

## Dr. Lex Fridman: Machines, Creativity & Love | Huberman Lab Podcast #29

Dr. Lex Fridman PhD, is a scientist at MIT (Massachusetts Institute of Technology), working on robotics, artificial intelligence, autonomous vehicles and human-robot interactions. He is also the host of the Lex Fridman Podcast where he holds conversations with academics, entrepreneurs, athletes and creatives. Here we discuss humans, robots, and the capacity they hold for friendship and love. Dr. Fridman also shares with us his unique dream for a world where robots guide humans to be the best versions of themselves, and his efforts to make that dream a reality.

#LexFridman #Engineering #Robots

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Please note that The Huberman Lab Podcast is distinct from Dr. Huberman's teaching and research roles at Stanford University School of Medicine. The information provided in this show is not medical advice, nor should it be taken or applied as a replacement for medical advice. The Huberman Lab Podcast, its employees, guests and affiliates assume no liability for the application of the information discussed.

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[bright music] - Welcome to the "Huberman Lab Podcast," where we discuss science and science-based tools for everyday life. I'm Andrew Huberman, and I'm a Professor of Neurobiology and Ophthalmology at Stanford School of Medicine. Today I have the pleasure of introducing Dr. Lex Fridman as our guest on the "Huberman Lab Podcast." Dr. Fridman is a researcher at MIT specializing in machine learning, artificial intelligence and human robot interactions. I must say that the conversation with Lex was without question, one of the most fascinating conversations that I've ever had, not just in my career, but in my lifetime. I knew that Lex worked on these topics. And I think many of you are probably familiar with Lex and his interest in these topics from his incredible podcast, the "Lex Fridman Podcast." If you're not already watching that podcast, please subscribe to it. It is absolutely fantastic. But in holding this conversation with Lex, I realized something far more important. He revealed to us a bit of his dream. His dream about humans and robots, about humans and machines, and about how those interactions can change the way that we perceive ourselves and that we interact with the world. We discuss relationships of all kinds, relationships with animals, relationships with friends, relationships with family and romantic relationships. And we discuss relationships with the machines. Machines that move and machines that don't move, and machines that come to understand us in ways that we could never understand for ourselves, and how those machines can educate us about ourselves. Before this conversation, I had no concept of the ways in which machines could inform me or anyone about themselves. By the end, I was absolutely taken with the idea, and I'm still taken with the idea that interactions with machines have a very particular kind, a kind that Lex understands and wants to bring to the world, can not only transform the self, but may very well transform humanity. So whether or not you're familiar with Dr. Lex

Fridman or not, I'm certain you're going to learn a tremendous amount from him during the course of our discussion, and that it will transform the way that you think about yourself and about the world. Before we begin, I want to mention that this podcast is separate from my teaching and research roles at Stanford. It is however part of my desire and effort to bring zero cost to consumer information about science and science-related tools to the general public. In keeping with that theme, I'd like to thank the sponsors of today's podcast. Our first sponsor is ROKA. ROKA makes sunglasses and eyeglasses that are of absolutely phenomenal quality. The company was founded by two All-American swimmers from Stanford, and everything about the sunglasses and eyeglasses they've designed had performance in mind. I've spent a career working on the visual system. And one of the fundamental issues that your visual system has to deal with is how to adjust what you see when it gets darker or brighter in your environment. With ROKA Sunglasses and Eyeglasses, whether or not it's dim in the room or outside, or not there's cloud cover, or whether or not you walk into a shadow, you can always see the world with absolute clarity. And that just tells me that they really understand the way that the visual system works. Processes like habituation and attenuation. All these things that work at a real mechanistic level have been built into these glasses. In addition, the glasses are very lightweight. You don't even notice really that they're on your face. And the quality of the lenses is terrific. Now, the glasses were also designed so that you could use them, not just while working or at dinner, et cetera, but while exercising. They don't fall off your face or slip off your face if you're sweating. And as I mentioned, they're extremely lightweight. So you can use them while running, you can use them while cycling and so forth. Also the aesthetic of ROKA glasses is terrific. Unlike a lot of performance glasses out there, which frankly make people look like cyborgs, these glasses look great. You can wear them out to dinner, you can wear them for essentially any occasion. If you'd like to try ROKA glasses, you can go to [roka.com](http://roka.com). That's R-O-K-A .com and enter the code Huberman to save 20% off your first order. That's ROKA, R-O-K-A .com and enter the code Huberman at checkout. Today's episode is also brought to us by InsideTracker. InsideTracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals. I'm a big believer in getting regular blood work done for the simple reason that many of the factors that impact our immediate and long-term health can only be assessed from a quality blood test. And now with the advent of quality DNA tests, we can also get insight into some of our genetic underpinnings of our current and long-term

health. The problem with a lot of blood and DNA tests out there, however, is you get the data back and you don't know what to do with those data. You see that certain things are high or certain things are low, but you really don't know what the actionable items are, what to do with all that information. With InsideTracker, they make it very easy to act in the appropriate ways on the information that you get back from those blood and DNA tests. And that's through the use of their online platform. They have a really easy to use dashboard that tells you what sorts of things can bring the numbers for your metabolic factors, endocrine factors, et cetera, into the ranges that you want and need for immediate and long-term health. In fact, I know one individual just by way of example, that was feeling good, but decided to go with an InsideTracker test and discovered that they had high levels of what's called C-reactive protein. They would have never detected that otherwise. C-reactive protein is associated with a number of deleterious health conditions, some heart issues, eye issues, et cetera. And so they were able to take immediate action to try and resolve those CRP levels. And so with InsideTracker, you get that sort of insight. And as I mentioned before, without a blood or DNA test, there's no way you're going to get that sort of insight until symptoms start to show up. If you'd like to try InsideTracker, you can go to [insidetracker.com/huberman](https://insidetracker.com/huberman) to get 25% off any of InsideTracker's plans. You just use the code Huberman at checkout. That's [insidetracker.com/huberman](https://insidetracker.com/huberman) to get 25% off any of InsideTracker's plans. Today's podcast is brought to us by Athletic Greens. Athletic Greens is an all-in-one vitamin mineral probiotic drink. I started taking Athletic Greens way back in 2012. And so I'm delighted that they're sponsoring the podcast. The reason I started taking Athletic Greens and the reason I still take Athletic Greens is that it covers all of my vitamin mineral probiotic basis. In fact, when people ask me, what should I take? I always suggest that the first supplement people take is Athletic Greens, for the simple reason, is that the things that contains covers your bases for metabolic health, endocrine health, and all sorts of other systems in the body. And the inclusion of probiotics are essential for a healthy gut microbiome. There are now tons of data showing that we have neurons in our gut, and keeping those neurons healthy requires that they are exposed to what are called the correct microbiota, little microorganisms that live in our gut and keep us healthy. And those neurons in turn help keep our brain healthy. They influence things like mood, our ability to focus, and many, many other factors related to health. With Athletic Greens, it's terrific, because it also tastes really good. I drink it once or twice a day. I mix mine with water and I add a little lemon juice, or sometimes a little bit of lime

juice. If you want to try athletic greens, you can go to [athleticgreens.com/huberman](https://athleticgreens.com/huberman). And if you do that, you can claim their special offer. They're giving away five free travel packs, little packs that make it easy to mix up Athletic Greens while you're on the road. And they'll give you a year supply of vitamin D3 and K2. Again, go to [athleticgreens.com/huberman](https://athleticgreens.com/huberman)

00:07:35 What is Artificial Intelligence?

to claim that special offer. And now, my conversation with Dr. Lex Fridman. - We meet again. - We meet again. Thanks so much for sitting down with me. I have a question that I think is on a lot of people's minds or ought to be on a lot of people's minds, because we hear these terms a lot these days, but I think most people, including most scientists and including me don't know really what is artificial intelligence, and how is it different from things like machine learning and robotics? So, if you would be so kind as to explain to us, what is artificial intelligence, and what is machine learning? - Well, I think that question is as complicated and as fascinating as the question of, what is intelligence? So, I think of artificial intelligence, first, as a big philosophical thing. Pamela McCormick said AI was the ancient wish to forge the gods, or was born as an ancient wish to forge the gods. So I think at the big philosophical level, it's our longing to create other intelligence systems. Perhaps systems more powerful than us. At the more narrow level, I think it's also set of tools that are computational mathematical tools to automate different tasks. And then also it's our attempt to understand our own mind. So, build systems that exhibit some intelligent behavior in order to understand what is intelligence in our own selves. So all of those things are true. Of course, what AI really means as a community, as a set of researchers and engineers, it's a set of tools, a set of computational techniques that allow you to solve various problems. There's a long history that approaches the problem from different perspectives. What's always been throughout one of the threads, one of the communities goes under the flag of machine learning, which is emphasizing in the AI space, the task of learning. How do you make a machine that knows very little in the beginning, follow some kind of process and learns to become better and better at a particular task? What's been most very effective in the recent about 15 years is a set of techniques that fall under the flag of deep learning that utilize neural networks. When your networks are these fascinating things inspired by the structure of the human brain, very loosely, but they have a, it's a network of these little

basic computational units called neurons, artificial neurons. And they have, these architectures have an input and output. They know nothing in the beginning, and their task with learning something interesting. What that's something interesting is, usually involves a particular task. There's a lot of ways to talk about this and break this down. Like one of them is how much human supervision is required to teach this thing. So supervised learning is broad category, is the neural network knows nothing in the beginning and then it's given a bunch of examples in computer vision that will be examples of cats, dogs, cars, traffic signs, and then you're given the image and you're given the ground truth of what's in that image. And when you get a large database of such image examples where you know the truth, the neural network is able to learn by example, that's called supervised learning. There's a lot of fascinating questions within that, which is, how do you provide the truth? When you given an image of a cat, how do you provide to the computer that this image contains a cat? Do you just say the entire image is a picture of a cat? Do you do what's very commonly been done, which is a bounding box, you have a very crude box around the cat's face saying, this is a cat? Do you do semantic segmentation? Mind you, this is a 2D image of a cat. So it's not, the computer knows nothing about our three-dimensional world, is just looking at a set of pixels. So, semantic segmentation is drawing a nice, very crisp outline around the cat and saying, that's a cat. That's really difficult to provide that truth. And one of the fundamental open questions in computer vision is, is that even a good representation of the truth? Now, there's another contrasting set of ideas that our attention they're overlapping is, well, it's used to be called unsupervised learning. What's commonly now called self-supervised learning. Which is trying to get less and less and less human supervision into the task. So self-supervised learning is more, it's been very successful in the domain of language model, natural English processing, and now more and more as being successful in computer vision task. And the idea there is, let the machine without any ground-truth annotation just look at pictures on the internet, or look at texts on the internet and try to learn something generalizable about the ideas that are at the core of language or at the core of vision. And based on that, we humans at its best like to call that common sense. So with this, we have this giant base of knowledge on top of which we build more sophisticated knowledge. We have this kind of commonsense knowledge. And so the idea with self-supervised learning is to build this commonsense knowledge about, what are the fundamental visual ideas that make up a cat and a dog and all those kinds of things without ever having human supervision? The dream there is

the, you just let an AI system that's self supervised run around the internet for awhile, watch YouTube videos for millions and millions of hours, and without any supervision be primed and ready to actually learn with very few examples once the human is able to show up. We think of children in this way, human children, is your parents only give one or two examples to teach a concept. The dream with self-supervised learning is that will be the same with machines. That they would watch millions of hours of YouTube videos, and then come to a human and be able to understand when the human shows them, this is a cat. Like, remember this' a cat. They will understand that a cat is not just the thing with pointy ears, or a cat is a thing that's orange, or is furry, they'll see something more fundamental that we humans might not actually be able to introspect and understand. Like, if I asked you, what makes a cat versus a dog, you wouldn't probably not be able to answer that, but if I showed you, brought to you a cat and a dog, you'll be able to tell the difference. What are the ideas that your brain uses to make that difference? That's the whole dream with self-supervised learning, is it would be able to learn that on its own. That set of commonsense knowledge, that's able to tell the difference. And then there's like a lot of incredible uses of self-supervised learning, very weirdly called self-play mechanism. That's the mechanism behind the reinforcement learning successes of the systems that won at Go, at, AlphaZero that won a chess. - Oh, I see. That play games? - [Lex] That play games. - Got it. - So the idea of self-play is probably, applies to other domains than just games. Is a system that just plays against itself. And this is fascinating in all kinds of domains, but it knows nothing in the beginning. And the whole idea is it creates a bunch of mutations of itself and plays against those versions of itself. And the fascinating thing is when you play against systems that are a little bit better than you, you start to get better yourself. Like learning, that's how learning happens. That's true for martial arts. It's true in a lot of cases. Where you want to be interacting with systems that are just a little better than you. And then through this process of interacting with systems just a little better than you, you start following this process where everybody starts getting better and better and better and better until you are several orders of magnitude better than the world champion in chess, for example. And it's fascinating because it's like a runaway system. One of the most terrifying and exciting things that David Silver, the creator of AlphaGo and AlphaZero, one of the leaders of the team said, to me is a, they haven't found the ceiling for AlphaZero. Meaning it could just arbitrarily keep improving. Now, in the realm of chess, that doesn't matter to us. That it's like, it just ran away with the game of chess. Like it's like just so much better than humans. But the



question is what, if you can create that in the realm that does have a bigger, deeper effect on human beings and societies, that can be a terrifying process. To me, it's an exciting process if you supervise it correctly, if you inject, if what's called value alignment, you make sure that the goals that the AI is optimizing is aligned with human beings and human societies. There's a lot of fascinating things to talk about within the specifics of neural networks and all the problems that people are working on. But I would say the really big, exciting one is self-supervised learning. We're trying to get less and less human supervision, less and less human supervision of neural networks. And also just a comment and I'll shut up. - No, please keep going. I'm learning. I have questions, but I'm learning. So please keep going. - So, to me what's exciting is not the theory, it's always the application. One of the most exciting applications of artificial intelligence, specifically neural networks and machine learning is Tesla Autopilot. So these are systems that are working in the real world. This isn't an academic exercise. This is human lives at stake. This is safety-critical. - These are automated vehicles. Autonomous vehicles. - Semi-autonomous. We want to be. - Okay. - We've gone through wars on these topics, - Semi-autonomous vehicles. - Semi-autonomous. So, even though it's called a FSD, Full Self-Driving, it is currently not fully autonomous, meaning human supervision is required. So, human is tasked with overseeing the systems. In fact, liability-wise, the human is always responsible. This is a human factor psychology question, which is fascinating. I'm fascinated by the whole space, which is a whole 'nother space of human robot interaction when AI systems and humans work together to accomplish tasks. That dance to me is one of the smaller communities, but I think it will be one of the most important open problems once they're solved, is how the humans and robots dance together. To me, semi-autonomous driving is one of those spaces. So for Elon, for example, he doesn't see it that way, he sees semi-autonomous driving as a stepping stone towards fully autonomous driving. Like, humans and robots can't dance well together. Like, humans and humans dance and robots and robots dance. Like, we need to, this is an engineering problem, we need to design a perfect robot that solves this problem. To me forever, maybe this is not the case with driving, but the world is going to be full of problems with always humans and robots have to interact, because I think robots will always be flawed, just like humans are going to be flawed, are flawed. And that's what makes life beautiful, that they're flawed. That's where learning happens at the edge of your capabilities. So you always have to figure out, how can flawed robots and flawed humans interact together such that they, like the sum is bigger

than the whole, as opposed to focusing on just building the perfect robot? - Mm-hmm. - So that's one of the most exciting applications I would say of artificial intelligence to me is autonomous driving, the semi-autonomous driving. And that's a really good example of machine learning because those systems are constantly learning. And there's a process there that maybe I can comment on, the, Andrej Karpathy who's the head of autopilot calls it the data engine. And this process applies for a lot of machine learning, which is you build a system that's pretty good at doing stuff, you send it out into the real world, it starts doing the stuff and then it runs into what are called edge cases, like failure cases, where it screws up. We do this as kids. That you have- - You do this as adults. - We do this as adults. Exactly. But we learn really quickly. But the whole point, and this is the fascinating thing about driving, is you realize there's millions of edge cases. There's just like weird situations that you did not expect. And so the data engine process is you collect those edge cases, and then you go back to the drawing board and learn from them. And so you have to create this data pipeline where all these cars, hundreds of thousands of cars are driving around and something weird happens. And so whenever this weird detector fires, it's another important concept, that piece of data goes back to the mothership for the training, for the retraining of the system. And through this data engine process, it keeps improving and getting better and better and better and better. So basically you send out a pretty clever AI systems out into the world and let it find the edge cases, let it screw up just enough to figure out where the edge cases are, and then go back and learn from them, and then send out that new version and keep updating that version. - Is the updating done by humans? - The annotation is done by humans. The, so you have to, the weird examples come back, the edge cases, and you have to label what actually happened in there. There's also some mechanisms for automatically labeling, but mostly, I think you always have to rely on humans to improve, to understand what's happening in the weird cases. And then there's a lot of debate. And this, the other thing, what is artificial intelligence? Which is a bunch of smart people having very different opinions about what is intelligence. So AI is basically a community of people who don't agree on anything. - And it seems to be the case. First of all, this is a beautiful description of terms that I've heard many times among my colleagues at Stanford, at meetings in the outside world. And there are so many fascinating things. I have so many questions, but I do want to ask one question about the culture of AI, because it does seem to be a community where at least as an outsider, where it seems like there's very little consensus about what the terms and the operational definitions

even mean. And there seems to be a lot of splitting happening now of not just supervised and unsupervised learning, but these sort of intermediate conditions where machines are autonomous, but then go back for more instruction like kids go home from college during the summer and get a little, moms still feeds them then eventually they leave the nest kind of thing. Is there something in particular about engineers, or about people in this realm of engineering that you think lends itself to disagreement? - Yeah, I think, so, first of all, the more specific you get, the less disagreement there is. So there's a lot of disagreement about what is artificial intelligence, but there's less disagreement about what is machine learning and even less when you talk about active learning or machine teaching or self-supervised learning. And then when you get into like NLP language models or transformers, when you get into specific neural network architectures, there's less and less and less disagreement about those terms. So you might be hearing the disagreement from the high-level terms, and that has to do with the fact that engineering, especially when you're talking about intelligence systems is a little bit of an art and a science. So the art part is the thing that creates disagreements, because then you start having disagreements about how easy or difficult the particular problem is. For example, a lot of people disagree with Elon how difficult the problem of autonomous driving is. And so, but nobody knows. So there's a lot of disagreement about, what are the limits of these techniques? And through that, the terminology also contains within it the disagreements. But overall, I think it's also a young science that also has to do with that. So like it's not just engineering, it's that artificial intelligence truly is a large-scale discipline, where it's thousands, tens of thousands, hundreds of thousands of people working on it, huge amounts of money being made as a very recent thing. So we're trying to figure out those terms. And, of course, there's egos and personalities and a lot of fame to be made. Like the term deep learning, for example, neural networks have been around for many, many decades since the '60s, you can argue since the '40s. So there was a rebranding of neural networks into the word, deep learning, term, deep learning, that was part of the re-invigoration of the field, but it's really the same exact thing. - I didn't know that. I mean, I grew up in the age of neuroscience when neural networks were discussed, computational neuroscience and theoretical neuroscience, they had their own journals. It wasn't actually taken terribly seriously by experimentalists until a few years ago. I would say about five to seven years ago. Excellent theoretical neuroscientist like Larry Abbott and other colleagues, certainly at Stanford as well that people started paying attention to computational methods. But

these terms, neural networks, computational methods, I actually didn't know that neural network works in deep learning where those have now become kind of synonymous. - No, they're always the same thing. - Interesting. It was, so. - I'm a neuroscientist and I didn't know that. - So, well, because neural networks probably means something else and neural science not something else, but a little different flavor depending on the field. And that's fascinating too, because neuroscience and AI people have started working together and dancing a lot more in the recent,

00:26:46 Machine & Human Learning

I would say probably decade. - Oh, machines are going into the brain. I have a couple of questions, but one thing that I'm sort of fixated on that I find incredibly interesting is this example you gave of playing a game with a mutated version of yourself as a competitor. - Yeah. - I find that incredibly interesting as a kind of a parallel or a mirror for what happens when we try and learn as humans, which is we generate repetitions of whatever it is we're trying to learn, and we make errors. Occasionally we succeed. In a simple example, for instance, of trying to throw bulls eyes on a dartboard. - Yeah. - I'm going to have errors, errors, errors. I'll probably miss the dartboard. And maybe occasionally, hit a bullseye. And I don't know exactly what I just did, right? But then let's say I was playing darts against a version of myself where I was wearing a visual prism, like my visual, I had a visual defect, you learn certain things in that mode as well. You're saying that a machine can sort of mutate itself, does the mutation always cause a deficiency that it needs to overcome? Because of mutations in biology sometimes give us super powers, right? Occasionally, you'll get somebody who has better than 20/20 vision, and they can see better than 99.9% of people out there. So, when you talk about a machine playing a game against a mutated version of itself, is the mutation always say what we call a negative mutation, or an adaptive or a maladaptive mutation? - No, you don't know until you get, so, you mutate first and then figure out and they compete against each other. - So, you're evolving, the machine gets to evolve itself in real time. - Yeah. And I think of it, which would be exciting if you could actually do with humans. It's not just. So, usually you freeze a version of the system. So, really you take on Andrew of yesterday and you make 10 clones of them. And then maybe you mutate, maybe not. And then you do a bunch of competitions of the Andrew of today, like you fight to the death, and who wins last. So, I love that idea of like creating a bunch of clones of myself

from like from each of the day for the past year, and just seeing who's going to be better at like podcasting or science, or picking up chicks at a bar or I don't know, or competing in Jujitsu. That's the one way to do it, I mean, a lot of Lexes would have to die for that process, but that's essentially what happens, is in reinforcement learning through the self-play mechanisms, it's a graveyard of systems that didn't do that well. And the surviving, the good ones survive. - Do you think that, I mean, Darwin's Theory of Evolution might have worked in some sense in this way, but at the population level. I mean, you get a bunch of birds with different shaped beaks and some birds have the shaped beak that allows them to get the seeds. I mean, is a trivially simple example of Darwinian in evolution, but I think it's correct even though it's not exhaustive. Is what you're referring to? You essentially that normally this is done between members of a different species, lots of different members of species have different traits and some get selected for, but you could actually create multiple versions of yourself with different traits. - So, with, I should probably have said this, but perhaps it's implied with machine learning, with reinforcement learning through these processes. One of the big requirements, is to have an objective function, a loss function, a utility function, those are all different terms for the same thing, is there's a like any equation that says what's good, and then you're trying to optimize that equation. So, there's a clear goal for these systems. - Because it's a game, like with chess, there's a goal. - But for anything. Anything you want machine learning to solve, there needs to be an objective function. In machine learning, it's usually called Loss Function, that you're optimizing. The interesting thing about evolution, it's complicated of course, but the goal also seems to be evolving. Like it's a, I guess, adaptation to the environment, is the goal, but it's unclear that you can convert that always. It's like survival of the fittest. It's unclear what the fittest is. In machine learning, the starting point, and this is like what human ingenuity provides, is that fitness function of what's good and what's bad, which it lets you know which of the systems is going to win. So, you need to have a equation like that. One of the fascinating things about humans, is we figure out objective functions for ourselves. Like it's the meaning of life, like why the hell are we here? And a machine currently has to have a hard-coded statement about why. - It has to have a meaning of- - Yeah. - Artificial intelligence-based life. - Right. It can't. So, like there's a lot of interesting explorations about that function being more about curiosity, about learning new things and all that kind of stuff, but it's still hard coded. If you want a machine to be able to be good at stuff, it has to be given very clear statements of what good at stuff means. That's

one of the challenges of artificial intelligence, is you have to formalize the, in order to solve a problem, you have to formalize it and you have to provide both like the full sensory information, you have to be very clear about what is the data that's being collected, and you have to also be clear about the objective function.

00:32:21 Curiosity

What is the goal that you're trying to reach? And that's a very difficult thing for artificial intelligence. - I love that you mentioned curiosity, I am sure this definition falls short in many ways, but I define curiosity as a strong interest in knowing something, but without an attachment to the outcome. It's sort of a, it could be a random search, but there's not really an emotional attachment, it's really just a desire to discover and unveil what's there without hoping it's a gold coin under a rock, you're just looking under rocks. Is that more or less how the, within machine learning, it sounds like there are elements of reward prediction and rewards. The machine has to know when it's done the right thing. So, can you make machines that are curious, or are the sorts of machines that you are describing, curious by design? - Yeah, curiosity is a kind of a symptom, not the goal. So, what happens, is one of the big trade-offs in reinforcement learning, is this exploration versus exploitation. So, when you know very little, it pays off to explore a lot, even suboptimal, like even trajectories that seem like they're not going to lead anywhere, that's called exploration. The smarter and smarter and smarter you get, the more emphasis you put on exploitation, meaning you take the best solution, you take the best path. Now, through that process, the exploration can look like curiosity by us humans, but it's really just trying to get out of the local optimal, the thing it's already discovered. From an AI perspective, it's always looking to optimize the objective function, it derives, and we can talk about the slot more, but in terms of the tools of machine learning today, it derives no pleasure from just the curiosity of like, I don't know, discovery. - So, there's no dopamine for machine learning. - There's no dopamine. - There's no reward, system chemical, or I guess electronic-reward system. - That said, if you look at machine learning literature and reinforcement learning literature, that will use, like deep mind, we use terms like dopamine, we're constantly trying to use the human brain to inspire totally new solutions to these problems. So, they'll think like, how does dopamine function in the human brain, and how can it lead to more interesting ways to discover optimal solutions? But ultimately currently, there has to be a formal objective function. Now, you

could argue the humans also has a set of objective functions we try and optimize, we're just not able to introspect them. - Yeah, we don't actually know what we're looking for and seeking and doing. - Well, like Lisa Feldman Barrett who we spoken with at least on Instagram, I hope you- - I met her through you, yeah. - Yeah, I hope you actually have are on this podcast. - Yes, she's terrific. - So, she has a very, it has to do with homeostasis like that. Basically, there's a very dumb objective function that the brain is trying to optimize, like to keep like body temperature the same. Like there's a very dom kind of optimization function happening. And then what we humans do with our fancy consciousness and cognitive abilities, is we tell stories to ourselves so we can have nice podcasts, but really it's the brain trying to maintain a, just like healthy state, I guess. That's fascinating. I also see the human brain, and I hope artificial intelligence systems, as not just systems that solve problems, or optimize a goal, but are also storytellers. I think there's a power to telling stories. We tell stories to each other, that's what communication is. Like when you're alone, that's when you solve problems, that's when it makes sense to talk about solving problems. But when you're a community, the capability to communicate, tell stories, share ideas in such a way that those ideas are stable over a long period of time, that's like, that's being a charismatic storyteller. And I think both humans are very good at this. Arguably, I would argue that's why we are who we are, is we're great storytellers. And then AI I hope will also become that. So, it's not just about being able to solve problems with a clear objective function,

#### 00:36:55 Story Telling Robots

it's afterwards, be able to tell like a way better, like make up a way better story about why you did something, or why you failed. - So, you think that robots or, and/or machines of some sort are going to start telling human stories? - Well, definitely. So, the technical field for that is called Explainable AI, Explainable Artificial Intelligence, is trying to figure out how you get the AI system to explain to us humans why the hell it failed, or why it succeeded, or there's a lot of different sort of versions of this, or to visualize how it understands the world. That's a really difficult problem, especially with neural networks that are famously opaque, that we don't understand in many cases, why a particular neural network does what it does so well, and to try to figure out where it's going to fail, that requires the AI to explain itself. There's a huge amount of money, like there's a huge amount of money in this, especially from government funding and so on. Because if you

want to deploy AI systems in the real world, we humans at least, want to ask it a question like, why the hell did you do that? Like in a dark way, why did you just kill that person, right? Like if a car ran over a person, we want to understand why that happened. And now again, we're sometimes very unfair to AI systems because we humans can often not explain why very well. But that's the field of Explainable AI that people are very interested in because the more and more we rely on AI systems, like the Twitter recommender system, that AI algorithm that's, I would say impacting elections, perhaps starting wars, or at least military conflict, that algorithm, we want to ask that algorithm, first of all, do you know what the hell you're doing? Do you understand the society-level effects you're having? And can you explain the possible other trajectories? Like we would have that kind of conversation with a human, we want to be able to do that with an AI. And in my own personal level, I think it would be nice to talk to AI systems for stupid stuff, like robots when they fail to- - Why'd you fall down the stairs? - Yeah. But not an engineering question, but almost like an endearing question, like I'm looking for, if I fell and you and I were hanging out, I don't think you need an explanation exactly what were the dynamics, like what was the under actuated system problem here? Like what was the texture of the floor? Or so on. Or like, what was the- - No, I want to know what you're thinking. - That, or you might joke about like, you're drunk again, go home, or something, like there could be humor in it, that's an opportunity. Like storytelling, isn't just explanation of what happened, it's something that makes people laugh, it makes people fall in love, it makes people dream, and understand things in a way that poetry makes people understand things as opposed to a rigorous log of where every sensor was, where every actuator was. - I mean, I find this incredible because one of the hallmarks of severe autism spectrum disorders is, a report of experience from the autistic person that is very much a catalog of action steps. It's like, how do you feel today? And they'll say, well, I got up and I did this, and then I did this, and I did this. And it's not at all the way that a person who doesn't have autism spectrum disorder would respond. And the way you describe these machines has so much humanism,

00:40:48 What Defines a Robot?

or so much of a human and biological element, but I realized that we were talking about machines. I want to make sure that I understand if there's a distinction between a machine that learns, a machine with artificial intelligence and a robot. Like at what point



does a machine become a robot? So, if I have a ballpoint pen, I'm assuming I wouldn't call that a robot, but if my ballpoint pen can come to me when I moved to the opposite side of the table, if it moves by whatever mechanism, at that point, does it become a robot? - Okay, there's 1 million ways to explore this question. It's a fascinating one. So, first of all, there's a question of what is life? Like how do you know something as a living form and not? And it's to the question of when does sort of a, maybe a cold computational system becomes a, or already loading these words with a lot of meaning, robot and machine, So, one, I think movement is important, but that's a kind of a boring idea that a robot is just a machine that's able to act in the world. So, one artificial intelligence could be both just the thinking thing, which I think is what machine learning is, and also the acting thing, which is what we usually think about robots. So, robots are the things that have a perception system that's able to take in the world however you define the world, is able to think and learn and do whatever the hell it does inside, and then act on the world. So, that's the difference between maybe an AI system learning machine and a robot, it's something that's able, a robot is something that's able to perceive the world and act in the world. - So, it could be through language or sound, or it could be through movement or both. - Yeah. And I think it could also be in the digital space as long as there's a aspect of entity that's inside the machine and a world that's outside the machine. And there's a sense in which the machine is sensing that world and acting in it. - So, we could, for instance, there could be a version of a robot, according to the definition that I think you're providing, where the robot, where I go to sleep at night and this robot goes and forges for information that it thinks I want to see loaded onto my desktop in the morning. There was no movement of that machine, there was no language, but it essentially, has movement in cyberspace. - Yeah, there's a distinction that I think is important in that there's an element of it being an entity, whether it's in the digital or the physical space. So, when you have something like Alexa in your home, most of the speech recognition, most of what Alexa is doing, is constantly being sent back to the mothership. When Alexa is there on its own, that's to me, a robot, when it's there interacting with the world. When it's simply a finger of the main mothership, then the Alexa is not a robot, then it's just an interaction device, then may be the main Amazon Alexa AI, big, big system is the robot. So, that's important because there's some element, to us humans, I think, where we want there to be an entity, whether in the digital or the physical space, that's where ideas of consciousness come in and all those kinds of things that we project our understanding of what it means to be a being.

## 00:44:30 Magic & Surprise

And so, to take that further, when does a machine become a robot, I think there's a special moment. There's a special moment in a person's life and in a robot's life where it surprises you. I think surprise is a really powerful thing, where you know how the thing works and yet it surprises you, that's a magical moment for us humans. So, whether it's a chess-playing program that does something that you haven't seen before, that makes people smile like, huh, those moments happen with AlphaZero for the first time in chess playing, where grand masters were really surprised by a move. They didn't understand the move and then they studied and studied and then they understood it. But that moment of surprise, that's for grandmasters in chess. I find that moment of surprise really powerful, really magical in just everyday life. - Because it supersedes the human brain in that moment? - So, it's not supersedes, like outperforms, but surprises you in a positive sense. Like I didn't think he could do that, I didn't think that you had that in you. And I think that moment is a big transition for a robot from a moment of being a servant that accomplishes a particular task with some level of accuracy, with some rate of failure, to an entity, a being that's struggling just like you are in this world. And that's a really important moment that I think you're not going to find many people in the AI community that talk like I just did. I'm not speaking like some philosopher or some hippie, I'm speaking from purely engineering perspective. I think it's really important for robots to become entities and explore that as a real engineering problem, as opposed to everybody treats robots in the robotics community, they don't even call them or he or she, they don't give them, try to avoid giving them names, they've really want to see like a system, like a servant. They see it as a servant that's trying to accomplish a task. To me, and don't think I'm just romanticizing the notion, I think it's a being, it's a currently perhaps a dumb being, but in the long arc of history, humans are pretty dumb beings too, so- - I would agree with that statement. [Andrew laughing] - So, I tend to really want to explore this treating robots really as entities, yeah. So, like anthropomorphization, which is the sort of the act of looking at a inanimate object and projecting onto it life-like features, I think robotics generally sees that as a negative, I see it as a superpower. Like that, we need to use that. - Well, I'm struck by how that really grabs onto the relationship

## 00:47:37 How Robots Change Us

between human and machine, or human and robot. So, I guess the simple question is, and I think you've already told us the answer, but does interacting with a robot change you? In other words, do we develop relationships to robots? - Yeah, I definitely think so. I think the moment you see a robot or AI systems as more than just servants but entities, they begin to change you, in just like good friends do, just like relationships just to other humans. I think for that, you have to have certain aspects of that interaction. Like the robot's ability to say no, to have its own sense of identity, to have its own set of goals, that's not constantly serving you, but instead, trying to understand the world and do that dance of understanding through communication with you. So, I definitely think there's a, I mean, I have a lot of thoughts about this as you may know, and that's at the core of my life-long dream actually of what I want to do, which is I believe that most people have a notion of loneliness in them that we haven't discovered, that we haven't explored, I should say. And I see AI systems as helping us explore that so that we can become better humans, better people towards each other. So, I think that connection between human and AI, human and robot, is not only possible, but will help us understand ourselves in ways that are like several orders of magnitude deeper than we ever could have imagined. I tend to believe that [sighing]

#### 00:49:35 Relationships Defined

well, I have very wild levels of belief in terms of how impactful that will be, right? - So, when I think about human relationships, I don't always break them down into variables, but we could explore a few of those variables and see how they map to human-robot relationships. One is just time, right? If you spend zero time with another person at all in cyberspace or on the phone or in person, you essentially have no relationship to them. If you spend a lot of time, you have a relationship, this is obvious. But I guess one variable would be time, how much time you spend with the other entity, robot or human. The other would be wins and successes. You enjoy successes together. I'll give a absolutely trivial example this in a moment, but the other would be failures. When you struggle with somebody, whether or not you struggle between one another, you disagree, like I was really struck by the fact that you said that robot saying no, I've never thought about a robot saying no to me, but there it is. - I look forward to you being one of the first people I send this robots to. - So do I. So, there's struggle. When you struggle with somebody,

you grow closer. Sometimes the struggles are imposed between those two people, so called trauma bonding, they call it in the whole psychology literature and pop psychology literature. But in any case, I can imagine. So, time successes together, struggle together, and then just peaceful time, hanging out at home, watching movies, waking up near one another, here, we're breaking down the elements of relationships of any kind. So, do you think that these elements apply to robot-human relationships? And if so, then I could see how, if the robot has its own entity and has some autonomy in terms of how it reacts you, it's not just there just to serve you, it's not just a servant, it actually has opinions, and can tell you when maybe your thinking is flawed, or your actions are flawed. - It can also leave. - It could also leave. So, I've never conceptualized robot-human interactions this way. So, tell me more about how this might look. Are we thinking about a human-appearing robot? I know you and I have both had intense relationships to our, we have separate dogs obviously, but to animals, it sounds a lot like human-animal interaction. So, what is the ideal human-robot relationship? - So, there's a lot to be said here, but you actually pinpointed one of the big, big first steps, which is this idea of time. And it's a huge limitation in machine-learning community currently. Now we're back to like the actual details. Life-long learning is a problem space that focuses on how AI systems can learn over a long period of time. What's currently most machine learning systems are not able to do, is to all of the things you've listed under time, the successes, the failures, or just chilling together watching movies, AI systems are not able to do that, which is all the beautiful, magical moments that I believe are the days filled with, they're not able to keep track of those together with you. - 'Cause they can't move with you and be with you. - No, no, like literally we don't have the techniques to do the learning, the actual learning of containing those moments. Current machine-learning systems are really focused on understanding the world in the following way, it's more like the perception system, like looking around, understand like what's in the scene. That there's a bunch of people sitting down, that there is cameras and microphones, that there's a table, understand that. But the fact that we shared this moment of talking today, and still remember that for like next time you're doing something, remember that this moment happened. We don't know how to do that technique-wise. This is what I'm hoping to innovate on as I think it's a very, very important component of what it means to create a deeper relationship, that sharing of moments together. - Could you post a photo of you in the robot, like selfie with robot and the robot sees that image and recognizes that was time spent, there were smiles, or there were tears- - Yeah. - And create some sort of metric of emotional depth

in the relationship and update its behavior? - So. - Could it... It texts you in the middle of the night and say, why haven't you texted me back? - Well, yes, all of those things, but we can dig into that. But I think that time element, forget everything else, just sharing moments together, that changes everything. I believe that changes everything. Now, there's specific things that are more in terms of systems that I can explain you. It's more technical and probably a little bit offline, 'cause I have kind of wild ideas how that can revolutionize social networks and operating systems. But the point is that element alone, forget all the other things we're talking about like emotions, saying no, all that, just remembering sharing moments together would change everything. We don't currently have systems that share moments together. Like even just you and your fridge, just all those times, you went late at night and ate thing you shouldn't have eaten, that was a secret moment you have with your refrigerator. You shared that moment, that darkness or that beautiful moment where you were just like heartbroken for some reason, you're eating that ice cream or whatever, that's a special moment. And that refrigerator was there for you, and the fact that it missed the opportunity to remember that is tragic. And once it does remember that, I think you're going to be very attached to the refrigerator. You're going to go through some hell with that refrigerator. Most of us have, like in the developed world, have weird relationships with food, right? So, you can go through some deep moments of trauma and triumph with food, and at the core of that, is the refrigerator. So, a smart refrigerator, I believe would change society. Not just the refrigerator, but these ideas in the systems all around us. So, I just want to comment on how powerful that idea of time is. And then there's a bunch of elements of actual interaction of allowing you as a human to feel like you're being heard. Truly heard, truly understood, that we human, like deep friendship is like that, I think, but there's still an element of selfishness, there's still an element of not really being able to understand another human. And a lot of the times when you're going through trauma together, through difficult times and through successes, you actually starting to get that inkling of understanding of each other, but I think that could be done more aggressively, more efficiently. Like if you think of a great therapist, I think I've never actually been to a therapist, but I'm a believer I used to want to be a psychiatrist. - Do Russians go to therapists? - No, they don't. They don't. And if they do, the therapist don't live to tell the story. I do believe in talk therapy, which friendship is to me, is it's talk therapy, or like you don't even necessarily need to talk [laughing] it's like just connecting through in the space of ideas and the space of experiences. And I think there's a lot of ideas of how to

make AI systems to be able to ask the right questions and truly hear another human. This is what we try to do with podcasting, right? I think there's ways to do that with AI. But above all else, just remembering the collection of moments that make up the day, the week, the months, I think you maybe have some of this as well. Some of my closest friends still are the friends from high school. That's time, we've been through a bunch of together, and that like we're very different people. But just the fact that we've been through that, and we remember those moments, and those moments somehow create a depth of connection like nothing else, like you and your refrigerator. - I love that because my graduate advisor, she unfortunately, she passed away, but when she passed away, somebody said at her memorial all these amazing things she had done, et cetera. And then her kids got up there, and she had young children and that I knew as when she was pregnant with them. And so, it was really, you're even now I can feel like your heart gets heavy, thinking about this, they're going to grow up without their mother. And it was really amazing, very strong young girls, and now the young women. And what they said was incredible, they said what they really appreciated most about their mother, who was an amazing person, is all the unstructured time they spent together. - Mm-hmm. - So, it wasn't the trips to the zoo, it wasn't she woke up at five in the morning and drove us to school. She did all those things too. She had two hour commute in each direction, it was incredible, ran a lab, et cetera, but it was the unstructured time. So, on the passing of their mother, that's what they remembered was that the biggest give and what bonded them to her, was all the time where they just kind of hung out. And the way you describe the relationship to a refrigerator is so, I want to say human-like, but I'm almost reluctant to say that. Because what I'm realizing as we're talking, is that what we think of as human-like might actually be the lower form of relationship. There may be relationships that are far better than the sorts of relationships that we can conceive in our minds right now based on what these machine relationship interactions could teach us. Do I have that right? - Yeah, I think so. I think there's no reason to see machines as somehow incapable of teaching us something that's deeply human. I don't think humans have a monopoly on that. I think we understand ourselves very poorly and we need to have the kind of prompting from a machine. And definitely part of that, is just remembering the moments. I think the unstructured time together, I wonder if it's quite so unstructured. That's like calling this podcast on structured time. - Maybe what they meant, was it wasn't a big outing, there was no specific goal, but a goal was created through the lack of a goal. Like we would just hang out and then you start playing, thumb war, and you

end up playing thumb war for an hour. So, it's the structure emerges from lack of structure. - No, but the thing is the moments, there's something about those times that creates special moments, and I think those could be optimized for. I think we think of like a big outing as, I don't know, going to Six Flags or something, or some big, the Grand Canyon, or go into some, I don't know, I think we would need to, we don't quite yet understand, as humans, what creates magical moments. I think it's possible to optimize a lot of those things. And perhaps like podcasting is helping people discover that, like maybe the thing we want to optimize for isn't necessarily like some sexy, like quick clips, maybe what we want, is long-form authenticity. - Depth. - Depth. So, we were trying to figure that out, certainly from a deep connection between humans and humans and NAS systems, I think long conversations, or long periods of communication over a series of moments like my new, perhaps, seemingly insignificant to the big ones, the big successes, the big failures, those are all just stitching those together and talking throughout. I think that's the formula for a really, really deep connection. That from like a very specific engineering perspective, is I think a fascinating open problem that has been really worked on very much. And for me, from a, if I have the guts

01:02:29 Lex's Dream for Humanity

and, I mean there's a lot of things to say, but one of it is guts, is I'll build a startup around it. - So, let's talk about this startup and let's talk about the dream. You mentioned this dream before in our previous conversations, always as little hints dropped here and there. Just for anyone listening, there's never been an offline conversation about this dream, I'm not privy to anything, except what Lex says now. And I realized that there's no way to capture the full essence of a dream in any kind of verbal statement in a way that captures all of it. But what is this dream that you've referred to now several times when we've sat down together and talked on the phone? Maybe it's this company, maybe it's something distinct. If you feel comfortable, it'd be great if you could share a little bit about what that is. - Sure. So, the way people express long-term vision, I've noticed is quite different. Like Elon is an example of somebody who can very crisply say exactly what the goal is. Also has to do with the fact that problems he's solving have nothing to do with humans. So, my long-term vision is a little bit more difficult to express in words, I've noticed, as I've tried, it could be my brain's failure, but there's a way to sneak up to it. So, let me just say a few things. Early on in life and also in the recent

years, I've interacted with a few robots where I understood there's magic there. And that magic could be shared by millions if it's brought to light. When I first met Spot from Boston Dynamics, I realized there's magic there that nobody else is seeing. - Is the dog. - The dog, sorry. The Spot is the four-legged robot from Boston Dynamics. Some people might have seen it, it's this yellow dog. And sometimes in life, you just notice something that just grabs you. And I believe that this is something that this magic is something that could be in every single device in the world. The way that I think maybe Steve Jobs thought about the personal computer, laws didn't think about the personal computer this way, but Steve did. Which is like, he thought that the personal computer should be as thin as a sheet of paper and everybody should have one, and this idea, I think it is heartbreaking that we're getting, the world is being filled up with machines that are soulless. And I think every one of them can have that same magic. One of the things that also inspired me in terms of a startup, is that magic can be engineered much easier than I thought. That's my intuition with everything I've ever built and worked on. So, the dream is to add a bit of that magic in every single computing system in the world. So, the way that Windows Operating System for a long time was the primary operating system everybody interacted with, they built apps on top of it. I think this is something that should be as a layer, it's almost as an operating system in every device that humans interacted with in the world. Now, what that actually looks like, the actual dream when I was officially a kid, it didn't have this concrete form of a business, it had more of a dream of exploring your own loneliness by interacting with machines, robots. This deep connection between humans and robots was always a dream. And so, for me, I'd love to see a world where there's every home as a robot, and not a robot that washes the dishes, or a sex robot, or I don't know, think of any kind of activity the robot can do, but more like a companion. - A family member. - A family member, the way a dog is. - Mm-hmm. - But a dog that's able to speak your language too. So, not just connect the way a dog does by looking at you and looking away and almost like smiling with its soul in that kind of way, but also to actually understand what the hell, like, why are you so excited about the successes? Like understand the details, understand the traumas. And that, I just think [sighing] that has always filled me with excitement that I could, with artificial intelligence, bring joy to a lot of people. More recently, I've been more and more heartbroken to see the kind of division, derision, even hate that's boiling up on the internet through social networks. And I thought this kind of mechanism is exactly applicable in the context of social networks as well. So, it's an operating system that



serves as your guide on the internet. One of the biggest problems with YouTube and social networks currently, is they're optimizing for engagement. I think if you create AI systems that know each individual person, you're able to optimize for long-term growth for a long-term happiness. - Of the individual, or- - Of the individual, of the individual. And there's a lot of other things to say, which is in order for AI systems to learn everything about you, they need to collect, they need to just like you and I when we talk offline, we're collecting data about each others secrets about each other, the same way AI has to do that. And that allows you to, and that requires you to rethink ideas of ownership of data. I think each individual should own all of their data and very easily be able to leave just like AI systems can leave, humans can disappear and delete all of their data in a moment's notice. Which is actually better than we humans can do, is once we load the data into each other, it's there. I think it's very important to be both, give people complete control over their data in order to establish trust that they can trust you. And the second part of trust is transparency. Whenever the data is used to make it very clear what is being used for. And not clear in a lawyerly legal sense, but clear in a way that people really understand what it's used for. I believe when people have the ability to delete all their data and walk away and know how the data is being used, I think they'll stay. - The possibility of a clean breakup, is actually what will keep people together. - Yeah, I think so. I think, exactly. I think a happy marriage acquires the ability to divorce easily without the divorce industrial complex or whatever. Things currently going on and then there's so much money to be made from lawyers and divorce. But yeah, the ability to leave is what enables love, I think. - It's interesting. I've heard the phrase from a semi-cynical friend, that marriage is the leading cause of divorce, but now we've heard that divorce, or the possibility of divorce could be the leading cause of marriage. - Of a happy marriage. - Good point. - Of a happy marriage. So, yeah. So, there's a lot of details there, but the big dream is that connection between AI system and a human. And I haven't. There's so much fear about artificial intelligence systems and about robots that I haven't quite found the right words to express that vision because the vision I have, it's not like some naive, delusional vision of like technology is going to save everybody, it's I really do just have a positive view of ways AI systems can help humans explore themselves. - I love that positivity and I agree that the stance everything is doomed is equally bad to say that everything's going to turn out all right, there has to be a dedicated effort. And clearly, you're thinking about what that dedicated effort would look like. You mentioned two aspects to this dream [clears throat] and I want to make sure that I

understand where they connect if they do, or if they are independent streams. One was this hypothetical robot family member, or some other form of robot that would allow people to experience the kind of delight that you experienced many times,

01:11:33 Improving Social Media

and that you would like the world to be able to have, and it's such a beautiful idea of this give. And the other is social media or social network platforms that really serve individuals and their best selves and their happiness and their growth. Is there crossover between those, or are these two parallel dreams? - It's 100% of the same thing. It's difficult to kind of explain without going through details, but maybe one easy way to explain the way I think about social networks, is to create an AI system that's yours. It's not like Amazon Alexa that's centralized, you own the data, it's like your little friend that becomes your representative on Twitter that helps you find things that will make you feel good, that will also challenge your thinking to make you grow, but not get to that, not let you get lost in the negative spiral of dopamine, that gets you to be angry, or most just get you to be not open to learning. And so, that little representative is optimizing your long-term health. And I believe that that is not only good for human beings, it's also good for business. I think longterm, you can make a lot of money by challenging this idea that the only way to make money, is maximizing engagement. And one of the things that people disagree with me on, is they think Twitter's always going to win. Like maximizing engagement is always going to win, I don't think so. I think people have woken up now to understanding that, like they don't always feel good, the ones who are on Twitter a lot, that they don't always feel good at the end of the week. - I would love feedback from whatever this creature, whatever, I don't know what to call it, as to maybe at the end of the week, it would automatically unfollow some of the people that I follow because it realized through some really smart data about how I was feeling inside, or how I was sleeping, or something that, I don't know, that just wasn't good for me. But it might also put things and people in front of me that I ought to see, is that kind of a sliver of what this look like? - The whole point, because of the interaction, because of sharing the moments and learning a lot about you, you're now able to understand what interactions led you to become a better version of yourself. Like the person you yourself are happy with. This isn't, if you're into flat earth and you feel very good about it, that you believe that earth is flat, like the idea that you should sensor that is ridiculous. If it makes you feel good and

you becoming the best version of yourself, I think you should be getting as much flat earth as possible. Now, it's also good to challenge your ideas, but not because the centralized committee decided, but because you tell to the system that you like challenging your ideas, I think all of us do. And then, which actually YouTube doesn't do that well, once you go down the flat-earth rabbit hole, that's all you're going to see. It's nice to get some really powerful communicators to argue against flat earth. And it's nice to see that for you, and potentially, at least long-term to expand your horizons, maybe the earth is not flat. But if you continue to live your whole life thinking the earth is flat, I think, and you're being a good father or son or daughter, and like you're being the best version of yourself and you're happy with yourself, I think the earth is flat. So, like I think this kind of idea, and I'm just using that kind of silly, ridiculous example because I don't like the idea of centralized forces controlling what you can and can't see, but I also don't like this idea of like not censoring anything. Because that's always the biggest problem with that, is this there's a central decider, I think you yourself can decide what you want to see and not, and it's good to have a companion that reminds you that you felt last time you did this, or you felt good last time you did this. - Man, I feel like in every good story, there's a guide or a companion that flies out, or forges a little bit further, a little bit differently and brings back information that helps us, or at least tries to steer us in the right direction. - So, yeah, that's exactly what I'm thinking and what I've been working on. I should mention as a bunch of difficulties here, you see me up and down a little bit recently. So, there's technically a lot of challenges here. Just like with a lot of technologies, and the reason I'm talking about it on a podcast comfortably as opposed to working in secret, is it's really hard and maybe it's time has not come. And that's something you have to constantly struggle with in terms of like entrepreneurially as a startup, like I've also mentioned to you, maybe offline, I really don't care about money,

#### 01:16:57 Challenges of Creativity

I don't care about business success, all those kinds of things. So, it's a difficult decision to make, how much of your time do you want to go all in here and give everything to this? It's a big roll the dice. Because I've also realized that's working on some of these problems, both with the robotics and the technical side in terms of the machine-learning system that I'm describing, it's lonely, it's really lonely. Because both on a personal level and a technical level. So, on the technical level, I'm surrounded by people that kind of

doubt me, which I think all entrepreneurs go through. And they doubt you in the following sense, they know how difficult it is. Like the people that the colleagues of mine, they know how difficult life-long learning is, they also know how difficult it is to build a system like this, to build the competitive social network. And in general, there's a kind of a loneliness to just working on something on your own for long periods of time. And you start to doubt whether, given that you don't have a track record of success, like that's a big one. But when you look in the mirror, especially when you're young, but I still have that, I'm most things, you look in the mirror, it's like, and you have these big dreams, how do you know you're actually as smart as you think you are? Like how do you know you're going to be able to accomplish this dream? You have this ambition. - You sort of don't, but you're kind of pulling on a string hoping that there's a bigger ball of yarn. - Yeah. [Andrew laughing] But you have this kind of intuition. I think I pride myself in knowing what I'm good at, because the reason I have that intuition, is 'cause I think I'm very good at knowing all the things I suck at, which is basically everything. So, like whenever I notice like, wait a minute, I'm kind of good at this, which is very rare for me. I think like that, that might be a ball of yarn worth pulling at. And the thing with in terms of engineering systems that are able to interact with humans, I think I'm very good at that. And because we talk about podcasting and so on, I don't know if I'm very good at podcasts. - You're very good at podcasting, right? - But I certainly don't, I think maybe it is compelling for people to watch a kindhearted idiot struggle with this form, maybe that's what's compelling. But in terms of like actual being a good engineer of human-robot interaction systems, I think I'm good. But it's hard to know until you do it, and then the world keeps telling you you're not, and it's full of doll, it's really hard. And I've been struggling with that recently, it's kind of a fascinating struggle. But then that's where the Goggins thing comes in, is like, aside from the state-hard motherfucker, is the, like whenever you're struggling, that's a good sign that if you keep going, that you're going to be alone in the success, right? - Well, in your case, however, I agree. And actually David had a post recently that I thought was among his many brilliant posts, was one of the more brilliant about how he talked about this myth of the light at the end of the tunnel. And instead, what he replaced that myth with, was a concept that eventually, your eyes adapt to the dark. That the tunnel, it's not about a light at the end, that it's really about adapting to the dark of the tunnel. It's very Goggins- - I love him so much. - Yeah. You got share a lot in common knowing you both a bit, share a lot in common. But in this loneliness and the pursuit of this dream, it seems to me, it has a certain component to it

that is extremely valuable, which is that the loneliness itself could serve as a driver to build the companion for the journey. - Well, I'm very deeply aware of that. So, like some people can make, 'cause I talk about love a lot, I really love everything in this world, but I also love humans, friendship and romantic, like even the cheesy stuff, just- - You like romantic movies? - Yeah, not those, not necessarily. So, well, I got so much from Rogan about like, was it the Tango scene from "Scent of a Woman,"

01:21:49 Suits & Dresses

but I find like there's nothing better than a woman in a red dress, just like the classy- - You should move to Argentina my friend. My father's Argentine, and you know what he said when I went on your podcast for the first time? He said, he dresses well. Because in Argentina, the men go to a wedding or a party or something, in the U.S., by halfway through the night, 10 minutes in the night, all the jackets are off. - Yeah. - It looks like everyone's undressing for the party they just got dressed up for. And he said, you know, I liked the way he dresses. And then when I started, he was talking about you. And then when I started my podcast, he said, why don't you wear a real suit like your friend Lex?

01:22:22 Loneliness

[laughing] - I remember that. - No, you can't. But let's talk about this pursuit just a bit more, because I think what you're talking about, is building a, not just a solution for loneliness, but you've alluded to the loneliness as itself, an important thing. And I think you're right. I think within people, there is like caverns of faults and shame, but also just the desire to have resonance, to be seen and heard. And I don't even know that it's seen and heard through language. But these reservoirs of loneliness, I think, well, they're interesting, maybe you could comment a little bit about it. Because just as often as you talk about love, I haven't quantified it, but it seems that you talk about this loneliness, and maybe you just if you're willing, you'll share a little bit more about that, and what that feels like now in the pursuit of building this robot-human relationship. And you've been, let me be direct, you've been spending a lot of time on building a robot-human relationship, where's that at? - Oh, in terms of business, in terms of systems? - No, I'm talking about a specific robot. - Oh [laughing] so, okay, I should mention a few things. So, one, is there's a startup with an idea where I hope millions of people can use. And

then there's my own personal like almost like Frankenstein explorations with particular robots. So, I'm very fascinated with the legged robots in my own, private sounds like dark, but like in of one experiments to see if I can recreate the magic. And that's been, I have a lot of really good already perception systems and control systems that are able to communicate affection in a dog-like fashion. So, I'm in a really good place there. The stumbling blocks, which also have been part of my sadness recently, is that I also have to work with robotics companies that I gave so much of my heart, soul and love and appreciation towards Boston Dynamics, but Boston Dynamics has also, as a company, it has to make a lot of money and they have marketing teams. And they're like looking at this silly Russian kid in a suit and tie, it's like, what's he trying to do with all this love and robot interaction and dancing and so on? So, there was a, I think let's say for now, it's like, when you break up with a girlfriend or something, right now, we decided to part ways on this particular thing. They're huge supporters of mine, they're huge fans, but on this particular thing, Boston Dynamics is not focusing on, or interested in human-robot interaction. In fact, their whole business currently, is keep the robot as far away from humans as possible because it's an in the industrial setting where it's doing monitoring in dangerous environments. It's almost like a remote security camera, essentially is its application. To me, I thought it's still, even in those applications, exceptionally useful for the robot to be able to perceive humans, like see humans and to be able to, in a big map, localize where those humans are and have human intention. For example, like this, I did this a lot of work with pedestrians, for a robot to be able to anticipate what the how the human is doing, like where it's walking. The humans are not ballistics object, just because you're walking this way one moment, it doesn't mean you'll keep walking that direction, you have to infer a lot of signals, especially with the head movement and the eye movement. And so, I thought that's super interesting to explore, but they didn't feel that. So, I'll be working with a few other robotics companies that are much more open to that kind of stuff, and they're super excited and fans of mine. And hopefully, Boston Dynamics, my first love, like getting back with an ex-girlfriend, will come around. But so, the algorithmically, it's basically a done there. The rest, is actually getting some of these companies to work with. And then there's, for people who'd worked with robots know that one thing is to write software that works, and the other is to have a real machine that actually works. And it breaks down all kinds of different ways that are fascinating. And so, there's a big challenge there. But that's almost, it may sound a little bit confusing in the context of our previous discussion because the previous discussion was more about

the big dream, how I hoped to have millions of people enjoy this moment of magic. This current discussion about a robot, is something I personally really enjoy, just brings me happiness, I really try to do now everything that just brings me joy, I maximize that 'cause robots are awesome. But two, given my little bit growing platform, I want to use the opportunity to educate people. Like robots are cool. And if I think they're cool, I hope be able to communicate why they're cool to others. So, this little robot experiment is a little bit of research project too, there's a couple of publications with MIT folks around that. But the other is just to make some cool videos and explain to people how they actually work. And as opposed to people being scared of robots, they could still be scared, but also excited, like see the dark side, the beautiful side, the magic of what it means to bring, for a machine to become a robot. I want to inspire people with that. But that's less, it's interesting because I think the big impact in terms of the dream does not have to do with embodied AI. So, it does not need to have a body. I think the refrigerator's enough, that for an AI system just to have a voice and to hear you, that's enough for loneliness. The embodiment is just - By embodiment, you mean the physical structure. - Physical instantiation of intelligence. So, it's a legged robot, or even just a thing. I have a few other of humanoid robot, a little humanoid robot maybe I'll keep them on the table, is like walks around, or even just like a mobile platform they can just like, turn around and look at you, it's like we mentioned with the pen. Something that moves and can look at you, it's like that Butter Robot that asks, what is my purpose? That is really, it's almost like art. There's something about a physical entity that moves around, that's able to look at you and interact with you, that makes you wonder what it means to be human. It like challenges you to think, if that thing looks like he has consciousness, what the hell am I? And I like that feeling, I think that's really useful for us, it's humbling for us humans. But that's less about research, it certainly less about business and more about exploring our own selves, and challenging others to think like, to think about what makes them human. - I love this desire to share the delight of an interaction with a robot. And as you describe it, I actually find myself starting to crave that because we all have those elements from childhood where,

01:30:09 Empathy

or from adulthood, where we experience something, we want other people to feel that. And I think that you're right, I think a lot of people are scared of AI, I think a lot of people

are scared of robots. My only experience, and of a robotic-like thing is my Roomba Vacuum, where it goes about, actually, it was pretty good at picking up Costello's hair when he was shed and I was grateful for it. But then when I was on a call or something, and it would get caught on a wire or something, I would find myself getting upset with the Roomba in that moment, I'm like, what are you doing? And obviously it's just doing what it does. But that's a kind of mostly positive, but slightly negative interaction. But what you're describing, it has so much more richness and layers of detail that I can only imagine what those relationships are like. - Well, there's a few, just a quick comment. So, I've had, they're currently in Boston and I have a bunch of Roombas from iRobot. And I did this experiment- - Wait, how many Roombas? [Lex laughing] It sounds like a fleet of Roombas. - Yeah. So, it's probably seven or eight, yeah. - Well, it's a lot of Roombas. This place is very clean. - Well, so, this, I'm kind of waiting, this is the place we're currently in Austin, is way larger than I need. But I basically got it to make sure I have room for robots. - So, you have these seven or so Roombas, you deploy all seven at once? - Oh, no, I do different experience with them, different experiments with them. So, one of the things I want to mention, is this is a, I think there was a YouTube video that inspired me to try this, is I got them to scream in pain and moan in pain whenever they were kicked or contacted. And I did that experiment to see how I would feel. I meant to do like a YouTube video on it, but then it just seemed very cruel. - Did any Roomba rights activists come at you? - Like I think if I released that video, I think it's going to make me look insane, which I know people know I'm already insane- - Now, you have to release the video. [Lex laughing] - Sure. Well, I think maybe if I contextualize it by showing other robots like to show why this is fascinating, because ultimately, I felt like there were human almost immediately. And that display of pain was what did that. - Giving them a voice. - Giving them a voice, especially a voice of dislike, of pain. - I have to connect you to my friend Eddie Chang, he studied speech and language, he's a neurosurgeon, and we're life-long friends. He studied speech and language, but he describes some of these more primitive, visceral vocalizations, cries, groans, moans of delight, other sounds as well, use your imagination, as such powerful rudders for the other, for the emotions of other people. And so, I find it fascinating, I can't wait to see this video. So, is the video available online? - No, I haven't recorded it, I just hit a bunch of Roombas that are able to scream in pain in my Boston place. [Andrew laughing] So, like people already- - Next podcast episode with Lex, maybe we'll have that one, who knows? - So, the thing is like people, I've noticed because I talk so much about love and



it's really who I am, I think they want to, to a lot of people, seems like there's there got to be a dark person in there somewhere. And I thought if I release videos of Roombas screaming and they're like, yep, yep, that guy's definitely insane. - What about like shouts of glee and delight, you could do that too, right? - Well, I don't know how to, to me, delight is quiet, right? - You're a Russian. Americans are much louder than Russians. - Yeah. - Yeah. - Yeah. But like I don't, unless you're talking about like, I don't know how you would have sexual relationships with the Roomba. - Well, I wasn't necessarily saying a sexual delight, but- - Trust me, I tried. I'm just kidding, that's a joke, internet. Okay [giggles] but I was fascinated in the psychology of how little it took. 'Cause you mentioned you had a negative relationship with a Roomba. - Well, I'd find that mostly, I took it for granted. - Yeah. - It just served me, it collected Costello's hair. And then when it would do something I didn't like, I would get upset with it. So, that's not a good relationship, it was taken for granted and I would get upset and then I'd park it again, and I just like you're in the corner. - Yeah. - But there's a way to frame it being quite dumb as almost cute. You're almost connecting with it for its dumbness. And I think that's artificial intelligence problem. - [Andrew] It's interesting. - I think flaws should be feature, not a bug. - So, along the lines of this, the different sorts of relationships that one could have with robots, and the fear, but also some of the positive relationships

#### 01:35:12 Power Dynamics In Relationships

that one could have, there's so much dimensionality, there's so much to explore. But power dynamics in relationships are very interesting, because the obvious ones, the unsophisticated view of this, is one, there's a master and a servant, right? But there's also manipulation, there's benevolent manipulation, children do this with parents, puppies do this. Puppies turn their head and look cute and maybe give out a little noise, kids coup and parents always think that they're doing this because they love the parent, but in many ways, studies show that those coups are ways to extract the sorts of behaviors and expressions from the parent that they want. The child doesn't know it's doing this, it's completely subconscious, but it's benevolent manipulation. So, there's one version of fear of robots that I hear a lot about that I think most people can relate to where the robots take over and they become the masters and we become the servants. But there could be another version that in certain communities that I'm certainly not a part of, but they call topping from the bottom, where the robot is actually manipulating

you into doing things, but you are under the belief that you are in charge, but actually they're in charge. And so, I think that's one that if we could explore that for a second, you could imagine it wouldn't necessarily be bad, although it could lead to bad things. The reason I want to explore this, is I think people always default to the extreme, like the robots take over and we're in little jail cells and they're out having fun and ruling the universe. What sorts of manipulation can a robot potentially carry out, good or bad? - Yeah. Just so, there's a lot of good and bad manipulation between humans, right? Just like you said. [Lex sighing] To me [sighing] especially like you said [giggles] topping from the bottom, is that the term? - I think someone from MIT told me that term. [Lex laughing] It wasn't Lex. - I think. So, first of all, there's power dynamics in bed, and power dynamics in relationships, and power dynamics on the street, and in the work environment, those are all very different. I think power dynamics can make human relationships, especially romantic relationships fascinating and rich and fulfilling and exciting and all those kinds of things. So, I don't think in themselves they're bad, and the same goes with robots. I really love the idea that a robot will be at top or a bottom in terms of like power dynamics. And I think everybody should be aware of that. And the manipulation is not so much manipulation, but a dance of like pulling away, a push and pull, and all those kinds of things. In terms of control, I think we're very, very, very far away from AI systems that are able to lock us up. To lock us up in, like to have so much control that we basically cannot live our lives in the way that we want. I think there's a, in terms of dangers of AI systems, there's much more dangers that have to do with autonomous weapon systems and all those kinds of things. So, the power dynamics as exercised in the struggle between nations and war and all those kinds of things. But in terms of personal relationships, I think power dynamics are a beautiful thing. Now, there's of course, going to be all those kinds of discussions about consent and rights and all those kinds of things. - Well, here, we're talking about, I always say in any discussion around this, if we need to define a really the context, it always should be consensual, age-appropriate, context-appropriate, species-appropriate,

01:39:11 Robot Rights

but now we're talking about human-robot interactions. And so, I guess that- - No, I actually was trying to make a different point, which is I do believe that robots will have rights down the line. And I think in order for us to have deep, meaningful relationships

with robots, we would have to consider them as entities in themselves that deserve respect. And that's a really interesting concept that I think people are starting to talk about a little bit more, but it's very difficult for us to understand how entities that are other than human. I mean, the same as with dogs and other animals can have rights on a level as humans. - Well, yeah. We can't and nor should we do whatever we want with animals, we have a USDA, we have Department of Agriculture that deal with animal care and use committees for research, for farming and ranching and all that. So, when you first said it, I thought, wait, why would, there'll be a bill of robotic rights, but it absolutely makes sense in the context of everything we've been talking about

01:40:20 Dogs: Homer & Costello

up until now. If you're willing, I'd love to talk about dogs, because you've mentioned dogs a couple of times, a robot dog, you had a biological dog. Yeah. - Yeah. I had a Newfoundland named Homer for many years growing up. - In Russia or in the U.S.? - In the United States. And he was about, he's over 200 pounds, that's a big dog. - That's a big dog. - People know Newfoundland. So, he's this black dog that's a really a long hair and just a kind soul. I think perhaps that's true for a lot of large, but he thought he was a small dog. So, he moved like that, and- - Was he your dog? - Yeah, yeah. - So, you had him since he was fairly young? - Since the very, very beginning, till the very, very end. And one of the things, I mean, he had this kind of a, we mentioned like the Roombas, he had kind-hearted dumbness about him that was just overwhelming, it's part of the reason I named him Homer, because it's after Homer Simpson, in case people are wondering which Homer I'm referring to. [Andrew laughing] And so, there's a. Yeah, exactly. There's a clumsiness that was just something that immediately led to a deep love for each other. And one of the, I mean, he was always, it's the shared moments, he was always there for so many a nights together, that's a powerful thing about a dog that he was there through all the loneliness, through all the tough times, through the successes and all those kinds of things. And I remember, I mean, that was a really moving moment for me, I still miss him to this day. - How long ago did he die? - Maybe 15 years ago. So, it's been awhile. But it was the first time I've really experienced like the feeling of death. So, what happened, is he got a cancer. And so, he was dying slowly. And then there's a certain point he couldn't get up anymore. Now, there's a lot of things that could say here that I struggle with. Maybe he suffered much longer than he needed to, that's something

I really think about a lot. But I remember when I had to take him to the hospital and the nurses couldn't carry him, right? So, you're talking about a 200 pound dog and I was really into power lifting at the time. And I remember they tried to figure out all these kinds of ways to. So, in order to put them to sleep, they had to take them into a room. And so, I had to carry him everywhere. And here's this dying friend of mine that I just had to, first of all, that was really difficult to carry, somebody that heavy when they're not helping you out. And, yeah. So, I remember it was the first time seeing a friend laying there and seeing life drain from his body. And that realization that we're here for a short time was made so real, that here is friend that was there for me the week before, the day before, and now he's gone. And that was, I don't know, that spoke to the fact that he could be deeply connected with the dog. Also spoke to the fact that the shared moments together that led to that deep friendship will make life so amazing, but it also spoke to the fact that death is a motherfucker. So, I know you've lost Costello recently. - Yeah. - And you can- - And as you're saying this, I'm definitely fighting back the tears. I thank you for sharing that. That I guess we're about to both cry over, I don't want to say dogs [laughing] that it was bound to happen just given when this is happening. Yeah, it's- - How long did you know that Costello was not doing well? - We'll, let's see, a year ago during the start of, about six months into the pandemic, he started getting abscesses and he was not, his behavior change and something really changed. And then I put him on testosterone which helped a lot of things. It certainly didn't cure everything, but it helped a lot of things, he was dealing with joint pain, sleep issues, and then it just became a very slow decline to the point where two, three weeks ago, he had a closet full of medication. I mean, this dog was, it was like a pharmacy. It's amazing to me when I looked at it the other day, I still haven't cleaned up and removed all those things, 'cause I can't quite bring myself to do it, but- - Do you think he was suffering? - Well, so, what happened, was about a week ago, it was really just about a week ago, it's amazing. He was going up the stairs, I saw him slip. And he was a big guy, he wasn't 200 pounds, but he was about 90 pounds, he's a bulldog, he was pretty big and he was fit. And then I noticed that he wasn't carrying a foot in the back like it was injured, it had no feeling at all. He never liked me to touch his hind paws, and I could do, that thing was just flopping there. And then the vet found some spinal degeneration and I was told that the next one would go. Did he suffer? Sure, hope not, but something changed in his eyes. - Yeah. - Yeah, it's the eyes again, I know you and I spend long hours on the phone and tell you about like the eyes and what they convey and what they mean about internal states and for

sake of robots and biology of other kinds, but- - You think something about him was gone in his eyes? - I think he was real, here, I am anthropomorphizing, I think he was realizing that one of his great joys in life, which was to walk and sniff and pee on things. [Lex laughing] This dog. - The fundamental. - Loved to pee on things, it was amazing. I've wondered where he put it, he was like a reservoir of urine, it was incredible. I think, oh, that's Eddie, he'd put like one drop on the 50 millionth plant. And then we get to the 50 millionth in one plant, and he just have, leave a puddle. And here I am talking about Costello peeing. He was losing that ability to stand up and do that, he was falling down while he was doing that. And I do think he started to realize. And the passage was easy and peaceful, but I'll say this, I'm not ashamed to say it, I mean, I wake up every morning since then just, I don't even make the conscious decision to allow my self to cry, I wake up crying. And I'm unfortunately able to make it through the day, thanks to the great support of my friends and you and my family, but I miss him, man. - You miss him? - Yeah, I miss him. And I feel like, Homer, Costello, the relationship to one's dog is so specific part. - So, that part of you is gone? - That's the hard thing. What I think is different, is that I made the mistake, I think. Moreover, I hope it was a good decision, but sometimes I think I made the mistake of I brought Costello a little bit to the world through the podcast or posting about him, I anthropomorphized about him in public. Let's be honest, I have no idea what his mental life was, or his relationship to me. And I'm just exploring all this for the first time 'cause he was my first dog, but I raised him since he was seven weeks. - Yeah, you got hold it together, I noticed the episode you released on Monday, you mentioned Costello. Like you brought them back to life for me for that brief moment. - Yeah. But he's gone. - That's the, he's going to be gone for a lot of people too. - Well, this is what I'm struggling with. I think that maybe you're pretty good at this. Like, have you done this before? [Andrew laughing] This is the challenge. Is that actually part of me. I know how to take care of myself pretty well. - Yeah. - Not perfectly, but pretty well. And I have good support. I do worry a little bit about how it's going to land and how people will feel. I'm concerned about their internalization. So that's something I'm still iterating on. - And you have to watch you struggle, which is fascinating. - Right. And I've mostly been shielding them from this, but what would make me happiest is if people would internalize some of Costello's best traits. And his best traits were that he was incredibly tough. I mean, he was a, 22-inch-neck bulldog, the whole thing. He was just born that way. What was so beautiful is that his toughness has never what he rolled forward. It was just how sweet and kind he was. And so if people can take that, then

there's a win in there someplace, so. - I think there's some ways in which she should probably live on in your podcast too. You should, I mean, it's such a, one of the things I loved about his role in your podcast is that he brought so much joy to you. We mentioned the robots. - Mm-hmm. - Right? I think that's such a powerful thing to bring that joy into, like, allowing yourself to experience that joy, to bring that joy to others, to share it with others. That's really powerful. And I mean, not to, this is like the Russian thing, is [chuckles] it touched me when Lucy Kay had that moment that I keep thinking about in this show "Louie," or like an old man was criticizing Louis for whining about breaking up with his girlfriend, and he was saying like the most beautiful thing about love, they made a song that's catchy now that's now making me feel horrible saying it, but like, is the loss. The loss really also is making you realize how much that person, that dog meant to you. And like allowing yourself to feel that loss and not run away from that loss is really powerful. And in some ways that's also sweet, just like the love was the loss is also sweet because you know that you felt a lot for that through your friend. So I, and like continue to bring that joy. I think it would be amazing to the podcast. I hope to do the same with [laughing] robots, or whatever else is the source of joy, right? And maybe, do you think about one day getting another dog? - Yeah, in time. You're hitting on all the key buttons here. I want that to, we're thinking about ways to kind of immortalize Costello in a way that's real, not just creating some little logo or something silly. Costello much like David Goggins is a person, but Goggins also has grown into kind of a verb. You're going to Goggins this or you're going to, and there's an adjective. Like that's extreme. Like it, I think that for me, Costello was all those things. He was a being, he was his own being, he was a noun, a verb and an adjective. So, and he had this amazing super power that I wish I could get, which is this ability to get everyone else to do things for you without doing a thing. [Lex laughing] The Costello effect, as I call it. - So is an idea I hope he lives on. - Yes. Thank you for that. This actually has been very therapeutic for me, which actually brings me to a question, we're friends, we're not just co-scientists, colleagues working on a project together and in the world, that's somewhat similar.

01:52:41 Friendship

- Just two dogs. - Just two dogs basically. But let's talk about friendship, because I think that I certainly know as a scientist that there are elements that are very lonely of the scientific pursuit. There are elements of many pursuits that are lonely. Music, Math

always seem to me like they're like the loneliest people. Who knows if that's true or not. Also people work in teams. And sometimes people are surrounded by people interacting with people and they feel very lonely. But for me, and I think as well for you, friendship is an incredibly strong force in making one feel like certain things are possible or worth reaching for, maybe even making us compulsively reach for them. So, when you were growing up, you grew up in Russia until what age? - 13. - Okay. And then you moved directly to Philadelphia? - To Chicago. - [Andrew] Chicago. - And then Philadelphia, and San Francisco and Boston and so on. But really to Chicago, that's where I went to high school. - Do you have siblings? - Older brother. - But most people don't know that. [Lex laughing] - Yeah, he is a very different person. But somebody I definitely look up to. So he's a wild man. He's extrovert, he was into, I mean, so he's also scientists, a bio engineer, but he's, when we were growing up, he was the person who did, drank and did every drug. And, but also as the life of the party. And I just thought he was the, when your older brother, five years older, he was the coolest person that I was wanting to be him. So for that, he definitely had a big influence. But I think for me in terms of friendship, growing up, I had one really close friend. And then when I came here I had another close friend, but I'm very, I believe, I don't know if I believe, but I draw a lot of strength from deep connections with other people, and just the small number of people. Just a really small number of people. That's when I moved to this country, I was really surprised how, like, there were these large groups of friends, quote, unquote. But the depth of connection was not there at all from my sort of perspective. Now, I moved to the suburb of Chicago, was Naperville. It's more like a middle class, maybe upper middle class. So it's like people that cared more about material possessions than deep human connection. So that added to the thing. But I drove more meaning than almost anything else was from friendship. Early on I had a best friend. His name was, his name is Yura. I don't know how to say it in English. - How do you say in Russian? - Yura. What's his last name? Do you remember if was... [Lex chuckles] - Mikolov. Yura Mikolov. So we just spent all our time together. There's also a group of friends. Like, I dunno, it's like eight guys. In Russia growing up, it's like parents didn't care if you're coming back at certain hour. So we'll spent all day, all night just playing soccer, usually called football, and just talking about life and all those kinds of things, even at that young age. I think people in Russia and Soviet Union grew up much quicker. [Lex chuckles] I think the education system at the university level is world-class in the United States in terms of like, really creating really big, powerful minds. At least they used to be, but I think that they aspire to

that. But the education system for like, for younger kids in the Soviet Union was incredible. Like they did not treat us as kids. The level of literature, Tolstoy, Dostoevsky. - When you were a small child? - Yeah. - Amazing. Amazing. - And like the level of mathematics, and you're made to feel like shit if you're not good at mathematics. Like we, I think in this country, there's more like, especially young kids 'cause they're so cute. Like they're being babied. We only start to really push adults later in life. Like, so if you want to be the best in the world at this, then you get to be pushed. But we were pushed at a young age. Everybody was pushed. And that brought out the best in people. I think it really forced people to discover, like discover themselves in the Goggin style, but also discover what they're actually passionate about, what they're not. - Is this true for boys and girls? Were they pushed equally there? - Yeah. They were pushed. Yeah, they were pushed equally, I would say. There was a, obviously there was more, not obviously, but at least from my memories, more of a, what's the right way to put it? But there was like gender roles, but not in a negative connotation. It was the red dress versus the suit and tie kind of connotation, which is like, there's a, like guys like lifting heavy things and girls like creating beautiful art, and, like there's- - A more traditional view of gender, more 1950, '60s. - But we didn't think in terms of, at least at that age, in terms of like roles and then like a homemaker or something like that or not, it was more about what people care about. Like girls cared about this set of things, and guys cared about the set of things. I think mathematics and engineering was something that guys cared about and sort of, at least my perception of that time. And then girls cared about beauty. So like guys want to create machines, girls want to create beautiful stuff. [Lex laughing] And now, of course, that I don't take that forward in some kind of philosophy of life, but it's just the way I grew up and the way I remember it. But all, everyone worked hard. The value of hard work was instilled in everybody. And through that, I think it's a little bit of hardship. Of course also economically everybody was poor, especially with the collapse of the Soviet Union. There's poverty everywhere. You didn't notice it as much, but there was a, because there's not much material possessions, there was a huge value placed on human connection. Just meeting with neighbors, everybody knew each other. We lived in an apartment building very different than you have in the United States these days. Everybody knew each other. You would get together,

01:59:47 Russians & Suffering



drink vodka, smoke cigarettes, and play guitar and sing sad songs about life. - What's with the sad songs in the Russian thing? I mean, Russians do I express joy from time to time. - Yeah, they do. - Certainly you do. But what do you think that's about? Is it 'cause it's cold there? But it's called other places too, right? - I think, let's just, first of all the Soviet Union, the echoes of World War II and the millions and millions and millions of people that, civilians that were slaughtered, and also starvation is there, right? So like the echoes of that, of the ideas, the literature, the art is there. Like that's a grandparents, that's parents, that's all there. So that contributes to it, that life can be absurdly unexplainably cruel. At any moment everything can change. So that's in there. Then I think there's an empowering aspect to finding beauty in suffering that then everything else is beautiful too. It's like, if you just linger or it's like, why you meditate on death? Is like, if you just think about the worst possible case and find beauty in that, then everything else is beautiful too. And so you write songs about the dark stuff. And that's somehow helps you deal with whatever comes. There's a hopelessness to the Soviet Union that, like, inflation, all those kinds of things where people were sold dreams and never delivered. And so like, there's a, if you don't sing songs about sad things, you're going to become cynical about this world. - Mm-hmm. Interesting. - So they don't want to give in to cynicism. Now, a lot of people did, one of the, but that is the battle against cynicism. One of the things that may be common in Russia is a kind of cynicism about, like, if I told you the thing I said earlier about dreaming about robots, it's very common for people to dismiss that dream, of saying, no, that's not, that's too wild. Like, who else do you know that did that? Or you want to start a podcast? Like who else? Like nobody's making money on podcasts. Like, why do you want to start a podcast? That kind of mindset I think is quite common, which is why I would say entrepreneurship in Russia is still not very good. Which to be a business, like, to be an entrepreneur you have to dream big, and you have to have others around you, like friends and support group that make you dream big. But if you don't give in to cynicism and appreciate the beauty in the unfairness of life, the absurd unfairness of life, then I think it just makes you appreciative of everything. It's like a, it's a prerequisite for gratitude. And so, yeah, I think that instilled in me ability to appreciate everything, just like everything. Everything's amazing. And then also there is a culture of like romanticizing everything. Like, it's almost like romantic relationships were very like soap opera, like is very like over the top dramatic. And I think that it was instilled in me too, not only do I appreciate everything about life, but I get like emotional about it. In a sense, like, I get like a visceral feeling of joy for everything. And

the same with friends or people of the opposite sex. Like, there's a deep, like emotional connection there that like [laughing] that's like way too dramatic too. Like, I guess relative to what the actual moment is. But I derive so much deep, like dramatic joy from so many things in life. And I think I would attributed that to the upbringing in Russia. But the thing that sticks most of all is the friendship. And have now since then had one other friend like that in the United States, he lives in Chicago. His name is Matt. And slowly here and there accumulating really fascinating people, but I'm very selective with that. Funny enough, the few times, it's not few it's a lot of times now interacting with Joe Rogan [chuckles] it's sounds surreal to say, but there was a kindred spirit there. Like I've connected with him. And there's been people like that also in the grappling sports that are really connected with. I've actually struggled, which is why I'm so glad to be your friend, is I've struggled to connect with scientists. - They can be a little bit wooden sometimes. - [Lex] Yeah. - Even the biologist. I mean, one thing that I, well, I'm so struck by the fact that you work with robots, you're an engineer, AI, science technology, and that all sounds like hardware, right? But what you're describing and I know is true about you is this deep emotional life and this resonance and it's really wonderful. I actually think it's one of the reasons why so many people, scientists and otherwise have gravitated towards you and your podcast is because you hold both elements. In the Hermann Hesse's book, I don't know if you, "Narcissus and Goldmund," right? It's about these elements of the logical rational mind and the emotional mind and how those are woven together. And if people haven't read it, they should, and you embody the full picture. And I think that's so much of what draws people to you. - I've read every Hermann Hesse book by the way. - As usual [chuckles]

02:05:38 Public vs. Private Life

as usual I've done about 9% of what life is. No, it's true. You mentioned Joe, who is a phenomenal human being, not just for his amazing accomplishments, but for how he shows up to the world one on one. I think I heard him say the other day on an interview, he said, there is no public or private version of him. And he's like, this is me. He said that it was beautiful. He said, I'm like the fish that got through the net. And there is no onstage offstage version. And you're absolutely right. And I. - Fish. [Lex laughing] - So, but, well, you guys, I have a question actually about- - But that's a really good point about public and private life. He was a huge, if I could just comment real quick. Like that,

he was a, I've been a fan of Joe for a long time, but he's been an inspiration to not have any difference between public and private life. I actually had a conversation with Naval about this, and he said that you can't have a rich life, like exciting life if you're the same person publicly and privately. And I think I understand that idea, but I don't agree with it. I think that's really fulfilling and exciting to be the same person privately and publicly with very few exceptions. Now that said, I don't have any really strange sex kinks. So like, I feel like it can be open with basically everything. I don't have anything I'm ashamed of. There's some things that could be perceived poorly, like the screaming Roombas, but I'm not ashamed of them. I just have to present them in the right context. But there's a freedom to being the same person in private as in public. And that Joe made me realize that you can be that. And also to be kind to others. It sounds kind of absurd, but I really always enjoyed like being good to others. Like just being kind towards others. But I always felt like the world didn't want me to be. Like, there's so much negativity when I was growing up, like just around people. If you actually just notice how people talk, they, from like, complaining about the weather, this could be just like the big cities that I've visited. But there's a general negativity, and positivity is kind of suppressed. You're not, one, you're not seen as very intelligent, and two, there's a kind of, you're seen as like a little bit of a weirdo. And so I always felt like I had to hide that. And what Joe made me realize, one, I could be fully just the same person private and public, and two, I can embrace being kind, in just, in the way that I like, in the way I know how to do. And sort of for me on like, on Twitter or like publicly, whenever I say stuff, that means saying stuff simply almost to the point of cliché. And like, I have the strength now to say it, even if I'm being mocked. [Lex laughing] You know what I mean? Like, just it's okay. If everything's going to be okay. Okay, some people will think you're dumb. They're probably right. The point is, like, just enjoy being yourself. And that Joe, more than almost anybody else, because he's so successful at it, inspired me to do that. Be kind and be the same person, private and public. - I love it. And I love the idea that authenticity doesn't have to be oversharing, right? That it doesn't mean you reveal every detail of your life. It's a way of being true to an essence of oneself. - Right. There's never a feeling when you deeply think and introspect that you're hiding something from the world or you're being dishonest in some fundamental way. So, yeah, that's truly liberating. It allows you to think, it allows you to like think freely, to speak freely, to just to be freely. That said, it's not like there's not still a responsibility to be the best version of yourself. So, I'm very careful with the way I say something. So, the whole point, it's not so simple to express

the spirit that's inside you with words. I mean, some people are much better than others. I struggle. Like oftentimes when I say something and I hear myself say it, it sounds really dumb and not at all what I meant. So that's the responsibility you have. It's not just like being the same person publicly and privately means you can just say whatever the hell. It means there's still responsibility to try to be, to express who you truly are. And that's hard. [Lex chuckles] - It hard. And I think that, we have this pressure, all people, when I say we, I mean all humans, and maybe robots too, feel this pressure to be able to express ourselves in that one moment in that one form. And it is beautiful when somebody, for instance, can capture some essence of love or sadness or anger or something in a song or in a poem or in a short quote, but perhaps it's also possible to do it in aggregate, all the things how you show up. For instance, one of the things that initially drew me to want to get to know you as a human being and a scientist and eventually we became friends, was the level of respect that you brought to your podcast listeners by wearing a suit. - Yeah. - I'm being serious here. I was raised thinking that if you overdress a little bit, overdressed by American, certainly by American standards, you're overdressed for a podcast, but it's genuine. You're not doing it for any reason, except I have to assume, and I assumed at the time, that it was because you have a respect for your audience, you respect them enough to show up a certain way for them. It's for you also, but it's for them. - Yeah. - And I think between that and your commitment to your friendship, just the way that you talk about friendships and love and the way you hold up these higher ideals, I think at least as a consumer of your content and as your friend, what I find, is that in aggregate, you're communicating who you are, it doesn't have to be one quote or something. And I think that we're sort of obsessed by like the one Einstein quote, or the one line of poetry or something, but I think you so embody the way that, and Joe as well, it's about how you live your life and how you show up as a collection of things and said and done. - Yeah, that that's, and so, the aggregate is the goal, the tricky thing, and Jordan Peterson talks about this because he's under attack way more than you and I will ever be, but- - Right now? - For now, right? This is very true for now. That the people who attack on the internet, this is one of the problems with Twitter, is they don't consider the aggregate, they take a single statements. And so, one of the defense mechanisms, like again why Joe has been an inspiration, is that when you in aggregate, a good person, a lot of people will know that. And so, that makes you much more immune to the attacks of people that bring out an individual statement that might be a misstatement of some kind, or doesn't express who

you are. And so, that, I like that idea is the aggregate. And the power of the podcast, is you have hundreds of hours out there, and being yourself and people get to know who you are. And once they do, and you post pictures of screaming Roombas as you kick them, they will understand that you don't mean well. By the way, as a side comment, I don't know if I want to release this because it's not just the Roombas- - You have a whole dungeon of robots. - Okay. So, this is a problem, the Boston Dynamics came up against this problem.

#### 02:14:04 How To Treat a Robot

But, let me work this out like workshop this out with you, and maybe because we'll post this, people will let me know. So, there's legged robots, they look like a dog, I'm trying to create a very real human-robot connection, but like they're also incredible because you can throw them like off of a building and they'll land fine. And this beautiful. - That's amazing. I've seen the Instagram videos of like cats jumping off of like fifth story buildings and then walking away. But no one should throw their cat out of a window of a building. - Well, this is the problem I'm experiencing, all certainly kicking the robots, its really fascinating how they recover from those kicks. But like just seeing myself do it and also seeing others do it, it just does not look good, and I don't know what to do with that. 'Cause it's such a- - Ill 'do it. [Lex laughing] - See. But you don't, 'cause you are- - A robot, no, I'm kidding. What's interesting? - Yeah. - Before today's conversation, I probably could do it, and I'm thinking about robots, bills of rights and things. Not to satisfy you or to satisfy anything, except that if they have some sentience aspect to their being, then I would load to kick it. - I don't think we'd be able to kick it, you might be able to kick the first time, but not the second, this is the problem of experience. One of the cool things, is one of the robots I'm working with, you can pick it up by one leg and is dangling, and you can throw it in any kind of way and it'll land correctly. So, it's really- - I had a friend who had a cat like that. [Lex laughing] - Oh man, we look forward to the letters on the cat- - Oh no, I'm not suggesting anyone did that, but he had this cat, and the cat, he would just throw it onto the bed from across the room, and then it would run back for more, or somehow that was the nature of the relationship. I think no one should do that to an animal, but this cat seemed to return for whatever reason. - But a robot is a robot, and it's fascinating to me how hard it is for me to do that. So, it's unfortunate, but I don't think I can do that to a robot. Like I struggle with that. So, for me to be able to do

that with a robot, I have to almost get like into the state that I imagine like doctors get into when they're doing surgery, like I have to do what robotics colleagues of mine do, which is like start seeing it as an object. - Dissociate. - Like dissociate. So, it was just fascinating that I have to do that in to do that with a robot. I just want to take that little bit of a tangent. - No, I think it's an important thing. I mean, I'm not shy about the fact that for many years I've worked on experimental animals, and that's been a very challenging aspect of being a biologist. Mostly mice, but in the past no longer, thank goodness 'cause I just don't like doing it, larger animals as well. And now I work on humans, which I can give consent, verbal consent. So, I think that it's extremely important to have an understanding of what the guidelines are and where one's own boundaries are around this. It's not just an important question,

#### 02:17:12 The Value of Friendship

it might be the most important question before any work can progress. - So, you asked me about friendship. I know you have a lot of thoughts about friendship, what do you think is the value of friendship in life? - Well, for me personally, just because of my life trajectory and arc friendship, and I should say, I do have some female friends that are just friends, they're completely platonic relationships, but it's been mostly male friendship to me, has been- - It has been all male friendships to me actually, yeah. - Interesting. - Yeah. - It's been an absolute lifeline. They are my family, I have a biological family and I have great respect and love for them and an appreciation for them, but it's provided me the, I won't even say confidence because there's always an anxiety in taking any good risk, or any risk worth taking. It's given me the sense that I should go for certain things and try certain things to take risk to weather that anxiety. And I don't consider myself a particularly competitive person, but I would sooner die than disappoint, or let down one of my friends. I can think of nothing worse actually, than disappointing one of my friends, everything else is secondary to me. - What disappointment? - Disappoint, meaning not, I mean, certainly I strive always to show up as best I can for the friendship, and that can be in small ways. That can mean making sure the phone is away, sometimes it's about, I'm terrible with punctuality 'cause I'm an academic. And so, I just get lost in time and I don't mean anything, but it's striving to, to listen to, to enjoy good times and to make time. It kind of goes back to this first variable we talked about, to make sure that I spend time and to get time in person and check in. And I think there's so many ways in which

friendship is vital to me, it's it's actually to me, what makes life worth living. - Yeah. Well, there's a, I am surprised like with the high school friends how we don't actually talk that often these days in terms of time, but every time we see each other, it's immediately right back to where we started. So, I struggled that how much time you really allocate, for the friendship to be deeply meaningful because they're always there with me even if we don't talk often. So, there's a kind of loyalty. I think maybe it's a different style, but I think to me, friendship is being there in the hard times, I think. Like I'm much more reliable when you're going through shit than in like- - You're pretty reliable anyway. - No, but if you're like a wedding or something like that, or like, I don't know, like you want an award of some kind, yeah, I'll congratulate the shit out of you, but like that's not, and I'll be there, but that's not as important to me as being there when like nobody else is like just being there when shit hits the fan, or something's tough where the world turns their back on you, all those kinds of things, that, to me, that's where friendship is meaningful.

02:20:33 Martial Arts

- Well, I know that to be true about you and that's a felt thing and a real thing with you. Let me ask one more thing about that actually, because I'm not a practitioner Jujitsu, I know you are, Joe is, but years ago, I read a book that I really enjoyed, which is Sam Sheridan's book, " A Fighter's Heart," he talks about all these different forms of martial arts. And maybe it was in the book, maybe it was in an interview, but he said that fighting, or being in physical battle with somebody, Jujitsu boxing or some other form of direct physical contact between two individuals creates this bond unlike any other. Because he said it's like a one night stand, you're sharing bodily fluids with somebody that you barely know. - Yeah. - And I chuckled about it 'cause it's kind of funny and it kind of tongue in cheek. But at the same time, I think this is a fundamental way in which members of a species bond is through physical contact. And certainly, there are other forms, there's cuddling, and there's hand holding, and there's in their sexual intercourse, and there's all sorts of things. - What's cuddling? I haven't heard of it. - I heard this recently, I didn't know this term, but there's a term, they've turned the noun cupcake into a verb, cupcaking it turns out, I just learned about this. Cupcaking is when you spend time just cuddling. I didn't know about this. You heard it here first, although I heard it first just the other day. Cupcaking is actually a- - Cuddling is everything, it's not just like, is it in bed, or is it in the coach? Like what's cuddling? I do look up what cuddling is- - We

need to look at this up and we need to define the variables. I think it definitely has to do with physical contact, I'm told, but in terms of battle, a competition, and the Sheridan quote, I'm just curious. So, do you get close, or feel a bond with people that, for instance, you rolled Jujitsu with, or even though you don't know anything else about them, was he right about this? - Yeah, I mean on many levels. He also has the book, what? "A Fighter's Mind." - Yeah, that was the third one. He's actually an excellent writer. What's interesting about him, just briefly about Sheridan, I don't know him, but I did a little bit of research, he went to Harvard, he was an art major at Harvard, he claims all he did was smoke cigarettes and do art. I don't know if his art was any good. And I think his father was in the SEAL teams. And then when he got out of Harvard, graduated, he took off around the world learning all the forms of martial arts, and was early to the kind of ultimate fighting kind of mixed martial arts and things. Great book. Yeah, yeah. - It's amazing. I don't actually remember it, but I read it, and I remember thinking that was an amazing encapsulation of what makes fighting like the art, like what makes it compelling. I would say that there's so many ways that Jujitsu grappling, wrestling, combat sports in general, is like one of the most intimate things you could do. I don't know if I would describe in terms of bodily liquids and all those kinds of things. - I think he was more or less joking. - I think there's a few ways that it does that. So, one, because you're so vulnerable [sighs] So, the honesty of stepping on the mat and often all of us have ego thinking we're better than we are at this particular art. And then the honesty of being submitted, or being worse than you thought you are and just sitting with that knowledge, that kind of honesty, we don't get to experience it in most of daily life. We can continue living somewhat of an illusion of our conceptions of ourselves 'cause people are not going to hit us with the reality, the mat speaks only the truth, the reality just hits you. And that vulnerability is the same as like the loss of a loved one, though it's the loss of a reality that you knew before, you now have to deal with this new reality. And when you're sitting there in that vulnerability, and there's these other people that are also sitting in that vulnerability, you get to really connect like, fuck, like I'm not as special as I thought I was, and life is like not, life is harsher than I thought I was, and we're just sitting there with that reality, some of us can put words to them, some we can't. So, I think that definitely, is a thing that at least the intimacy. The other thing is the human contact. There's something about, I mean, like a big hug, like during COVID, very few people hugged me and I hugged them, and I always felt good when they did. Like we were all tested, and especially now we're vaccinated, but there's still people, this is true of San



Francisco's, it's true in Boston, they want to keep, not only six feet away, but stay at home and never touch you. That loss of basic humanity is the opposite of what I feel in Jujitsu, where it was like that contact where you're like, I don't give a shit about whatever rules we're supposed to have in society where you have to keep a distance and all that kind of stuff. Just the hug, like the intimacy of a hug, that's like a good bear hug, and you're like just controlling another person, and also there is some kind of love communicated through just trying to break each other's arms. I don't exactly understand why violence is the such a close neighbor to love, but it is. - Well, in the hypothalamus, the neurons that control sexual behavior, but also non-sexual contact, are not just nearby the neurons that control aggression and fighting, they are salt and pepper with those neurons. It's a very interesting, and it almost sounds kind of risky and controversial and stuff, I'm not anthropomorphizing about what this means, but in the brain, those structures are interdigitated, you can't separate them except at a very fine level. And here, the way you describe it, is the same as a real thing. - I do want to make an interesting comment. Again, these are the things that could be taken out of context, but one of the amazing things about Jujitsu, is both guys and girls train it. And I was surprised. So, like I'm a big fan of yoga pants [giggles] at the gym kind of thing. It reveals the beauty of the female form. But the thing is, like girls are dressed in skintight clothes in Jujitsu often. And I found myself not at all, thinking like that at all when training with girls. - Well, the context is very non-sexual. - But I was surprised to learn that. When I first started to Jujitsu, I thought, wouldn't that be kind of weird to train with the opposites that in something so intimate. - So, boys and girls, men and women, they roll Jujitsu together? - Completely. - Interesting. - And the only times girls kind of try to stay away from guys, I mean, there's two contexts, of course, there's always going to be creeps in this world. So, everyone knows who kind of stay away from, and the other is there's a size disparity. So, girls will often try to roll with people a little bit closer weight-wise, But no, that's one of the things that are empowering to women, that's what they fall in love with when they started doing Jujitsu, is first of all, they gain an awareness and a pride over their body, which is great. And then second, they get to [chuckles] especially later on, start submitting big dudes like these bros that come in who are all shredded and like muscular, and they get to technique to exercise dominance over them, and that's a powerful feeling. - You've seen women force a larger guy to tap her, or even choke them up. - Well, I was deadlifting like a four, oh boy, I think it's 495. So, I was really into power-lifting when I started at Jujitsu, and I remember being submitted by, I thought I

walked in feeling like I'm going to be, if not the greatest fighter ever, at least top three. And so, as a white belt, you roll in like all happy. And then you realize that as long as you're not applying too much force, that you're having, I remember being submitted many times by like 130, 120-pound girls at our Balance Studios in Philadelphia, that a lot of incredible female Jujitsu players. And that's really humbling too that technique can overpower in combat pure strength. And that's the other thing, there is something about combat that's primal. Like there, it just feels, it feels like we were born to do this. Like that- - We have circuits in our brain that are dedicated to this kind of interaction. There's no question. - And that's what it felt like, it wasn't that I'm learning a new skill. It was like, somehow I am remembering echoes of something I've learned in the past. - Well, it's like hitting puberty. A child before puberty has no concept of boys and girls having this attraction, regardless of whether or not they're attracted to boys or girl, doesn't matter. At some point, most people, not all, but certainly, but most people, when they hit puberty, suddenly people appear differently, and certain people take on a romantic or sexual interest for the very first time. - Yeah. - And so it's like, it's revealing a circuitry in the brain. It's not like they learn that it's innate. And I think it, when I hear the way you describe Jujitsu and enrolling Jujitsu, it reminds me a little bit, Joe was telling me recently about the first time he went hunting and he felt like it revealed a circuit that was in him all along, but he hadn't experienced before. - Yeah. That's definitely there. And of course, there's the physical activity. One of the interesting things about Jujitsu is it's one of the really strenuous exercises that you can do late into your adult life, like into your 50, 60, 70s, 80s. When I came up, there's a few people in their 80s that were training. And as long as you're smart, as long as you practice techniques and pick your partners correctly, you can do that kind of art. That's late into life. And so you're getting exercise. There's not many activities I find that are amenable to that. So, because it's such a thinking game, the Jujitsu in particular is an art or technique pays off a lot. So you can still maintain, first of all, remain injury free if you use good technique, and also through good technique be able to go, be active with people that are much, much younger. And so that was, to me,

02:31:34 Body-Mind Interactions

that and running are the two activities you can kind of do late in life. Because to me a healthy life has exercises as the piece of the puzzle. - No, absolutely. And I'm glad that

we're on the physical component, because I know that there's for you, you've talked before about the crossover between the physical and the intellectual and the mental. Are you still running at ridiculous hours of the night for ridiculously long? - Yeah, so, definitely. I've been running late at night here in Austin. People tell, the area we're in now, people say it's a dangerous area, which I find laughable coming from the bigger cities. No, I run late at night. There's something. - If you see a guy running through Austin at 2:00 a.m. in a suit and tie, it's probably. [Lex laughing] - Well, yeah. I mean, I do think about that 'cause I get recognized more and more in Austin. I worry that, but not really, that I get recognized late at night. But there is something about the night that brings out those deep philosophical thoughts and self-reflection, that really enjoy. But recently I started getting back to the grind. So I'm going to be competing or hoping to be compete in September and October. - In Jujitsu? - In Jujitsu, yeah. To get back to competition. And so that requires getting back into a great cardio shape. I've been getting, running as part of my daily routine. - Got it. - [Lex] Yeah. - Well, I always know I can reach you regardless of time zone in the middle of the night, wherever that happens. - Well, part of that has to be just being single and being a programmer. Those two things just don't work well in terms of a steady sleep schedule.

#### 02:33:22 Romantic Love

- It's not bankers hours kind of work. Nine to five. I want to, you mentioned single. I want to ask you a little bit about the other form of relationship, which is romantic love. So, your parents are still married? - Still married, still happily married. - That's impressive. - [Lex] Yeah. - A rare thing nowadays. - [Lex] Yeah. - So you grew up with that example? - Yeah. I guess that's a powerful thing, right? If there's an example that I think can work. - Yeah. I didn't have that in my own family, but when I see it, it's inspiring and it's beautiful. The fact that they have that, and that was the norm for you, I think is really wonderful. - Well, it was a, in the case of my parents it was interesting to watch 'cause there's obviously tension. Like, there'll be times where they fought and all those kinds of things. They obviously get frustrated with each other and they like, but they find mechanisms how to communicate that to each other, like to make fun of each other a little bit, like to tease, to get some of that frustration out, and then ultimately to reunite and find their joyful moments and be that the energy. I think it's clear 'cause I got together in there I think early 20s, like very, very young. I think you grow together as people. - Yeah. You're

still in the critical period of brain plasticity. [laughing] - And also, I mean, it's just like divorce was so frowned upon that you stick it out. And I think a lot of couples especially from that time, the Soviet Union, that's probably applies to a lot of cultures. You stick it out and you put in the work, you learn how to put in the work. And once you do, you start to get to some of those rewarding aspects of being, like through time has sharing so many moments together. That's definitely something that was an inspiration to me, but maybe that's where I have. So I have a similar kind of longing to have a lifelong partner, like to have that kind of view, where same with friendship, lifelong friendship is the most meaningful kind. That there is something with that time of sharing all that time together. Like till death do us part is a powerful thing. Not by force, not because of the religion said it or the government said it or your culture said it, but because you want to. - Do you want children? - Definitely, yeah. Definitely want children. It's- - How many Roombas do you have? - Oh, I thought- - You should, no, no- - Human children? - No, human to human children. - 'Cause I already have the children. - Exactly. What I was saying, you probably need to at least as many human children as you do Roombas. Big family, small family. - So. - In your mind's eyes, they're a bunch of Fridman's running around. - So I'll tell you, like realistically, I can explain exactly my thinking, and this is similar to the robotics work is, if I'm like purely logical right now, my answer would be I don't want kids. Because I just don't have enough time. I have so much going on. But when I'm using the same kind of vision I use for the robots is I know my life will be transformed with the first. Like I know I would love being a father. And so the question of how many, that's on the other side of that hill. It could be some ridiculous number. So I just know that- - I have a feeling and I could be, I don't have a crystal ball, but I don't know. I see an upwards of, certainly three or more come comes to mind. - So much of that has to do with the partner you're with too. So like that, that's such an open question, especially in this society of what the right partnership is. 'Cause I'm deeply empathetic. I want to see, like to me, what I look for in your relationship is for me to be really excited about the passions of another person, like whatever they're into, it doesn't have to be a career success. Any kind of success, just to be excited for them, and for them to be excited for me. And like share in that excitement and build, and build and build. But there was also practical aspects of like, what kind of shit do you enjoy doing together? And I think family is a real serious undertaking. - It certainly is. I mean, I think that I have a friend who said it, I think best, which is that you first have, he's in a very successful relationship and has a family. And he said, you first have to define the role and then you have to cast the right person

for the role. [Lex laughing] - Well, yeah, there's some deep aspects of that, but there's also an aspect to which you're not smart enough from this side of it to define the role. I think there's part of it that has to be a leap that you have to take. And I see having kids that way. You just have to go with it and figure it out also. As long as there's love there, like what the hell is life for even? So I've, there's so many incredibly successful people that I know that I've gotten to know that all have kids. And the presence of kids for the most part has only been something that energizes them, something they gave them meaning, something that made them the best version of themselves, like made them more productive, not less, which is fascinating to me. - It is fascinating. I mean, you can imagine if the way that you felt about Homer, the way that I feel and felt about Costello is at all a glimpse of what that must be like then. - Exactly. The downside, the thing I worry more about is the partner side of that. I've seen, the kids are almost universally a source of increased productivity and joy and happiness. Like, yeah, they're a pain in the ass. Yeah, is complicated. Yeah, so and so forth, people like to complain about kids. But then when you actually look past that little shallow layer of complaint, kids are great. The source of pain for a lot of people is if when the relationship doesn't work. And so I'm very kind of concerned about like, dating is very difficult, and I'm a complicated person. And so it's been very difficult to find the right kind of person. But that statement doesn't even make sense because I'm not on dating apps, I don't see people. You're like the first person I saw in awhile. It's like you and Michael Malice and like Joe. So, like, I don't think I've seen like a female. What is it? An element of the female species in quite a while. So, I think you have to put yourself out there. What is it? Daniel Johnston says, true love will find you, but only if you're looking. So there's some element of really taking the leap and putting yourself out there in kind of different situations. And I don't know how to do that when you're behind a computer all the time. - Well, you're a builder and you're a problem solver, and you find solutions, and I'm confident the solution is out there, and. - I think you're implying that I'm going to build the girlfriend, which I think. - Well, and maybe we shouldn't separate this friendship, the notion of friendship and community, and if we go back to this concept of the aggregate, maybe you'll meet this woman through a friend, or maybe you'll or something of that sort. - So, one of the things, I dunno if you feel the same way, I definitely one of those people that just falls in love and that's it. - Yeah, I can't say I'm like that. With Costello it was instantaneous. - Yeah. - It really was. I mean, I know it's not romantic love, but it was instantaneous. No, I, but that's me. And I think that if you know, you know, because that's a good thing that you have there. - It's, I'm

very careful with that, because you don't want to fall in love with the wrong person. So I try to be very kind of careful with, I've noticed this because I fall in love with every, like this mug, everything I fall in love with things in this world. So, like, you have to be really careful because a girl comes up to you and says she loves DUSTY HUSKY, that doesn't necessarily mean to marry her tonight. - Yes. And I like the way you said that out loud so that you heard it, you doesn't mean you need to marry her tonight, right? - [Lex] Exactly. - [Andrew] Right. - But I mean, but people are amazing, and people are beautiful and that's, so I'm fully embraced that, but also you have to be careful with relationships. And at the same time, like I mentioned to you offline, I don't, there's something about me that appreciates swinging for the fences and not dating, like doing serial dating, or dating around. - Like you're a one guy, one girl kind of guy. - [Lex] Yeah. - And you said that. - And it's tricky because you want to be careful with that kind of stuff. Especially now there's a growing platform that have a ridiculous amount of female interests of a certain kind. But I'm looking for deep connection, and I'm looking by sending home alone, and every once in a while talking to Stanford professors. - Perfect solution. - On a podcast. - Perfect solution. - Is going to workout great. - It's well, it's part of,

02:42:51 The Lex Fridman Podcast

that constitutes machine learning of sorts. - Yeah, of sorts. - I do, you mentioned what has now become a quite extensive and expansive public platform, which is incredible. I mean, the number of people out, first time I saw your podcast, I noticed the suit, I was like, he respects his audience, which was great, but I also thought this is amazing. People are showing up for science and engineering and technology information and those discussions and other sorts of discussions. Now, I do want to talk for a moment about the podcast. So my two questions about the podcast are, when you started it, did you have a plan? And regardless of what that answer is, do you know where you're taking it, or would you like to leave us? I do believe in an element of surprise is always fun. But what about the podcast? Do you enjoy the podcast? I mean, your audience certainly includes me, really enjoys the podcast. It's incredible. - So I love talking to people, and there's something about microphones that really bring out the best in people. Like you don't get a chance to talk like this. If you and I were just hanging out, we would have a very different conversation in the amount of focus we allocate to each other. We would be having fun talking about other stuff and doing other things. There'll

be a lot of distraction. There would be some phone use and all that kind of stuff. But here we're 100% focused on each other and focus on the idea. And like sometimes playing with ideas that we both don't know the answer to, like a question we don't know the answer to. We're both like fumbling with it, trying to figure out, trying to get some insights at something we haven't really figured out before and together arriving at that. I think that's magical. I don't know why we need microphones for that, but we somehow do. - It feels like doing science. - It feels like doing science for me, definitely. That's exactly it. And I'm really glad you said that because I don't actually often say this, but that's exactly what I felt like. I wanted to talk to friends and colleagues at MIT to do real science together. That's how I felt about it. Like to really talk through problems that are actually interesting, as opposed to like incremental work that we're currently working for for a particular conference. So really asking questions like, what are we doing? Like, where's this headed to? Like, what are the big, is this really going to help us solve, in the case of AI, solve intelligence? Like, is this even working on intelligence? There's a certain sense, which is why I initially called it artificial intelligence. Is like most of us are not working on artificial intelligence. You're working on some very specific problem and a set of techniques, at the time it's machine learning to solve this particular problem. This is not going to take us to a system that is anywhere close to the generalizability of the human mind. Like the kind of stuff the human mind can do in terms of memory, in terms of cognition, in terms of reasoning, common sense reasoning. This doesn't seem to take us there. So the initial impulse was, can I talk to these folks do science together through conversation? And I also thought that there was not enough, I didn't think there was enough good conversations with world-class minds that I got to meet. And not the ones with the book, or like this was just the thing. Oftentimes you go on this tour when you have a book, but there's a lot of minds that don't write books. - And the books constrain the conversation too, when you're talking about this thing, this book. - But there's, I've noticed that, with people that haven't written a book who are brilliant, we get to talk about ideas in a new way. We both haven't actually, when we raise a question, we don't know the answer to it once the question is raised. And we try to arrive there. Like, I dunno, I remember asking questions of world-class researchers in deep learning of, why do neural networks work as well as they do? That question is often loosely asked, but like when you have microphones and you have to think through it, and you have 30 minutes to an hour to think through it together, I think that's science. I think that's really powerful. So that was the one goal. The other one is, again, don't usually talk about this, but

there's some sense in which I wanted to have dangerous conversations. Part of the reasons I wanted to wear a suit is like, I want it to be fearless. The reason I don't usually talk about it is because I feel like I'm not good at conversation. So it looks like it doesn't match the current skill level. But I wanted to have really dangerous conversations that I uniquely would be able to do. Not completely uniquely, but like, I'm a huge fan of Joe Rogan, and I had to ask myself, what conversations can I do that Joe Rogan can't? For me, I know I bring this up, but for me that person I thought about at the time was Putin. Like that's why I bring him up. He's just like with Costello, he's not just a person. He's also an idea to me for what I strive for. Just to have those dangerous conversations. And the reason I'm uniquely qualified as both the Russian, but also there's the judo and the martial arts, there's a lot of elements that make me have a conversation he hasn't had before. And there's a few other people that I kept in mind, like Don Knuth, is a computer scientist from Stanford that I thought is one of the most beautiful minds ever. And nobody really talked to him, like really talked to him. He did a few lectures, which people love, but really just have a conversation with him. There's a few people like that. One of them passed away, John Conway, that I never got, we agreed to talk, but he died before we did. There's a few people like that, that I thought like it's such a crime to not hear those folks. And I have the unique ability to know how to purchase a microphone on Amazon and plug it into a device that records audio and then publish it, which seems relatively unique. Like that's not easy in the scientific community. People knowing how to plug in a microphone. - No. They can build Faraday cages, and two-photon microscopes and bioengineer, all sorts of things, but the idea that you could take ideas and export them into a structure or a pseudo structure that people would benefit from seems like a cosmic achievement to them. - I don't know if it's fear or just a basically they haven't tried it, so they haven't learned the skill level. - But I think they're not trained. I mean, we could riff on this for awhile, but I think that, but it's important. And maybe we should, which is that it's, they're not trained to do it. They're trained to think in specific games and specific hypotheses, and many of them don't care to, right? They became scientists because that's where they felt safe, and so why would they leave that Haven of safety? - Well, they also don't necessarily always see the value in it. We're all together learning, you and I are learning the value of this. I think you're probably having an exceptionally successful and amazing podcast that you started just recently. - Thanks to your encouragement. - Well, but there's a raw skill there that's, you're definitely an inspiration to me in how you did the podcast in the level of excellence you reach. But I think you've



discovered that that's also an impactful way to do science. That podcast. And I think a lot of scientists have not yet discovered that. That this is a, if they apply same kind of rigor as they do to academic publication or to even conference presentations, and they do that rigor and effort to podcast, whatever that is, that could be a five-minute podcast, a two-hour podcasts, it could be conversational, or it can be more like lecture like, if they apply that effort, you have the potential to reach over time, tens of thousands, hundreds of thousands, millions of people. And that's really, really powerful. But yeah, for me giving a platform to a few of those folks, especially for me personally, so maybe you can speak to what fields you're drawn to, but I thought computer scientists were especially bad at this. So there's brilliant computer scientists that I thought it would be amazing to explore their mind, explore their thinking. And so that I took that almost as an, on as an effort. And at the same time I had other guests in mind, or people that connect to my own interests. So the wrestling. Wrestling, music, football, both American football and soccer. I have a few particular people that I'm really interested in. Buvaisar Saitiev. The Saitiev brothers, even Khabib for wrestling, just to talk to them, 'cause. - Oh, 'cause you can, you guys can communicate- - In Russian and in wrestling, right? As wrestlers and as Russians. And so that little, it's like an opportunity to explore a mind that I'm able to bring to the world. And also it, I feel like it makes me a better person, just that being that vulnerable and exploring ideas together. I don't know, like good conversation. I don't know how often you have really good conversation with friends, but like podcasts are like that. And it's deeply moving. - It's the best. And what you brought through. I mean, when I saw you sit down with Penrose, Nobel Prize winning physicist, and these other folks that, it's not just 'cause he has a Nobel, it's what comes out of his mouth is incredible. And what you were able to hold in that conversation was so much better, light years beyond what he had any other interviewer, I don't want to even call you an interviewer 'cause it's really about conversation. Light years beyond what anyone else had been able to engage with him was such a beacon of what's possible. And I know that, I think that's what people are drawn to. And there's a certain intimacy, that certainly to people, our friends, as we are, and they know each other, that there's more of that, but there's an intimacy in those kinds of private conversations that are made public. And. - Well, that's the, with you, you're probably starting to realize, and Costello, is like, part of it, because you're authentic and you're putting yourself out there completely, people are almost not just consuming the words you're saying, they also enjoy watching you, Andrew, struggle with these ideas or try to communicate these ideas. They like the

flaws, they like a human being. - Oh, good, that flaws. - Well, that's good 'cause I got plenty of those. - But they like the self-critical aspects, like where you're very careful, where you're very self-critical about your flaws. I mean, in that same way, it's interesting I think for people to watch me talk to Penrose, not just because Penrose is communicating ideas, but here's this like silly kid trying to explore ideas. Like they know this kid. There's a human connection that is really powerful. Same, I think with Putin, right? Like it's not just as a good interview with Putin, it's also, here's this kid struggling to talk with one of the most powerful, some will argue dangerous people in the world. They love that. The authenticity that led up to that. And in return, I get to connect, everybody I run to in the street and all those kinds of things, there's a depth of connection there, almost within like a minute or two that's unlike any other. - Yeah, there's an intimacy that you've formed with with them. - Yeah, we've been on this like journey together. And yeah, I have the same thing with Joe Rogan before I ever met him, right? Like I was, because I was a fan of Joe for so many years, there's something, there's a kind of friendship as absurd as it might be to say in podcasting and listening to podcasts. - Yeah. Maybe it fills in a little bit of that or solves a little bit of that loneliness that you've been talking about earlier.

02:55:54 The Hedgehog

- Until the robots are here. [laughing] - I have just a couple more questions, but one of them is on behalf of your audience, which is, I'm not going to ask you the meaning of the hedgehog, but I just want to know, does it have a name? And you don't have to tell us the name, but just, does it have a name? Yes or no? - Well, there's a name he likes to be referred to as, and then there's a private name in the privacy of his own company that we call each other. No. [Lex laughing] I'm not that insane. No, his name is Hedgy. He's a hedgehog. I don't like stuffed animals. But his story is one of minimalism. So I gave away everything I own, now three times in my life. By everything I mean almost everything, kept jeans and shirt and a laptop. And recently it's also been guitar, things like that. But he survived because he was always in, at least in the first two times was in the laptop bag, and he just got lucky. And so I just liked the perseverance of that. And I first saw him in the, the reason I got a stuffed animal, I don't have other stuffed animals, is it was in a thrift store, in this like giant pile of stuffed animals and he jumped out at me, because unlike all the rest of them, he has this intense mean look about him. That he's

just, he's upset at life, at the cruelty of life. And it's just, especially in the contrast of the other stuffed animals, they have this dumb smile on their face. If you look at most stuffed animals, they have this dumb look on their face. They're just happy. Is like "Pleasantville." - It's what we say in neuroscience, they have a smooth cortex, not many form. - Exactly. And this, like Hedgy like saw through all of it. He was like Dusty'sky's man from underground. I mean, there's a sense that he saw the darkness of the world and persevered. So like, and there's also a famous Russian cartoon, "Hedgehog in the Fog" that I grew up with, I connected with. [Lex laughing] People who know of that cartoon, you could see it on YouTube, it's. - "Hedgehog in the Fog." - Yeah. [Lex laughing] It's just, as you would expect, especially from like early Soviet cartoons. It's a hedgehog, like sad, walking through the fog, exploring like loneliness and sadness. It's like, but it's beautiful. It's like a piece of art, people should, even if you don't speak Russian, you'll see, you'll understand. - Oh, the moment you said that I was going to ask, so it's in Russian? But of course it's in- - It's in Russian, but it's more, it's very little speaking in it. It's almost a, there's an interesting exploration of how you make sense of the world when you see it only vaguely through the fog. So he's trying to understand the world. - We have Mickey Mouse, we have Bugs Bunny. We have all these crazy animals, and you have the "Hedgehog in the Fog." - So there's a certain period, and this is again, I don't know what it's attributed to, but it was really powerful, which there's a period in Soviet history, I think probably '70s and '80s where like, especially kids were treated very seriously. Like they were treated like they're able to deal with the weightiness of life. And that was reflected in the cartoons. And there was, it was allowed to have like really artistic content, not like dumb cartoons that are trying to get you to like smile and run around, but like create art. Like stuff that, you know how like short cartoons or short films can win Oscars, like that's what they're swinging for. - So what strikes me about this is a little bit how we were talking about the suit earlier, it's almost like they treat kids with respect. - Yeah. - Like that they have an intelligence and they honor that intelligence. - Yeah, they're really just adult in a small body. Like you want to protect them from the true cruelty of the world. - Sure. - But in terms of their intellectual capacity or like philosophical capacity, they are right there with you. And so that the cartoons reflected that, the art that they consumed, education reflected that. So he represents that. I mean, there's a sense of, because it's survived so long and because I don't like stuffed animals, that it's like we've been through all of this together and it's the same, sharing the moments together as the friendship. And there's a sense in which, if

all the world turns on you and goes to hell, at least we got each other. And he doesn't die, because he's an inanimate object, so. - Until you animate him. - Until you animate him. And then I probably would want to know what he was thinking about this whole time. He's probably really into Taylor Swift or something like that. And it's like that I wouldn't even want to know anyway. - Well, I now feel a connection to Hedgy, the hedgehog that I certainly didn't have before. And I think that encapsulates the kind of possibility of connection

### 03:01:17 Concluding Statements

that is possible between human and other object and through robotics certainly. There's a saying that I heard when I was a graduate student that's just been ringing in my mind throughout this conversation in such a, I think appropriate way, which is that, Lex, you are in a minority of one, you are truly extraordinary in your ability to encapsulate so many aspects of science, engineering, public communication, about so many topics, martial arts and the emotional depth that you bring to it. And just the purposefulness, and I think if it's not clear to people, it absolutely should be stated. But I think it's abundantly clear that just the amount of time and thinking that you put into things is, it is the ultimate mark of respect. So, I'm just extraordinarily grateful for your friendship and for this conversation. - I'm proud to be a friend. And I just wished you showed me the same kind of respect by wearing a suit and make your father proud maybe next time. [Andrew laughing] - Next time indeed. Thanks so much my friend. - Thank you. Thank you, Andrew. - Thank you for joining me for my discussion with Dr. Lex Fridman. If you're enjoying this podcast and learning from it, please consider subscribing on YouTube. As well, you can subscribe to us on Spotify or Apple. Please leave any questions and comments and suggestions that you have for future podcast episodes and guests in the comment section on YouTube. At Apple, you can also leave us up to a five-star review. If you'd like to support this podcast, we have a Patreon. That's [patreon.com/andrewhuberman](https://patreon.com/andrewhuberman). And there you can support us at any level that you like. Also, please check out our sponsors mentioned at the beginning of the podcast episode. That's the best way to support this podcast. Links to our sponsors can be found in the show notes. And finally, thank you for your interest in science. [bright music]