

- Lex Fridman: [00:00](#) The following is a conversation with Elon Musk, Part II. The second time we spoke on the podcast with parallels, if not in quality, then in outfit to the, objectively speaking, greatest sequel of all time, Godfather, part two. As many people know, Elon Musk is a leader of Tesla, SpaceX, Neuralink, and the Boring Company. What may be less known is that he's a world-class engineer and designer, constantly emphasizing first principles thinking in taking on big engineering problems that many before him have considered impossible.
- Lex Fridman: [00:37](#) As scientists and engineers, most of us don't question the way things are done. We simply follow the momentum of the crowd. But revolutionary ideas that changed the world on the small and large scales happen when you return to the fundamentals and ask: "Is there a better way?" This conversation focuses on the incredible engineering and innovation done in brain computer interfaces in Neuralink.
- Lex Fridman: [01:04](#) This work promises to help treat neurobiological diseases, to help us further understand the connection between the individual neuron to the high-level function of the human brain. And finally, to one day expand the capacity of the brain through two-way communication, with computational devices, the internet and artificial intelligence systems. This is the Artificial Intelligence podcast. If you enjoy it, subscribe on YouTube, Apple Podcasts, Spotify, support it on the page you're on, or simply connect with me on Twitter, Lex Fridman, spelled F-R-I-D-M-A-N.
- Lex Fridman: [01:40](#) And now as an anonymous YouTube commenter referred to our previous conversation as the quote "historical first video of two robots conversing without supervision," here's the second time, the second conversation with Elon Musk.
- Lex Fridman: [01:57](#) Let's start with an easy question about consciousness. In your view, is consciousness something that's unique to humans or is it something that permeates all matter? Almost like a fundamental force of physics?
- Elon Musk: [02:10](#) I don't think consciousness permeates all matter.
- Lex Fridman: [02:13](#) Panpsychics believe that. There's a philosophical ...
- Elon Musk: [02:16](#) How would you tell?
- Lex Fridman: [02:19](#) That's true? That's a good point.

- Elon Musk: [02:21](#) I believe in scientific method. Don't want to blow your mind or anything, but the scientific method is if you cannot test the hypothesis, then you cannot reach meaningful conclusion that it is true.
- Lex Fridman: [02:30](#) Do you think consciousness, understanding consciousness is within the reach of science of the scientific method?
- Elon Musk: [02:37](#) We can dramatically improve our understanding of consciousness. I'd be hard pressed to say that we understand anything with complete accuracy, but can we dramatically improve our understanding of consciousness? I believe the answer is yes.
- Lex Fridman: [02:53](#) Does an AI system, in your view have to have consciousness in order to achieve human level or super human level intelligence? Does it need to have some of these human qualities like consciousness, maybe a body, maybe a fear of mortality, capacity to love, those kinds of silly human things?
- Elon Musk: [03:16](#) It's different. There's this scientific method which I very much believe in where something is true to the degree that it is testably so. And otherwise you're really just talking about preferences or untestable beliefs or that kind of thing. So it ends up being somewhat of a semantic question where we are conflating a lot of things with the word intelligence. If we parse them out and say, are we headed towards the future where an AI will be able to out-think us in every way, then the answer is unequivocally yes.
- Lex Fridman: [04:05](#) In order for an AI system that needs to out-think us in every way, it also needs to have a capacity to have consciousness, self-awareness and understand ...
- Elon Musk: [04:16](#) It will be self-aware, yes. That's different from consciousness. I mean to me in terms of what consciousness feels like, it feels like consciousness is in a different dimension. But this could be just an illusion. If you damage your brain in some way physically, you damage your consciousness, which implies that consciousness is a physical phenomenon in my view.
- Elon Musk: [04:44](#) The thing is that I think are really quite likely is that digital intelligence will be able to out-think us in every way. And it will suddenly be able to simulate what we consider consciousness. So to the degree that you would not be able to tell the difference.

- Lex Fridman: [04:59](#) And from the aspect of the scientific method, it might as well be consciousness if we can simulate it perfectly?
- Elon Musk: [05:06](#) If you can't tell the difference when this is sort of the Turing test, but think of it more advanced version of the Turing test. If you're talking to a digital superintelligence and can't tell if that is a computer or a human. Like let's say you're just having a conversation over a phone or a video conference or something aware, you think you're talking, looks like a person, makes all of the right inflections and movements and all the small subtleties that constitute a human and talks like a human, makes mistakes like a human, and you literally just can't tell, are you really conversing with a person or an AI?
- Lex Fridman: [05:56](#) Might as well.
- Elon Musk: [05:56](#) Might as well.
- Lex Fridman: [05:57](#) Be human. So on a darker topic, you've expressed serious concern about existential threats of AI, is perhaps one of the greatest challenges our civilization faces. But since I would say we're an optimistic descendants of apes, perhaps we can find several paths of escaping the harm of AI. So if I can give you three options, maybe you can comment, which do you think is the most promising?
- Lex Fridman: [06:23](#) So one is scaling up efforts in AI safety and beneficial AI research in hope of finding an algorithmic or maybe a policy solution. Two is becoming a multiplanetary species as quickly as possible. And three is merging with AI and riding the wave of that increasing intelligence as it continuously improves. What do you think is most promising, most interesting as a civilization that we should invest in?
- Elon Musk: [06:54](#) I think there're a lot, a tremendous amount of investment going on in AI. Where there is a lack of investment is in AI safety, and there should be, in my view, a government agency that oversees anything related to AI to confirm that it is, does not represent a public safety risk. Just as there is a regulatory authority for, like the Food and Drug Administration, there's NHTSA for automotive safety, there's the FAA for aircraft safety. We've generally come to the conclusion that it is important to have a government referee or a referee that is serving the public interest in ensuring that things are safe when there's a potential danger to the public.

Elon Musk: [07:38](#) I would argue that AI is unequivocally something that has potential to be dangerous to the public and therefore should have a regulatory agency just as other things that are dangerous to the public have a regulatory agency. But let me tell you, the problem with this is that the government moves very slowly, and the rate of ... Usually the way a regulatory agency comes into being is that something terrible happens. There's a huge public outcry and years after that there's a regulatory agency or a rule put in place.

Elon Musk: [08:14](#) It takes something like seatbelts. It was known for a decade or more that seatbelts would have a massive impact on safety and save so many lives and serious injuries. And the car industry fought the requirements to put seatbelts in tooth and nail. That's crazy. And hundreds of thousands of people probably died because of that. And they said people wouldn't buy cars if they had seatbelts, which is obviously absurd.

Elon Musk: [08:47](#) Or look at the tobacco industry and how long they fought anything about smoking. That's part of why I helped that movie, Thank You for Smoking. You could see just how pernicious it can be when you have these companies, effectively achieve regulatory capture of government, the bad. People in the AI community refer to the advent of digital superintelligence as a singularity, that is not to say that it is good or bad, but that it is very difficult to predict what will happen after that point. And that there's some probability it will be bad, some probability it will be good. We want to affect that probability and have it be more good than bad.

Lex Fridman: [09:38](#) Well let me, on the merger with AI question and the incredible work that's being done in Neuralink, there's a lot of fascinating innovation here across different disciplines going on. So the flexible wires, the robotics sewing machine, the response to brain movement, and everything around and sharing safety and so on. So we currently understand very little about the human brain. Do you also hope that the work at Neuralink will help us understand more about the human mind, about the brain?

Elon Musk: [10:13](#) Yeah. I think the work in Neuralink will definitely shed a lot of insight into how the brain, the mind works. Right now, just the data we have regarding how the brain works is very limited. We've got fMRI, that's like putting a stethoscope on the outside of a factory wall, and then putting it all over the factory wall and you can hear the sounds, but you don't know what the machines are doing really. It's hard. You can infer a few things, but it's very broad brush stroke.

Elon Musk: [10:46](#) In order to really know what's going on in the brain, you have to have high precision sensors and then you want to have stimulus and response. Like if you trigger a neuron, how do you feel? What do you see? How does it change your perception of the world?

Lex Fridman: [11:00](#) ESP can do physically just getting close to the brain, being able to measure signals from the brain will give us, open the door and inside the factory.

Elon Musk: [11:08](#) Yes, exactly. Being able to have high precision sensors, that tell you what individual neurons are doing and then being able to trigger neuron and see what the response is in the brain so you can see the consequences of, if you fire this neuron, what happens? How do you feel? What is changed? It'll be really profound to have this in people because people can articulate their change. Like if there's a change in mood or if they can tell you if they can see better or hear better or be able to form sentences better or worse or their memories are jogged or that kind of thing.

Lex Fridman: [11:52](#) So on the human side, there's this incredible general malleability, plasticity of the human brain. The human brain adapts, adjusts and so on.

Elon Musk: [12:01](#) It's not that plasticity, to be totally frank.

Lex Fridman: [12:03](#) So there's a firm structure, but nevertheless there is some plasticity, and the open question is if I could ask a broad question is, how much that plasticity can be utilized? On the human side, there's some plasticity in the human brain and on the machine side we have neural networks, machine learning, artificial intelligence. It's able to adjust and figure out signals. So there's a mysterious language that we don't perfectly understand that's within the human brain. And then we're trying to understand that language to communicate both directions.

Lex Fridman: [12:39](#) So the brain is adjusting a little bit. We don't know how much and the machine is adjusting. Where do you see as they try to reach together almost like with an alien species, try to find a protocol, communication protocol that works. Where do you see the biggest benefit arriving from, on the machine side or the human side? Do you see both of them working together?

Elon Musk: [13:02](#) I think the machine side is far more malleable than the biological side, by a huge amount. So it'll be the machine that

adapts to the brain. That's the only thing that's possible. The brain can't adapt that well to the machine. You can't have neurons start to regard an electrode as another neuron. Because a neuron just, it's like the pulse and so something else is pulsing. See, so there is that elasticity in the interface, which we believe is something that can happen, but the vast majority of the malleability will have to be on the machine side.

Lex Fridman: [13:38](#) But it's interesting when you look at that synaptic plasticity at the interface side, there might be an emergent plasticity. Because it's whole nother, it's not like in the brain, it's a whole nother extension of the brain. We might have to redefine what it means to be malleable for the brain. So maybe the brain is able to adjust to external interfaces.

Elon Musk: [13:59](#) There'll be some adjustments to the brain because there's going to be something reading and simulating the brain, and so it will adjust to that thing. But the vast majority of the adjustment will be on the machine side. This is just, it has to be that, otherwise it will not work.

Elon Musk: [14:19](#) Ultimately, we currently operate on two layers. We have a limbic like prime primitive brain layer, which is where all of our impulses are coming from. It's like we've got a monkey brain with a computer stuck on it, that's the human brain. And a lot of our impulses and everything are driven by the monkey brain, and the computer, the cortex is constantly trying to make the monkey brain happy. It's not the cortex that's steering the monkey brain, the monkey brain's steering the cortex.

Lex Fridman: [14:49](#) But the cortex is the part that tells the story of the whole thing. So we convince ourselves it's more interesting than just the monkey brain.

Elon Musk: [14:59](#) The cortex is what we call like human intelligence, so that's like the advanced computer relative to other creatures. Other creatures do not have, really they don't have the computer or they have a very weak computer relative to humans. But it seems like surely the really smart thing should control the dumb thing, but actually the dumb thing controls the smart thing.

Lex Fridman: [15:28](#) So do you think some of the same kind of machine learning methods, whether that's natural language processing applications are going to be applied for the communication between the machine and the brain? To learn how to do certain things like movement of the body, how to process visual stimuli and so on. Do you see the value of using machine learning to

understand the language of the two-way communication with the brain?

Elon Musk: [15:55](#) Sure. Yeah, absolutely. I mean we're a neural net and AI is basically a neural net. So it's like digital neural net will interface with biological neural net. And hopefully bring us along for the ride. But the vast majority of our intelligence will be digital. Think of the difference in intelligence between your cortex and your limbic system is gigantic. Your limbic system really has no comprehension of what the hell the cortex is doing. It's just literally hungry, or tired, or angry, or sexy or something. And then that communicates that impulse to the cortex and tells the cortex to go satisfy that.

Elon Musk: [16:50](#) Then a great deal of, a massive amount of thinking, like truly stupendous amount of thinking has gone into sex without purpose, without provocation, without procreation. Which is actually quite a silly action, in the absence of procreation. It's a bit silly. Why are you doing it? Because it makes the limbic system happy, that's why.

Lex Fridman: [17:16](#) That's why.

Elon Musk: [17:18](#) But it's pretty absurd, really.

Lex Fridman: [17:21](#) Well, the whole of existence is pretty absurd in some sense.

Elon Musk: [17:25](#) Yeah. But I mean this is a lot of computation that has gone into how can I do more of that with the procreation not even being a factor? This is I think, a very important area of research by NSF.

Lex Fridman: [17:40](#) An agency that should receive a lot of funding, especially after this conversation.

Elon Musk: [17:44](#) I'm proposing the formation of a new agency.

Lex Fridman: [17:47](#) Oh boy. What is the most exciting or some of the most exciting things that you see in the future impact of Neuralink, both on the science, engineering and societal broad impact?

Elon Musk: [18:02](#) So Neuralink, I think at first will solve a lot of brain related diseases. So create anything from like autism, schizophrenia, memory loss, like everyone experiences memory loss at certain points in age. Parents can't remember their kids' names and that kind of thing. So there's, I think a tremendous amount of good that Neuralink can do in solving a critical damage to the

brain, or the spinal cord. There's a lot that can be done to improve quality of life of individuals and those will be steps along the way. And then ultimately, it's intended to address the rest of the existential risk associated with a digital superintelligence.

- Elon Musk: [18:47](#) We will not feel to be smarter than a digital supercomputer. So therefore, if you cannot beat them, join them. And at least we won't have that option.
- Lex Fridman: [19:01](#) So you have hope that Neuralink will be able to be a connection to allow us to merge, to ride the wave of the improving AI systems?
- Elon Musk: [19:12](#) I think the chance is above 0%.
- Lex Fridman: [19:14](#) So it's non-zero?
- Elon Musk: [19:17](#) Yes.
- Lex Fridman: [19:17](#) There's a chance.
- Elon Musk: [19:18](#) Have you've seen Dumb and Dumber?
- Lex Fridman: [19:22](#) Yes.
- Elon Musk: [19:22](#) So I'm saying there's a chance.
- Lex Fridman: [19:24](#) So you're saying one in a billion or one in a million, whatever it was that Dumb and Dumber?
- Elon Musk: [19:28](#) It weren't for maybe one in a million to improving, maybe it'll be one in a thousand, and then one in a hundred, then one in 10. It depends on the rate of improvement of Neuralink and how fast we're able to make progress.
- Lex Fridman: [19:41](#) Well, I've talked to a few folks here that are quite brilliant engineers. So, I'm excited.
- Elon Musk: [19:45](#) Yeah. I think it's fundamentally good. Giving somebody back full motor control after they've had a spinal cord injury, restoring brain functionality after a stroke, solving debilitating genetically oriented brain diseases. These are all incredibly great, I think. And in order to do these, you have to be able to interface with the neurons at a detailed level. You need to be able to fire the right neurons, read the right neurons. And then effectively you



can create a circuit, replace what's broken with silicon and essentially fill in the missing functionality.

Elon Musk: [20:25](#) And then over time we can develop a tertiary layer. Like limbic system as a primary layer, then the cortex is a second layer. And I said, obviously the cortex is vastly more intelligent than the limbic system. But people generally like the fact that they have a limbic system and a cortex. I haven't met anyone who wants to delete either one of them. They're like, okay, I'll keep them both. That's cool.

Lex Fridman: [20:49](#) The limbic system is kind of fun.

Elon Musk: [20:50](#) That is where all the fun is, absolutely. And then people generally don't want to lose their cortex either. Right? So they like having the cortex and the limbic system. And then there's a tertiary layer which will be digital superintelligence. And I think there's room for optimism given that the cortex is very intelligent and limbic system is not, and yet they work together well. Perhaps there can be a tertiary layer where digital superintelligence lies. And that will be vastly more intelligent than the cortex, but still coexist peacefully in a benign manner with the cortex and limbic system.

Lex Fridman: [21:29](#) That's super exciting future, both in the low-level engineering that I saw is being done here and the actual possibility in the next few decades.

Elon Musk: [21:38](#) It's important that Neuralink solves this problem sooner rather than later because the point at which we have digital superintelligence, that's where we pass the singularity and things become just very uncertain. It doesn't mean that they're necessarily bad or good, but the point of which we pass singularity, things become extremely unstable. So we want to have a human brain interface before the singularity or at least not long after it, to minimize existential risk for humanity and consciousness as we know it.

Lex Fridman: [22:06](#) There's a lot of fascinating actual engineering, low-level problems here at Neuralink that are quite exciting.

Elon Musk: [22:14](#) The problems that we face in Neuralink are material science, electrical engineering, software, mechanical engineering, microfabrication, it's a bunch of engineering disciplines, essentially. That's what it comes down to is you have to have a tiny electrode, it's so small, it doesn't hurt neurons. But it's got to last for as long as a person, so it's got to last for decades. And

then you've got to take that signal, and you've got to process that signal locally at low power.

Elon Musk: [22:48](#) So we need a lot of chip design engineers, because we've got to do signal processing. And do so in a very power efficient way so that we don't heat your brain up. Because the brain's very heat sensitive. And then, we've got to take those signals and we've got to do something with them. And then we've got to stimulate back to, so you could bi-directional communication.

Elon Musk: [23:16](#) So if someone's good at material science, software, mechanical engineering, electrical engineering, chip design, microfabrication, those are the things we need to work on. We need to be good at material science so that we can have tiny electrodes that lasts a long time. And it's a tough thing with the material science, it's a tough one because you're trying to read and simulate electrically in an electrically active area, your brain is very electrically active and electrochemically active.

Elon Musk: [23:46](#) So how do you have, say a coding on the electrode that doesn't dissolve over time? And is safe in the brain? This is a very hard problem. And then how do you collect those signals in a way that is most efficient, because you really just have very tiny amounts of power to process those signals. And then we need to automate the whole thing. So it's like LASIK, so if this is done by neurosurgeons, there's no way it can scale to large numbers of people. And it needs to scale to large numbers of people because I think ultimately we want the future repeated, to be determined by a large number of humans.

Lex Fridman: [24:32](#) Do you think that this has a chance to revolutionize surgery, period? So neurosurgery and surgery [crosstalk 00:00:24:38].

Elon Musk: [24:38](#) Yeah, absolutely. Yeah, for sure. It's got to be like LASIK, like if LASIK had to be hand done, done by hand by a person, that wouldn't be great. It's done by a robot. And the ophthalmologist just needs to make sure your head's in my position and then they just press a button and go.

Lex Fridman: [24:59](#) Smart Summon and soon AutoPark takes on the full beautiful mess of parking lots and their human-to-human nonverbal communication. I think it has actually the potential to have a profound impact in changing how our civilization looks at AI and robotics because this is the first time human beings, people that don't own a Tesla, that may have never seen a Tesla or heard about a Tesla, get to watch hundreds of thousands of cars without a driver. Do you see it this way, almost like an

education tool for the world about AI? Do you feel the burden of that, the excitement of that, or do you just think it's a smart parking feature?

Elon Musk: [25:40](#) I do think you are getting at something important, which is, most people have never really seen a robot. And what is the car that is autonomous, it's a four-wheeled robot.

Lex Fridman: [25:49](#) Right. Yeah. It communicates a certain message with everything from safety to the possibility of what AI could bring to its current limitations, its current challenges. It's what's possible. Do you feel the burden of that? Almost like a communicator educator to the world about AI?

Elon Musk: [26:08](#) We were just really trying to make people's lives easier with autonomy, but now that you mention it, I think it will be an eyeopener to people about robotics. Because most people have never seen a robot and there are hundreds of thousands of Teslas. Won't be long before there's a million of them that have autonomous capability, and the drive without a person in it. And you can see the evolution of the car's personality, and thinking with each iteration of autopilot. You can see it's uncertain about this, or now it's more certain. Now it's moving in a slightly different way.

Elon Musk: [26:50](#) I can tell immediately if a car is on Tesla Autopilot because it's got just little nuances of movement. It just moves in a slightly different way. If a car's on Tesla Autopilot, for example on the highway, are far more precise about being in the center lane than a person. If you drive down the highway and look at where cars are, the human driven cars are within their lane. They're like bumper cars. They're moving all over the place. The car on Autopilot, dead center.

Lex Fridman: [27:17](#) Yeah. So the incredible work that's going into that neural network, it's learning fast. Autonomy is still very, very hard. We don't actually know how hard it is fully, of course. You look at most problems you tackle this one included, with an exponential lens, but even with an exponential improvement, things can take longer than expected sometimes. So where does Tesla currently stand on its quest for full autonomy? What's your sense? When can we see successful deployment of full autonomy?

Elon Musk: [27:56](#) Well on the highway already, the probability of intervention is extremely low. So, for highway autonomy with the latest release, especially the probability of needing to intervene, is

really quite low. In fact, I'd say for stop-and-go traffic, it's far safer than a person right now. The probability of an injury or an impact is much, much lower for autopilot than a person. And with navigate and autopilot, you can change lanes, take highway interchanges.

Elon Musk: [28:29](#) And then we're coming at it from the other direction, which is lower speed, full autonomy. And in a way this is like, how does a person learn to drive? You learn to drive in the parking lot. The first time you learn to drive probably wasn't jumping on Walker Street in San Francisco. That'd be crazy. You learn to drive in the parking lot, get things right at low speed.

Elon Musk: [28:49](#) And then the missing piece that we're working on is traffic lights and stop streets. Stop streets I would say are actually also relatively easy because you know where the stop street is. Worst case you can geocode it, and then use visualization to see where the line is and stop at the line to eliminate the GPSR. So it's actually, I'd say it's probably complex traffic lights and very winding roads. The two things that need to get solved.

Lex Fridman: [29:21](#) What's harder, perception or control for these problems? So being able to perfectly perceive everything or figuring out a plan once you perceive everything? How to interact with all the agents in the environment? In your sense, from a learning perspective, is perception or action harder, in that giant, beautiful, multi-task learning neural network?

Elon Musk: [29:42](#) The hardest thing is having accurate representation of the physical objects in vector space. So, taking the visual input, primarily visual input, some sonar and radar and then creating an accurate vector space representation of the objects around you. Once you have an accurate vector space representation, the planning and control is relatively easier. That is relatively easy.

Elon Musk: [30:10](#) Basically, once you have accurate vector space representation, then you're like a video game, like cars in Grand Theft Auto or something. They work pretty well. They drive down the road, they don't crash, pretty much unless you crash into them. That's because they've got an accurate vector space representation of where the cars are, and then they're rendering that as the output.

Lex Fridman: [30:33](#) Do you have a sense, high level that Tesla's on track on being able to achieve full autonomy? So on the highway ...

Elon Musk: [30:43](#) Yeah, yeah, absolutely.

Lex Fridman: [30:44](#) And still no driver state? Driver sensing?

Elon Musk: [30:48](#) We have driver sensing with torque on the wheel.

Lex Fridman: [30:50](#) That's right. By the way, just a quick comment on karaoke, most people think it's fun, but I also think it is the driving feature. I've been saying for a long time, singing in the car is really good for attention management and vigilance management.

Elon Musk: [31:04](#) That's right. Tesla Caraoke is great. It's one of the most fun features of the car.

Lex Fridman: [31:09](#) Do you think of a connection between fun and safety sometimes?

Elon Musk: [31:12](#) Yeah, if you can do both at the same time, that's great.

Lex Fridman: [31:16](#) I just met with Ann Druyan, wife of Carl Sagan, who directed Cosmos.

Elon Musk: [31:22](#) I'm generally a big fan of Carl Sagan, he's super cool. And had a great way of putting things. All of our consciousness, all civilization, everything we've ever known and done is on this tiny blue dot. People also get too trapped in their squabbles amongst humans, and just don't think of the big picture. They take civilization and our continued existence for granted. They shouldn't do that. Look at the history of civilizations, they rise and they fall, and now civilization is all, it's globalized. And so civilization, I think now rises and falls together. There's not geographic isolation. This is a big risk. Things don't always go up. That should be an important lesson of history.

Lex Fridman: [32:13](#) In 1990 at the request of Carl Sagan, the Voyager One spacecraft, which is a spacecraft that's reaching out farther than anything human-made into space. Turned around to take a picture of Earth from 3.7 billion miles away, and as you're talking about the pale blue dot, that picture, there it takes up less than a single pixel in that image. Appearing as a tiny blue dot, as a pale blue dot, as Carl Sagan called it. So he spoke about this dot of ours in 1994. And if you could humor me, I was wondering if in the last two minutes you could read the words that he wrote describing this pale blue dot?

Elon Musk: [32:57](#) Sure. It's funny, the universe appears to be 13.8 billion years old. Earth, like four and a half billion years old. In another half

Elon Musk Neuralink, AI, Autopilot, and the Pale... (Completed 11/12/19) Page 13 of 14  
Transcript by [Rev.com](#)

billion years or so the sun will expand and probably evaporate the oceans, and make life impossible on Earth. Which means that if it had taken consciousness 10% longer to evolve, it would never have evolved at all, 10% longer. And I wonder how many dead one-planet civilizations there are out there in the cosmos, that never made it to the other planet and ultimately extinguished themselves or were destroyed by external factors? Probably a few.

Elon Musk: [33:47](#) It's only just possible to travel to Mars. Just barely. If G was 10% more, wouldn't work really. If G was 10% lower, it would be easy. You can go single stage from surface of Mars, all the way to the surface of the Earth because Mars is 37 syndrome of gravity, thereabouts. You need a giant boost to get off the Earth.

Elon Musk: [34:18](#) Channeling Carl Sagan. Look again at that dot that's here. That's home. That's us. On it, everyone you love, everyone you know, everyone you've ever heard of, every human being who ever was lived out their lives. The aggregate of our joy and suffering. Thousands of confident religions, ideologies and economic doctrines. Every hunter and forager, every hero and coward, every creator and destroyer of civilization, every King and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer. Every teacher of morals, every corrupt politician, every superstar, every supreme leader, every Saint and sinner in the history of our species lived there. Automotive dust suspended in a sun beam.

Elon Musk: [35:14](#) Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all those vastness, there is no hint that help will come from elsewhere to save us from ourselves. The earth is the only world known so far to harbor life. There was nowhere else, at least in the near future to which our species could migrate.

Elon Musk: [35:34](#) This is not true. This is false, Mars.

Lex Fridman: [35:39](#) And I think Carl Sagan would agree with that. He couldn't even imagine it at that time. So thank you for making the world dream. And thank you for talking today. I really appreciate it. Thank you.

Elon Musk: [35:49](#) Thank you.