NICKI HARRIS BUSINESS 09.01.2019 11:00 AM

Elon Musk: Humanity Is a Kind of 'Biological Boot Loader' for AI

AI is outpacing our ability to understand it, the Tesla CEO says. It will open a new chapter for society, replies the Alibaba cofounder.

Jack Ma, left, debates AI—and the future of humanity—with Elon Musk. ALY SONG/REUTERS

On Wednesday, Tesla CEO Elon Musk and Alibaba cofounder Jack Ma took the stage at the World AI Conference in Shanghai to debate artificial intelligence and its implications for humanity. As expected, Ma took a far more optimistic stance than Musk. Ma encouraged people to have faith in humanity, our creativity, and the future. "I don't think artificial intelligence is a threat," he said, to which Musk replied, "I don't know, man, that's like, famous last words." An edited transcript of the discussion follows.

Elon Musk: What are we supposed to say? Just things about AI perhaps? Yeah. OK. Let's see.

Jack Ma: The AI, right? OK, great.

EM: Actually, I'm told that—does AI mean love? There's like a name, AI, it sort of sounds a bit like love?

JM: Yeah, AI—I hate the word "AI" called artificial intelligence. I call it Alibaba intelligence.

EM: Yeah, might end up being true. You never know.

I think generally, people underestimate the capability of AI. They sort of think like, it's a smart human. But it's, it's really much—it's going to be much more than that. It'll be much smarter than the smartest human. It'll be like, can a chimpanzee really understand humans? Not really, you know. We just seem like strange aliens. They mostly just care about other chimpanzees. And this will be how it is more or less in relative—in fact, if the difference is only that small, that would be amazing. Probably it's much, much greater. So like, the biggest mistake that I see artificial intelligence researchers making is assuming that they're intelligent. Yeah they're not, compared to AI. And so like, a lot of them cannot imagine something smarter than themselves, but AI will be vastly smarter—vastly.

So what do you do with a situation like that? I'm not sure. You know. I hope they're nice. I mean, I have obviously, some, you know, I think in a situation where you, you know, the old saying, if you can't beat them, join them. You know, that's what Neuralink is about. Can we be able to go along for the ride with AI? I mean, I really think that there should be other companies like Neuralink, essentially, to create a high bandwidth interface to the brain. Because right now, we are already a cyborg. People don't realize we are already a cyborg. Because we are so well integrated with our phones and our computers. The phone is almost like an extension of yourself. If you forget your phone, it's like a missing limb. But the bandwidth, the communication bandwidth to the phone is very low, especially input. So in fact, input bandwidth to computers has actually gone down, because typing with two thumbs, as opposed to 10 fingers, is a big reduction in bandwidth. Input bandwidth has gone up because of video and imagery. So input bandwidth is many orders of magnitude greater than output bandwidth. But at a certain point, if we're just—assuming a benign scenario with AI, we will just be too slow. So you know, I always think like human speech, to a computer, will sound like very slow tree wheezing. It's kind of like whale sounds ...

JM: You have a vision about the technology. I'm not a tech guy. I think I'm all about life. I think AI is going to open a new chapter of the society of the world that people try to understand ourselves better, rather than the outside world. And it's so difficult to predict the future. 99.99 percent of the predictions that human beings had in history about the future—all wrong.

EM: Including that one?

JM: Oh, yeah. Only you know, 0.00 percent of the predictions are right. They're right but by accident.

EM: Yeah. But it's also true that 80 percent of statistics are false.

JM: I'm happy about the artificial intelligence, or Alibaba intelligence, that's going to understand a human, the inside of the human, better. So when people worry a lot about artificial intelligence, people should have more confidence in themselves. Because I think a lot of solutions we don't have today, but there will be solutions tomorrow. We don't have solutions but the young people will have solutions. So I'm quite optimistic. And I don't think artificial intelligence is a threat. I don't think artificial intelligence is something terrible, but human beings are smart enough to learn that. And to me, artificial intelligence is just like—people worry a lot about this today are those people. I called them college smartness. People like us, street smart, we aren't scared of that. We think it's a great fun, and we want to challenge ourselves to embrace it.

EM: I don't know, man, that's like, famous last words.

> **"We are already a cyborg. Because we are so well integrated with our phones and our computers."**
> — ELON MUSK

Let me tell you, in general, the rate of advancement of computers is insane. A good example would be videogames. You know, if you go back 40 years ago, 50 years ago maybe, you had Pong, that was just two rectangles and a square. Now, you've got photorealistic real-time simulations with millions of people playing simultaneously. If you assume any rate of improvement at all, the games will be indistinguishable from reality, you will not be able to tell the difference. Either that or civilization will end. Those are the two options. But even if the rate of technology improvements slowed down by 1,000, then OK, advanced 1,000 years, or 10,000 years, this is still very tiny. Civilization has been around for probably, arguably, I think 7,000 years or something like that. If you counted from the first time there was any writing, any recorded symbols, besides cave paintings, that's a very tiny amount of time considering the universe is 13.8 billion years old. I mean, if civilization lasted for a million years, you'd only increment the third decimal point after 13.8 billion years. So that seems like a long time given that we've only been around for 7,000 years, and it's been pretty, it's been kind of a roller coaster, on the civilization front. I'm not trying to be—I'm a naturally optimistic person. To be clear. I'm not saying hey, doom and gloom. I'm just saying that this is the apparent pattern. The rate of change of technology is incredibly fast. It is outpacing our ability to understand it. Well, I'm not sure, is that good or bad? I don't know.

It seemed to me some time ago that you could sort of think of humanity as a biological boot loader for digital super intelligence. For those who don't know what a boot loader is, it's a very tiny piece of code without which the computer cannot start. But it's sort of like the minimal bit of code necessary for a computer to start. Like you couldn't evolve silicon circuits—there needed to be biology to get there.

JM: Good. Well, let's talk about something fun. I have a mind that you want to go to Mars. So what will life look like on Mars? Are you both

what's going on here. So why are you so curious about Mars?

EM: Well, I think the thing about Mars is that I think it's important for us to take the set of actions that are most likely to continue consciousness into the future. What increases the probability of consciousness, of continuing into the future. I think we should not take it for granted that consciousness will continue. Because we have not encountered any aliens, where are the aliens? This is the Fermi paradox. This is one of the most important questions. How come we have not found any aliens? There are people out there who think we've found aliens. Trust me, I would know. We have not.

> **"I don't think artificial intelligence is something terrible, but human beings are smart enough to learn that."**
> — JACK MA

People ask me, "Have you been to Area 51?" OK, please. SpaceX actually has Area 59, it's even better, eight better than 51. So among the set of actions we can take, that are likely to increase the scope and scale of consciousness such that we are better able to understand the nature of the universe, one of those actions is to become a multi-planet species or ensure that life is multi-planetary, not because I think—it's not from the standpoint of it just being an escape hatch, or because I think that Earth is doomed. But there is a certain probability that is irreducible, that something may happen to us, despite our best intentions, despite everything we try to do. There's a probability at a certain point that some either external force or some internal unforced error causes civilization to be destroyed. Or sufficiently impaired such that it can no longer extend to another planet.

Let me put it another way. This is the first time in the 4 1/2 billion–year history of Earth that it's been possible to extend life beyond Earth. Before this, it was not possible. How long will this window be open? It may be open for a long time, or it may be open for a short time. I think it would be wise to assume that it is open for a short time. And then let us secure the future, secure the future of consciousness, such that life of the lights of consciousness is not extinguished. And we should try to do this as quickly as possible. That's my view.

JM: Good. It's so difficult to secure the future of the Earth, but we can secure the future of the next 100 years. I admire your courage for exploring Mars, but I admire a lot of people spending efforts on improving the Earth. It's great to send 1 million people to Mars, but we have to care about the 7.4 billion people on Earth. How can we make the world more sustainable?

EM: Yeah. That's not how it works though.

JM: I think people spend more time on the Earth. Think about it. Because no matter how long the civilization of the human beings will be, like 1 million or 2 million or half million years. But we only have 100 years. So we cannot solve all the problems of the future. But we have to be responsible for the future. But we should care more about how we can enjoy it better. My view is that by the artificial intelligence or AI, when human beings understand ourselves better, then we can improve the world better. The last 200 years, human beings tried to understand the other side better, understand the other people better. But I think what I feel excited about with AI is that AI is to understand people, the inside of the human beings. The Earth, I heard you're going to dig a tunnel deep in the Earth, which is amazing. I think anyway, every time I read the news about your interest in outer space, I look at you with great respect. We need heroes like you. But we need more heroes like us, working hard on the Earth, improving things every day. That's what I want.

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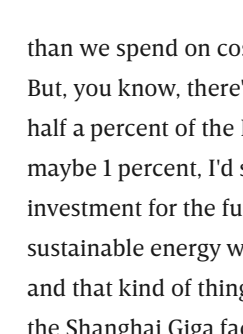

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EM: Sure, I mean, to be clear, I'm very pro Earth. When I say, you know, us becoming a multi-planet species or extending life beyond Earth, expanding the scope and scale of consciousness, I'm talking from a resource standpoint, about less than 1 percent of Earth's resources should be dedicated to making life multi-planetary, or making consciousness multi-planetary. So, you know, I think it should be like, somewhere in between how much we spend on lipstick and how much we spend on health care. You know, things like for the preservation of consciousness, we should spend maybe slightly more than we spend on cosmetics. And I'm pro cosmetics, I think they're great. But, you know, there's probably worth spending, I don't know, like at least half a percent of the Earth's GDP on extending life to be multi–planetary, maybe 1 percent, I'd say seems like a good a good use of resources, a wise investment for the future. And obviously, I spend a lot of my time on sustainable energy with Tesla, with electric cars, and solar and batteries and that kind of thing. And I'm really excited to be here in Shanghai for the Shanghai Gigafactory. I think the Tesla China team has done an amazing job, really mind-blowing, like, I'm just astounded by how good the job is, and how much progress has been made. And I think it's a good story for the world. So, you know, I think it's like, I really think China is the future. It's very impressive. and there's also some great progress on entrepreneurial rocket companies in China as well. I believe two have made orbit, and it's very difficult, very hard to make orbit. If you make orbit, I have great respect. Because it's very hard.

JM: Should we pick up another topic? Jobs?Jobs or life. Jobs.

EM: Sure.

> **"The rate of change of technology is incredibly fast. It is outpacing our ability to understand it. Is that good or bad? I don't know."**
> — ELON MUSK

JM: So what new jobs will be created because of AI? Or has the change already started? What do you think? My view is that the jobs—actually every technology revolution, people start to worry, right? Last 200 years, we worry about the new technology going to take away all the jobs. Actually, we made a lot of jobs. Second, because of the Industrial Revolution, jobs create a lot of jobs. What I think is the next 20–30 years, human beings will live much longer. The life science technology is going to make people live probably 100 or 120 years. That may not be a good thing, because you got grandfather's grandfather still working hard. But the challenge is, my question is, why should we have a lot of jobs? I think people should work three days a week, four hours a day. Where we have electricity, the power of electricity is that we give people more time, so you can go to the party in the evening, you can go to dancing party in the evening. So because of electricity, people have more time. I think because of artificial intelligence, people will have more time to enjoy being human beings. In your life, in my life I think I visited probably 300 cities in my life. My father visited through 30 cities, my grandfather visited only three cities. So my grandchildren will probably visit 3,000 cities! Always on the Tesla, always traveling around. So I don't think we need a lot of jobs. At that time, the jobs we need are to make people happier, make people experience life, enjoy the human beings. So I don't worry about the jobs a lot. First, we're going to have a lot of jobs. Second, we don't need a lot of jobs. Third, in the agriculture period, average age is like 30–35 years old. In the industry period, technology revolution, people can live 70 years. So in the artificial intelligent period, people can live 120 years I think. Now the problem comes when people's life is getting better, people don't want to have children. When grand-grandfather's there, you don't want to have children. At that time, we are going to have a lot of jobs with nobody. We're old guys. For sure, you will not be happy, because when you're grand-grandfather, I need to work tomorrow, then that's a disaster. So we should be ready, that we are going to enter into the era that everybody can live 120 years. And these are the problems that come up. So that's my view about jobs. Don't worry about it, we will have jobs.

EM: Yeah .. I think so if you're working on something that involves people or engineering, it's probably a good approach. You know, art, of course. Like I said, I think we're gonna have to figure out this Neuralink situation. Otherwise, we will be left behind. It's very important to do this quickly. I think time — we don't have much time.

JM: We don't have much time for what?

EM: We don't have much time to solve the Neuralink.

JM: Yeah.

EM: Yeah. If you think of like technology and technology awareness, if there was like a topological map of technology awareness, it's mostly flat with a few short buildings, and then some very tall spires. And unless you're on that very tall spire, it's not obvious what the topology is.

JM: Yeah, I never worry about the things that I cannot solve. I left other people to solve it. If nobody can solve it, just let it be. That's my life. Oh, let's talk about education. I'm quite interested in education.

> **"First, we're going to have a lot of jobs. Second, we don't need a lot of jobs."**
> — JACK MA

So what knowledge or skills will be useful to master the future? Do you have any advice for young professionals who want to pursue a career in AI? Young professionals. I don't think you will have professionals of AI in the future. Well, I worry a lot about—people worry about jobs, but I worry about education. All the education systems, the things we teach our kids, the way we teach our kids, are mainly designed for the industrial period. And I'm sure the machines will be much cleverer than human beings in the future. How can human beings do better? Human beings should be smarter, human beings should be wiser. So how can we, human beings, be wiser, smarter? I think that we should change the way of education. Change things, because in the past, we focus a lot about, you know, remembering things. Computers can remember better than you are. Want to calculate faster? Computer can calculate much faster. Want to run faster? Computer can run much faster than you. So human beings should have confidence by being more creative, more constructive. So how can we teach our kids to be more creative and constructive? And I think this is the key of the education. And I want to spend more time on training kids on arts, on painting, on seeing, on dancing, you know, all these other creative things that make people live like humans. Don't worry about the machines. For sure, we should understand one thing: that man can never make another man.

Computer is a computer. A computer is just a toy. Man cannot even make a mosquito. So we should have confidence. Computers only have chips, men have the heart. It's the heart where the wisdom comes from. So I think in the next 10 or 20 years, human beings or every country, every government, should focus on reforming the education system, making sure our kids will be able to find jobs in the future, be able to live a life where they're only working three days a week, four hours a day. And that is very important. If we do not change the education system that we are in, we are all going to be in trouble. That's my view. And I don't worry about it, we will change it.

EM: Yeah, I would say try to learn as much as possible that allows you to predict the future or make the future. So the saying is that the best way to predict the future is to make it. And then assess whether what you're learning is enabling you to predict the future with less error. Are you less wrong? We are always wrong to some degree. But can you reduce the error on your future predictions? I think that's the way to look at education. Of course it's both creative, create the future and predict the future. So that includes art and all those other things. But close the loop on being less wrong about the future. I'd say that's the right way to think about education.

I mean, down the road with a Neuralink, you can just upload any subject instantly. So it'll be like the Matrix. You want to fly a helicopter? No problem. Well, helicopters will fly themselves, but you know, if you want it to do whatever, any given skill, you just upload it instantly. I mean, the way education works right now it's extremely low bandwidth, it's extremely slow. Lectures are the worst, really. Very slow.

Just try to predict the future with less error. This is very hard. As you're saying. It shows 99.9 percent. But it's not very good, generally a prediction of the future. But I think often people don't try. The first thing is to try. If you don't try, OK, you've got to try and then adjust based on the error of your prior predictions.

JM: Yeah, I think, just to try is very good, we should always have the confidence to try the future. And I never worry about the errors and mistakes. Errors and mistakes are the best sets of human lives. And humans—I think the when people worry about the disasters that AI is going to bring, I think it's not the disasters. It's the mistakes that human beings make. And trust human beings will be able to correct the mistakes and improve themselves, and for that we need education. In China today, we have [18 million] new babies born every year. Which which is not enough. We need we need to have like much more than that. But I think the best resources of human beings, or the best resources on the Earth, are not the coasts, not the oil, not the electricity. It's the human brains. How can we make the human great brains more creative, more constructive? How can we make sure that the machines are always the toys and tools of humans, rather than the control? So I never in my life, and especially the last two years people talk about AI say human beings would be controlled by machines. I never think about that. I think it's impossible. Right? It's impossible, because human beings, they are different. Machines are invented by human beings. And according to the science, right, humans can never create another animal that is smarter than humans. Especially when you have so many smart people, it's impossible to make another smarter people.

EM: I very much disagree with that.

JM: OK, that's good!

EM: The first thing we should assume is that we are very dumb. And we can, we can definitely make things smarter than ourselves. I mean there didn't used to be humans, right. Our early civilizations were very primitive. We didn't have any technology, really, we're just like running around, you know, trying to not get eaten, or struggling to survive a winter. Now we have heating and we grow food. This is all new stuff. So, you know, things have obviously gotten way more smarter than the past, way smarter. So that's going to continue. We're not the last step in evolution. So the most important thing, like I said, the most important mistake I see smart people making is assuming that they're smart. They're not.

JM: So give me an example, what animals or things that a human being made that is smarter than human beings.

EM: Well computers actually are already much smarter than than people on so many dimensions. We just keep moving the goalposts. So we used to think like, for example, being good at chess was an example of a smart human. And then Kasparov was crushed by Deep Blue in '97. That was a long time ago, 22 years. I mean, right now your cell phone could crush the world champion at chess, literally. Go used to be thought of as something that humans were better at than computers. Then Lee Sedol was beaten four to one by Alpha Zero. Then a new version of Alpha Zero—I should say AlphaGo. AlphaGo beat Lee Sedol. Then there's Alpha Zero. Alpha Zero crushed AlphaGo 100 to 0. Now it's just pointless because it just keeps playing itself. Humans are—trying to play a computer at Go is like trying to fight Zeus. It's not going to work. Hopeless, we are hopeless. Hopelessly inadequate. In terms of rendering into—basically there's just a smaller and smaller corner of what of intellectual pursuits that humans are better than computers. And that every year, it gets smaller and smaller, and soon will be far far surpassed in every single way. Guaranteed. Or civilization will end. Those are the two possibilities.

JM: Yeah, my view is that computers may be clever, but human beings are much smarter.

EM: Yeah, definitely not.

> **"A computer is just a toy. Computers only have chips, men have the heart. It's the heart where the wisdom comes from."**
> — JACK MA

JM: Clever is very academic, is knowledge driven. Smarter is experience driven. Computer is clever. But it's human beings—we invented the computer. I've never seen a computer invent a human being. This is my first point. Second point is about playing Go and chess. It's stupid to compete with a computer on played goals. Just like 100 years ago, where human beings created cars. So human beings said, I can't run faster than a car. It's impossible. It's only stupid people to compete with a car to run faster. Go is designed for human to play with human. Right? The chess is designed for human to play with human. Why should a human fight against a computer? So I never ever play chess or Go with a computer. I'll be happy to see two computers fight each other. I'm not interested in playing Go with a computer. So I told those guys, they are very upset. Computer will be smarter human beings because computer can play chess better. I think you are stupid to compete with that. Don't do that. So this is .. only do things we are good at.

EM: Sure. OK, well, what would be an example of something that humans are better than a computer at? And then let's see if that happens.

JM: Well, a computer is only one of the clever tools that humans created. And computers are clever, but there will be more tools that human beings will create, much cleverer than computers. That's my view.

EM: My view on AI is essentially, you can view the advancement of AI as solving things with increasing degrees of freedom. So the thing with the most degrees of freedom is reality. But AI is steadily advanced, solving things that have more and more degrees of freedom. So obviously, it's something like checkers was very easy to solve, that we could solve with classical software, classical computer, not really all that challenging. And in fact, there is a complete solution for checkers, meaning it is literally impossible. Every version of checkers is known. And then there's chess, which also had many, many more degrees of freedom than checkers. Many orders of magnitude more than checkers. But still really, I would say a lower order of magnitude, lower degree of freedom game. Then there's Go, which had many orders of magnitude more degrees of freedom than chess. So it's really just stepping through orders of magnitude of degrees of freedom. This is the way to, I think, view the advancement of intelligence. And it's really gonna get to the point where it just can completely simulate a person in every way possible. I mean, there's a strong argument we're in a simulation right now. It also reminds you of that joke, if life was a video game, what would be the review? It's like, well, the graphics are incredible, the plot is confusing, and the respawn takes a long time. That's life. It takes 20 years to spawn a human being and have them be fully conscious.

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> — ELON MUSK

I'm worried about the birth rate, which you alluded to earlier. The