

# AI and You

Transcript

Guest: Eric Daimler, part 1

Episode 151

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Hello, and welcome to episode 151! My guest today is Eric Daimler, founder and CEO of [Conexus](#), a company that solves companies' data deluge problem with CQL – not sequel, C-Q-L – a platform based upon category theory, which we'll hear Eric talk about. Eric has over 20 years of experience as an entrepreneur, investor, technologist, and policymaker where he served under the Obama Administration as a Presidential Innovation Fellow for AI and Robotics in the Executive Office of the President. He served as the sole authority driving the agenda for U.S. leadership in research, commercialization, and public adoption of AI and robotics. Let's get right into the interview.

Eric, welcome to the show.

Oh, it's good to be here. Thanks for having me.

And so, you're calling in from San Francisco, and you have spent a lot of time in the industry around AI, predominantly robotics early on. Can you describe your trajectory into the sphere of AI, how it started, how it's evolved?

Wow. I have done AI and robotics for, for 20 plus years. Uh you know, Carnegie at Stanford, university of Washington, Seattle. so I, and I've done it from a lot of different perspectives. initially as a researcher, as an academic but also as a venture capitalist on Sandhill Road and as an entrepreneur a few times. I am grateful that all that experience culminated in a position working with the White House during the Obama administration as the first AI advisor to that administration, kind of colloquially known as in the science advisory group with which I work that kind of rounds out a series of experiences from AI as a researcher to, as an entrepreneur, venture capitalist to finally working in, in public policy. So I've been in the industry quite a long time and, and seen many different perspectives.

Well, and you put the spin of final on public policy, but I think we are seeing that there is a lot more on the other side of, of that going on right now. And you've been involved a lot in this cross-fertilization between academia and business. And in one sense, AI is the ultimate expression of that, having originated clearly in academic places long before it was seen as having value elsewhere. And what has that journey for you been like, how did you get started in the business aspects of this, and what excites you about the relationship between the academic aspect of AI and its commercial application?

Well, yeah, as for my involvement, I think it fits that trajectory that people talk about with regard to finding a career. I think that the saying goes something like this where any technology that was invented before you were 15 is just background. Any technology that was invented between

the time you're 15 and 30 is something you think you might be able to make a career out of. And any technology that's invented after you were 35 is against the law of nature.

Douglas Adams

Yeah that certainly speaks to how I, I participate with TikTok, which is very, very little. And it seems like I've kind of aged out of, of that type of new newish expressions of, of our digital technology. But I am just grateful that I may not have been quite 15, but maybe 10, 11, 12 when I'm grateful that my parents just exposed me to computers. And I just immediately thought - not to sound too precocious - but that these devices and, and maybe me being an introvert in a little bit, like maybe in nerdish in disposition thought that computers could allow us to be more expressive as humans. I really enjoyed programming as a way to - we might say in, in for other people in modern terms writing just writing is getting ideas down. And I thought programming would do that for even a broader set of set of people. So I'm just, I'm grateful that, that you know, fortunate set of circumstances presented itself to me. AI was trendy at the time with, with people not just Douglas Adams, who pointing to a future and certainly being kind of related to these concepts of learning algorithms and imagining a future of robotics but also other futurists that pointed, pointed the way. I remember Herb Simon at the time. I forget whether he had his Nobel Prize at that juncture also became an inspiration as somebody I wanted to follow. So, set of fortune got me involved in ai at a, at a strangely young age.

And with all that involvement at Carnegie Mellon, which is foundational center for robotics, do you tilt more towards the hardware end, the embodied end of AI these days?

No, that's a great question. I chose Carnegie Mellon over Stanford, MIT where I also got accepted because at that time and, and I might even still, they were leaders in robotics specifically the mechanical or physical expression of, of learning algorithms. I at various times have gone in and out of being more involved with robotics that occupied some amount of my attention when I worked during the Obama administration. It occupied me some amount of time as an investor. but I don't currently find myself spending a lot of time on the physical expression of robotics. I have some fantastic, grateful to have these great friends that are doing great work in that domain. And I am a big fan of a lot of what is going on in that area. But I find that my exposure to modern robotics finds probably its biggest expression in, in watching autonomous cars going down my street in front of my office here, about every, every half hour or so,

Well, yes, we've seen news about the autonomous cars in San Francisco and it's mixed. Have you seen them ganging up in some of the ways that have been reported, or has it been relatively harmless?

It's a funny thing to talk about because it, it may be helpful just to start for listeners too. Think about when they think autonomous cars actually first took the road in a public road - anywhere in the world, you can say, doesn't have to be in America or North America - anywhere in the world. When do you think the first autonomous, fully autonomous no driver in the, in the driver's seat took a public road on, on its own. And, and you might think, well, that was, that 2010, no, you, we might remember there was a defense department, DARPA Grand Challenge, where there was

some cars that went off-road before that. So you say 2005? Well, there must have been some research before that. So you say maybe 2000 or maybe being really generous, 1995, because it took a while for these technologies to begin to find some sophistication that would allow themselves to then compete. But the answer really is 1983.

Paris. Right?

It was a long, long time, actually at Carnegie Mellon in Pittsburgh. so it was a van uh the joke at the time was it was a van that, that had the computing power, the entire developing world inside of it, but it was a van. It went five miles per hour, but it, and it was a sunny, it was clear it was dry but it was, it, it, but it stopped at stop sites. It stopped lane stop signs and stop lights drove by itself at five miles per hour. Now, Mercedes had an autonomous car, I think, in that same year, or at least contemporaneous to this van that, but the limitation with that is it, it required a lane, really hard lane markings, solid lane markings, such as on a freeway with German quality roads, not American quality roads. And, and it needed a controlled circumstance such as you'd find on a freeway. but those are the two first examples of autonomous vehicles. And we have found that were misled about these things because we've heard for last decade that people like Elon Musk claiming that autonomous, fully autonomous driving will be here next year, <laugh>, that's for people in the, in the, in the art, I guess in the sci in the science, doing this work, knew that was always ridiculous because it's been allowed for 30 years. So to say that suddenly next year we're going to make this magical leap into full economy was always occurring as a hype of the Tesla stock. I go use that all as background to describe what I see out on the streets of San Francisco. And, and in Phoenix, when I took a ride, when I was in the White House, we, we took, we had a good fortune of taking a ride on autonomous vehicles in the state of the art of those cars near the end of the Obama administration at an event president Obama had in Pittsburgh where I got to see at that time what, what the leading of research looked like. And, and we had multiple times where the driver had to intervene just going around the block, just going around the block. Like it wasn't even anything difficult. And another issue was, is that we don't have laws actually that are sufficiently clear to define the totality of the, we'll say the *workspace* in which these cars operate. That's often a big issue. So I have got the good fortune of riding in some of these autonomous cars in San Francisco. Sometimes when with friends, with research level cars, so they're not actually commercially ready, and, and other times, with the commercially ready cars here in San Francisco. I found that there's various places in which they get stuck. So I have, I have seen them. One place they get stuck is a little unsettling because you don't know if the car was going to crash or if it was going to do an emergency braking, but you didn't wanna be there to test it as a passenger. So that's, that's one dangerous place that just requires a lot more exploration. Another is funky intersections. You could say maybe a five-way intersection. You could say it's a really steep climb, or steep sudden descent. Another one where a car literally stopped for us, so this isn't the worst thing because the car thought it was in danger, and it wasn't - is having a really high curb on one side and having a blockage for a street car on the other on a steep diss descent. So there's no, there was no problem, except the car that stopped and didn't think it could, it could go on. But the third one, I think defines this situation about autonomous cars more accurately about the types of problems that are experienced. And I can even back up and we can talk about in a while to think about the definition of AI, which is that I was in a car

that did a 360. So that spun around on itself over a block, okay? Not dangerously, but spun around on itself over a block in the, in downtown San Francisco, because, because this car could not find in an automated way, a safe place in its judgment to drop me off. So, a car, a car couldn't, they couldn't see where to drop me off. Now, I, as a passenger, thinking, Hey, just if I was a taxi talking to a taxi driver, "Hey, pull over right here. this looks like a fine spot." Well, that was a loading zone. H"ey, pull over right here. I'll be quick." It was a fire hydrant. "Hey, pull over right here." Uh this is you know, no parking from five to seven or whatever, but I'll be fast. If anybody else was driving they would've just pulled over. But the car can't, because literally in the, in the literal interpretation of the law, there was no safe place to pull over. So ultimately, there had to be a driver intervention. Otherwise, I could have been spinning around in that, in that circle in San Francisco... uh for all time.

And that exposes the ways in which this development is immature. Not just in the technology of navigating around the street, but all the other modalities that are in, in interactions that are involved in a trip, like, as you say, talking to a driver, "Let me off here. I'll just be a moment. Don't worry about the fire hydrant." I should point out that you are coming on after Missy Cummings, who gave us some very unvarnished views about the state of the art in autonomous vehicles already from, from various roles that she's in inhabited. I would like to pivot, because it strikes me that you have this this three-way perspective: academia, business, government. And from those combined perspectives, when you look at AI today, and this is a very broad question, but take it as such; do you think more about problems or opportunities and, I know that's that that shouldn't be a single axis, but then just take it where you want.

Yeah. I thank you for that. If that actually does get to the point about why I even do this and, and talk to large audiences about ai, what I don't uh when I, what, I could just be sitting on a beach somewhere. I mean, is this important to me to have people involved in the conversation around technology? I'm really grateful for what, what people have told me is that if I don't have a unique experience in all these domains of AI, it's definitely very, very rare to have the experience of a research or a business person and, and someone being a public policy. So I do have the technical exposure to know what's going on. And what I'm left with is that I want more people involved in the conversation about how to deploy these technologies left to our own devices, us researchers, or us business people, we will, we'll just work on our quarterly objectives uh to get our technology out there. and we are going to be working in the best interest of our organization, but really, we want some feedback not just from users, but from society at large. And the reason is because we find it very expensive to be developing technology and then have people reject it or even resist it. And then as a fellow citizen, I really want people to be embracing it. I, because of these technologies are often life changing. They certainly can be life-enhancing. but there's some obvious safety considerations. You know, we certainly talk about privacy and bias, but even the ways we can be manipulated have come to be quite well known. How we put in constraints guard, say, guardrails, maybe in the form of regulation, maybe just in the form of societal norms, is really important for a lot of people beyond just me, or people that have backgrounds like mine to be helping to form that conversation. In order to do that, we need people with some amount of awareness or understanding about what's possible and not possible.

It's often a concern when I've tried engaging with these audiences, maybe a decade ago, I found that with a lack of understanding, some people would think some things are really easy, but they were actually really hard. or they would think some technologies are really hard. but they were really easy. So there's some value in these conversations having a broader set of the population, understand what's possible with the technology, what's not possible, technology, and then to experiment with how they might use it. I could say this one last thing about that which is that your large language model, such as the traction we now see from ChatGPT is really a fantastic technology for a certain set of uses. I encourage people to just experiment with it. You know, I even will just keep a tab open on a browser to try to play around and refocus my mind from the 20 year training of using a search engine to now a new way of using my brain to interact with we'll say a different way of doing search.

Me too. And so many parallels with other aspects of ai, like even self-driving cars, like driving the Tesla, the self-driving is often useful. And then there are times that it's going to produce the wrong result. And just like ChatGPT can hallucinate. Again, going back to those three areas of your life, those three sectors we could sort of pithily characterize them as business being "move fast and break things," government being somewhere between "first do no harm," And "I'm from the government and I'm here to help," and, and academia as being, "I wonder what happened when we do this?" Um, and, and, and so if you, if we go back to you putting on your, your hat that you had in the Obama administration, I wanna see where you think that role where, where you think government should be taking us right now, because well - Actually, first of all, were you at the time involved with the Office of Science and Technology Policy Report, which I think came out in 2016?

Yeah.

And it's hard to believe now just how much the landscape has changed. At the time, <laugh> AI was not in the mainstream. Now it's on late night talk shows. And so that means people are having all kinds of reactions driven by fear, uncertainty, doubt, sensationalism. And does that mean government is perking up its ears? And like we have the European Union AI actors, do you foresee an increased need for the US government to feel like it needs to step in and do something?

This is a, a rich conversation on which we could, we could talk for a, a, a very long time. if I was asked even a year ago if I thought that AI was over overhyped or under hyped, I would emphatically say it was under-hyped. today, in, in 2023, I really quite strongly believe that AI is appropriately hyped. I feel grateful for Sam Altman and the folks good folks, talented folks, well-meaning folks at OpenAI for the contribution they made in not just the technology, but in bringing awareness to AI for a broader side of the population. As I was just explaining, I wanted to bring more people into the conversation. And --

Here they are!

Nothing is done a better job than ChatGPT, where now people are talking about it, as you say, on late night tv. I think that's fantastic. People need to be talking about, oh, gosh this really could

change how I do my work. Yeah, it can, it really can do uh wonders as, as well as it presents dangers. I often will say that robots will not take your job. However people using robots or using automated technology are very likely to take your job or displace you. And what's frightening about this, I often think that it, it's something that doesn't get enough attention is that in a digital world, what is often so unsettling is that the changes can be so abrupt. Not only they can, they be hidden, but that when something works digitally, it works infinitely well. So the scale and the rapidity with which this thing can be repeated and permeate through society can shock people. I think in the month in which we're recording this we are reacting to some, well-meaning often smart people asking for a delay in AI development. I personally think it's ridiculous for a variety of reasons we can talk about, but it's a reasonable *reaction* to the speed with which this wondrous technology has become available and the realization that we do not have appropriate thinking, let alone constraints or guardrails or regulation around it. So society has not gotten a feeling for what to do, and yet, we still have, in some sense, this scar tissue from seeing what happened the last time a digital technology - social media - became widely available without us first thinking of the dangers. So it's a reasonable reaction.

And that still hasn't been repaired.

Absolutely has not been repaired. So it's really important to, to be thinking and thinking quickly about how to put appropriate guardrails around many of these technologies. And I have suggestions for that, some of which actually your listeners could find in an open letter I wrote to the president a year or two ago suggesting some elements for regulation that could either be championed by the White House or championed by Congress.

Is regulation the only weapon that government has to wield here? I mean, it's certainly the one that springs first to mind. But how else does government affect the development, deployment, use and safety of AI in ways that matter to us?

Well, we certainly are in the middle of a conversation right now about our supply chain, about the degree to which we are going to allow China, for example, to be acquiring some US technology that has more attention over the last couple years. You know, when I was in federal government, I actually spent most of my time around issues of defense for the US and its allies. The technology then was already seen as becoming sufficiently complex in these domains of learning algorithms that we needed to have a good rethink. And that work continues. I think some smart people continued that work into the last administration and now into this administration. It's really important that the US and its allies coordinate those actions for defense in consideration of modern digital technologies. For society, I think there are a range of regulations that probably do need to be put in place. and some of these suggestions I outline in the open letter to the President, one is just a requirement, and I think you could make this a requirement, that we define the provenance or the lineage, in other words, the source and the pathway for all information. Where did this come from? I want to see, essentially, you could say infinite hyperlinks all the way down. Where did this come from? So that source data could be authenticated. You know, so often we, we rely on this media source or that media source, and it, it stops at "do I trust them?". But that's, that's not a really great place to be. Now, I don't want to bury it in an infinite layer of references like you might have in an academic journal. but I think

that is one way to begin to start the process of having a factual basis of truth for some information.

So it's like Wikipedia attaching "citation required" to useful parts of sentences.

Yeah. And then that can get more sophisticated with symbolic ai. So in what, what is now available with some of these technologies is not only will I have a citation, but I can also define the links between citations, and I can have people scale the contributions of those that they may make in establishing the links between that data and have those be authenticated as factual all the way down.

Where does symbolic AI come into that?

So, symbolic AI really became out of fashion in the late eighties, early nineties, when it was found to seemingly - seemingly - always involve custom code. It became sort of an artisanal expression of computer science, where you might have individual programmers continuing to work on their own little custom implementations, but it did not scale. That allowed for then, after a period of time, the emergence of machine learning as a different domain of artificial intelligence. What we've found, however, over the last 10, 15 years, is the reemergence of a domain of mathematics. It's abstract mathematics. It's related to type theory. It's called category theory. It's currently used in quantum mechanics, specifically for quantum compilers. It's also used to authenticate or verify smart contracts on the blockchain. We find that that's being used now for organizational databases to guarantee the semantics of those bodies of knowledge. So that's where I now find my focus, because it's the limitation of broad scale useful AI. It's not telegenic AI like we see with large language models or the certain fancy image AI that we like, like DALL-E. but it's what's required if you're going to build an airplane or operate a power grid or, or, or, or deploy a solar array. you, you, you can't be using large language models for these life and death or zero failure tolerance circumstances that requires a symbolic AI.

And what do you call the technology you were just talking about that had those different applications?

Well, it, it's a non-machine learning AI, symbolic AI. What allows that today to scale is a new emerging branch of abstract mathematics. It's called category theory.

And can you give us a quick introduction to that?

Category theory is a sort of meta math. It's related to type theory which may not help your listeners any much, but you might be able to say for some of those that may be familiar with graph theory. Not to get too technical this is an infinitely ( $n$ -dimensional in the lingo) graph theory, you might say, not entirely accurate, but it's a way of thinking about it. And graph theory, a lot of people will know, because it expresses itself in these spider graph visualizations that people may have seen 20 years ago when we were trying to establish relationships in terrorist networks, for example, or just a whole bunch of other linked relationships. What category theory fundamentally provides is these set of relationships that can be contextual and also can have a nuance of equivalence instead of a hard - let's call it an equal sign - that's that

not the most eloquent way to say it, but instead of a hard equal sign, I'm going to say that, well, these two things can more or less substitute for each other, or they'll substitute for each other, depending on the context. If the price of oranges is too high, I'll get apples in this particular case. That's a simple way of talking about context that we use in our ordinary lives and in digital world, that's what we want. In a mechanical world in the industrial revolution, that's not what you wanted. You know, gears or gears assembly lines are assembly lines. You don't really have an equivalent on an assembly line. So this is the age of math for the 21st century different than the age of math that was more appropriate to a mechanical age.

And I just want to nerd out for a minute, and then I promise our listeners I'll move on to something less esoteric, but that's reminding me of a couple of things. One of them is the CYC and NELL projects by Doug Lenat which were sort of the rule-based systems on steroids gathering all kinds of facts and their relationships, or at least hoping it would build the relationships between them. And the other is Wordnet and inferring relationships between text and the vectors that would allow you to construct algebra, like king - man + woman equals, and it would tell you, queen. Is that the sort of relationship building we're talking about there?

It's lovely how you just defined the beginnings of establishing these rule networks. You know, how these networks begin to scale is that some subject matter expert needs to define the nature of the source data. What's now available, however, is that as those rules for source data scale, humans will reach a natural point of exhaustion. Where you give me an Excel sheet with a hundred rows, I can deal with it. You give me 10,000, I'm going to start to develop a program, you give me a billion, and I can't even test definitively whether or not I have errors in a billion rows. It'd be a database at that point. But if you now have a trillion or a few trillion it just become incomprehensible how to even think about this, because the scale of errors available in these types of meshes of data and data sources isn't linear. It's actually exponential. When you then have that limitation of humans being able to reason about data, or reason about connections with data, which is knowledge we then need to look at an AI. So an AI can reason. A human can't, but an AI can't,

Uh, a lot of people would've put the other way around. Why do you say that humans can't reason but AI can?

At a trillion data points. Oh, right. It's, I can't think about that. Can't keep that in my head way before that. I can't keep stuff in my head.

That's the end of the first part of the interview; we've split it in two for the usual reasons.

In today's news ripped from the headlines about AI, Runway Research has a multi-modal system, called Gen-1, that can modify a video to alter it in the style of a supplied image. So, for instance, you can supply a video of a man walking across a field, give it an image of an astronaut walking on the moon, and it creates a video with the same action as the first one, but now it looks like the astronaut on the Moon, walking across the lunar surface. Or you can give it a text prompt, like "Claymation style," and it modifies the video to look like that. They've just announced the undated but presumably imminent release of a system called Gen-2, which doesn't need a video to work from and can generate one from a



text description, in the same way that the image generation tools like MidJourney create stills. If that's even slightly performant, in the way that previews of what Google's Phenaki system can do, you can imagine the sort of attention it will get.

Next week, we'll conclude the interview with Eric Daimler, when we'll talk about the future of jobs, and regulation with respect to AI. That's next week, on *AI and You*.

Until then, remember: no matter how much computers learn how to do, it's how we come together as *humans* that matters.

<http://aiandyou.net>