement learning. The idea is that there's sort of a cult of prediction. It's like, I've had this from senior management before. It's like, you're a data science team, give us the number and we'll bet all of our money on that number—

Peter Wang (Host) (38:09):

Mentat, compute, right? Mentat, compute.

Paco Nathan (Guest) (38:11):

No, that doesn't work. That's fragile. This is not how hedge funds work. You don't put all your money on black 21 and just spin the roulette disc. So instead you really want very sophisticated contingency plans. And this is a lot of what I've learned out of say, working with reinforcement learning is you're not trying to predict the next set. What you're trying to do is build a very complex, deep-learning-enabled set of contingency plans. So you don't come up with a model. In fact some of them are model free. You come up with a policy and the policy says, hey, if things go out of kilter, here are some of your most optimal paths back into an optimal range of where you'll survive.

Paco Nathan (Guest) (38:54):

And from there you can optimize, but things will get out of kilter more often because the kind of environment that you're talking about there, the ones that will succeed, are dealing simultaneously with, gosh, we have political crisis. There's a chance of nukes flying. We have a couple of pandemics going on

at the same time. By the way, there's [an] air mass coming out from Africa that's like 45 centigrade. On top of that, we have [an] economic meltdown and a global supply network problem.

Peter Wang (Host) (39:23):

TL;DR is all of your Excel spreadsheets are broken.

Paco Nathan (Guest) (39:26):

Yeah, exactly.

Peter Wang (Host) (39:27):

Essentially none of these things are linear. You can't even do a cubic [inaudible] fit like that poor dude under the Trump administration tried. You're like the cubic, you try to fit a cubic to the thing. But yeah, the world is becoming more complex. Well, it's always been complex I suppose, but we're now at a point where everything is always in the two-to-three-sigma range.

Paco Nathan (Guest) (39:48):

It's in our face.

Peter Wang (Host) (39:48):

You cannot ignore it anymore. So that is sort of the pressing crisis on why a prediction or sorry, better cognition is the thing you have to do to survive. It's the gear check. You can't even survive if you don't have it.

Paco Nathan (Guest) (40:02):

One of the most obscure mathematical treaties about cognition, I'll say it's obscure, I'll probably get in trouble for this, but one of my favorites is one that kind of got superseded, so you don't see it in schools as much, but it's by a French mathematician named René Thom. And he was going into very advanced areas of math to describe how is it that a person can think to be able to throw a spear and hit the prey. There's an antelope running, I'm going to get in the mindset of that antelope. I'm going to throw the spear where the antelope is going to be, not where it is now, and I'm going to feed my family. I mean that kind of feedback loop is very complex and it is that kind of cognition as a form of prediction of very complex things. And that is really core to human intelligence and that's how we work as groups to do things like that is really a lot of where we've evolved.

Peter Wang (Host) (40:54):

Well, and the brass tacks of it is this, your body, 25% of your calories I think goes to your brain even though it's 5% of the mass or something like that. So you cannot have the VP of cartilage in your knee complaining that the brain's getting all this oxygen and sugar. The VP of cartilage in your knee has just got to be okay with it because he's going to get his sugar and he is going to get oxygen because the brain is figuring out all this other stuff and integrating all the sensors and remembering things. And I think this is the kind of thing where when you have human organizations that have operated in the mode of the sustaining thing for so long and you have Wall Street telling all of the employees what sugar they're taking home in their equity plans on the basis of how well you precisely to the penny hit your earnings every quarter…

Peter Wang (Host) (41:44):

That whole structure I think is just, it just doesn't work. It just doesn't work for the kind of dynamical environment when going back to these medieval institutions, or I guess renaissance institutions that we have around the joint stock corporation and whatnot, these set of rules for how people play and how we collaborate…I think that for me, the big sort of ultimately the question maybe because we've just talked about all sorts of stuff, going all over the place. And ultimately I think for me the question sits at this, which is human coordination, we've managed all of the tools that we have, what makes us the apex predator on the planet, what's given us all of the great benefits we enjoy as individual humans today, it all comes from human coordination at larger swarms, at larger scales and over longer time horizons able to take action at finer scales, at smaller time horizons and sharing more homogeneity, more consistency and quality or whatever.

Peter Wang (Host) (42:45):

It's sort of this two-folded innovation we've done, more humans, more collaboration, whether it's things like the idea of currency to allow human coordination across over the horizon, beyond even cultural barriers, all of it at the same time we've gotten better and better science, better and better ability to make predictions at fine scales and also then build things at a quality down to nanometer scale. So a cybernetic future, where we continue to amplify these capabilities, bigger human coordination at larger scale, at finer time scales, like finer time resolution. The 15-minute fame just became the five-minute became the 15-second trending viral video that's not just trending for the town that was played on the local AM radio station, but you could have 15 seconds of fame across a billion people on TikTok. And so a cybernetic future amplifies all of these things. Bigger horizons, bigger scale of coordination, bigger coherence, but over shorter time scales.

Peter Wang (Host) (43:46):

We can do that now. So for the future of human systems living in information age, in light of capitalism, seeking maximization of all these things, what does a durable collaboration look like? An intentional one. One where we are actually in the driver's seat saying, we want our value, here's the values we're trying to manifest and live by. How do we harness all this capability to meet those values? Not how must we walk away from our values just to survive being thrashed around in a technological environment that's beyond any of our ability to reckon, literally the word reckon. We can't even reckon how any of this stuff works. So that's the question I think that we have to really stare at.

Paco Nathan (Guest) (44:26):

I agree. I mean from my perspective, for what it's worth, I think you've really touched on already you're using the word reckon. I mean I think the core of human intelligence that we've seen over the millennia is really about language and this idea of making language more precise or more durable or able to act at a wider or longer span. Our notions of what we can do with nanotech these days are essentially a form of language, of how we've gone from using bones and sticks and whatnot, to actually being able to manipulate molecules. And I think that as we have encountered these horizons of, “God this is just too complex, I don't know how to deal with it, but we're going to,” we've adapted and evolved new language to be able to manipulate. And so I think that that's a lot of the horizon we're contending with.

Paco Nathan (Guest) (45:14):

Now, we don't really have a way to describe memes traveling through global media other than calling it "fake news." We can say memes or fake news…we don't really have a good language. The way that, say I spend a lot of time in Spain and I love seafood and the way that they can describe seafood or the way they can describe, if you go to Peru and they can describe corn or potatoes and they have thousands of varieties, we don't have that yet for how to really live in global media. I think we have to, and that's part of a crisis that we're facing now. And I think it will be our language that evolves first. I think that that's definitely been the case. When we're talking about corporations over the last 400 years, that's what evolved. It was the legal language, these special incantations to allow it to happen across groups of people over decades or centuries, we had to evolve the language. I think that's a lot of the real artifact of science over time is that we can learn and we can express.

Peter Wang (Host) (46:14):

Wow, there's a lot, I was not expecting that answer. Lot to contemplate there. You're right in the sense that these durable systems require us to speak a different language. Well, I mean religion required us to learn different kinds of languages but these kinds of human collaborations require different kinds of languages. These linguistic ends, what was the quote? These violent delights will meet with violent…but there's something around, well, okay, not to go down another rabbit hole with language and—

Paco Nathan (Guest) (46:46):

Looking into the corporate metabolism writings, that was what we were calling it was "linguistic domain."

Peter Wang (Host) (46:51):

Corporate metabolism. Okay, linguistic domain, yes.

Paco Nathan (Guest) (46:53):

Linguistic domains we can see different domains like law. There are things that happen when you put certain words together and they probably don't mean what you think unless you are trained as an attorney. And similarly in finance, there are magic things that happen when you put certain words together in a contract and put money behind it, there will be outcomes. And unless you really understand what's going on in that domain, you might get caught at unawares. This also happens in marketing and advertising. And so we see it wherever there is some kind of communication, we see these different types of domains emerge. They have specialized language and as we have evolved to have more complex language and be able to control it and wield it, that's where we can go out and do these amazing things. And until then we're just kind of floundering around like somebody [inaudible] with a stick looking at a mastodon.

Peter Wang (Host) (47:42):

I can talk about this for hours with you and we should obviously have a follow-up episode.

Paco Nathan (Guest) (47:45):

Okay, great.

Peter Wang (Host) (47:46):

We are coming to the end of this one, but I want to end with a really interesting, provocative, and maybe deeply unsatisfying question, which is that earlier you said a very interesting word and you said in the application of predictions and all these things, you have some kinds of reinforcement learning systems that are model free. The “model free” is a very interesting term. There's always a model there, just maybe the explainability is zero. But is there something here? Because this linguistic idea is new to me in this context of what we're talking about, but I'm wondering, and especially in light of when you look at what things like GPT-3 can do, and DALL-E, I've been playing with DALL-E a little bit, absolutely fascinating. The first innovation for humans, one could argue, I mean we were born with thumbs, but humans as a species, our great power is language.

Peter Wang (Host) (48:33):

Language is just audio or oral telepathy, but it's actually telepathy of a sort, and so the fact that we're able to be telepathic with each other and coordinate is like if you're an alien or if you're a prey and animal and you have these humans basically coordinating magically, you don't even know you’re totally screwed. Humans are actually incredibly dangerous because we can do this, that's our efficacy and our power. But what you're saying something very interesting, what if it turns out that the ultimate ends of all of this as we build systems, our only way to collaborate with each other in an environment that's so rich and complex is each of us has to have our own translator, our own envoy that makes this other incomprehensible world comprehensible just to us. And it's almost like the mathematical dual of the Tower of Babel curse, which is actually humanity ascendant in the future so that we actually are incomprehensible to each other. We actually can only become comprehensible to each other through the mediation of cybernetic systems that then in degrees are able to increase the scope and complexity of what's being expressed.

Peter Wang (Host) (49:49):

And then to translate it back to us, they turn it into embodied experiences. And essentially the memes we understand because if we become too comprehensible to each other, if our brains become so homogenized that we are able to absorb whatever random pop culture is broadcast, that also we're treading water at the top of the ocean. So I had not actually contemplated that as a potential positive and not dystopian end. We grow up accompanied by essentially a benevolent tutor or companion who helps us make sense of the world, meets us where we are, gives us the language, gives us the experiences to understand more and more richly and deeper and empathize with other people. And that is our companion. That's our bridge to the world. It's also weird in a way because of course I really love human personal connection and all the natural physical empathy that comes from being able to be there with people. On the other hand, I hadn't really thought about this as a potential way it could go. Well, what do you think about that? Sorry, I've just been—

Paco Nathan (Guest) (50:53):

I love it. I mean, I hadn't put together the idea of a mathematical dual or a contrapositive or [inaudible] Tower of Babel, but the idea out of science fiction would be say a transom, I think like Ursula Le Guin and others really had this idea of transom to describe what you’re articulating there, was this idea that, yeah, it acts as intermediary, but it's a device of language. I love playing with DALL-E mini, just as a way of expression, but when you start to see these models that can do multimodal, multiple senses that are learned and generated, and when you start to understand, well, what if it wasn't just text and visual, what if we also had auditory and some vibrations?

Peter Wang (Host) (51:35):

It was music, it was the story. I mean, the thing you could build is these are really automated. Again, to the point about prediction and all this stuff, forget the prediction, if these were just empathy bridges. So you see someone and you don't understand what they're trying to say or why they feel the way they feel and the empathy bridge comes in and paints a picture of here is why they feel this way, or here's where they're trying to come from and it builds that bridge. You can imagine building some systems that can achieve 70% fidelity and something like this on certain narrow topics today. But in the future, we could absolutely have a thing where it's just tell me a story, tell me why I should care about this. Tell me, I feel this way about that, but why does that person feel that way about that?

Paco Nathan (Guest) (52:21):

I mean, I don't think that this is far-out science fiction. I think this is—

Peter Wang (Host) (52:25):

I don't think it is either.

Paco Nathan (Guest) (52:25):

Look at the history of Google Translate. I mean they crossed thresholds in 2005 and here we are 17 years later. I mean, it's really good. It's really amazingly good. And you can use it to travel. I mean, it's enabling things that wouldn't have been possible before. I think we're kind of there. I mean, one of the empathy engines that we all tend to experience are films. It's like you go and you see a film. I'm going to think differently about stuff and this person means something different to me now. One of the things I found really fascinating about DALL-E was one of the initial areas to report a lot of uptick and usage was in filmmaking, because they can cut down the time of storyboards.

Paco Nathan (Guest) (53:05):

So from writers, having you and I talking on a podcast and it's like, no, we've actually got storyboards. We took your quotes, we ran them through DALL-E, we got a sequence, we're going to start to shoot next week. I mean, I think that you close the loop on having that kind of reinforcement learning meets empathy engine, and until you've got it as a Google Translate on your phone, and that's probably the weirdest thing I'm going to say today, but I think we're there.

Peter Wang (Host) (53:30):

But maybe this is how we can get across the thousand plateaus. This is how we get across the hyperindividualized…I would say, so much of the consumption and so much of the spectation and everything around the Westernized experience in general is so individualized and it's feeding the id, creating narcissism. This is maybe our way through that, is using these tools to actually not just figure out a preference just to sell more ads to us, but actually knowing us and knowing our friends so well that it helps bring us closer through the vehicle of storytelling, through creating novel language. Memes, emojis, what's wonderful watching my son, my 12-year-old, growing up through Discord and with memes and Giphy and with emojis and all these things around, we can communicate a lot in a meme, actually. Of course, he's got tired of me saying surprise Pikachu, so I have to retire that meme.

Peter Wang (Host) (54:24):

But I think the idea that there's richer human experience that's maybe translanguage and that may actually be the next, that language is something we can personalize a bit more. Really mind blowing, honestly. But I think one of the most delightful thoughts I've had in a long time. Paco, this has been [an] absolute pleasure. Thank you so much for going on this strange journey with me, and there's a lot more we could talk about, hopefully we will in a follow-up episode, I'd love to talk more about the AI stuff and your perspectives on AI winter, where is the state of the industry today, what should we expect coming forward besides these empathy bridges that we just talked about. But yeah, thank you so much for joining us on the podcast. Really appreciate, love this conversation. Thank you so much.

Peter Wang (Host) (55:08):

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