Transcript for [NVIDIA CEO Jensen Huang's Vision for the Future](https://www.youtube.com/watch?v=7ARBJQn6QkM) by [Merlin AI](https://merlin.foyer.work/)

0:00 - At some point, you have to believe something. We've reinvented computing as we know it. What
0:03 - is the vision for what you see coming next? We asked ourselves, if it can do this, how far can
0:08 - it go? How do we get from the robots that we have now to the future world that you
0:13 - see? Cleo, everything that moves will be robotic someday and it will be soon. We
0:17 - invested tens of billions of dollars before it really happened. No that's very good, you
0:22 - did some research! But the big breakthrough I would say is when we...
0:28 - That's Jensen Huang, and whether you know it or not his decisions are shaping your future. He's the CEO of
0:36 - NVIDIA, the company that skyrocketed over the past few years to become one of the most valuable companies in
0:41 - the world because they led a fundamental shift in how computers work unleashing this current
0:46 - explosion of what's possible with technology. "NVIDIA's done it again!" We found ourselves being
0:51 - one of the most important technology companies in the world and potentially ever. A huge amount of
0:56 - the most futuristic tech that you're hearing about in AI and robotics and gaming and self-driving
1:01 - cars and breakthrough medical research relies on new chips and software designed by him and his
1:06 - company. During the dozens of background interviews that I did to prepare for this what struck me most
1:10 - was how much Jensen Huang has already influenced all of our lives over the last 30 years, and how
1:16 - many said it's just the beginning of something even bigger. We all need to know what he's building
1:22 - and why and most importantly what he's trying to build next. Welcome to Huge Conversations...
1:36 - Thank you so much for doing this. I'm so happy to do it. Before we dive in, I wanted to tell you
1:42 - how this interview is going to be a little bit different than other interviews I've seen you
1:45 - do recently. Okay! I'm not going to ask you any questions about - you could ask - company finances,

1:51 - thank you! I'm not going to ask you questions
about your management style or why you don't
1:55 - like one-on ones. I'm not going to ask you
about regulations or politics. I think all
2:01 - of those things are important but I think that our
audience can get them well covered elsewhere. Okay.
2:06 - What we do on huge if true is we make optimistic
explainer videos and we've covered - I'm the worst
2:13 - person to be an explainer video. I think you
might be the best and I think that's what I'm
2:18 - really hoping that we can do together is make a
joint explainer video about how can we actually
2:25 - use technology to make the future better. Yeah. And
we do it because we believe that when people see
2:30 - those better futures, they help build them. So
the people that you're going to be talking to
2:33 - are awesome. They are optimists who want to
build those better futures but because we
2:39 - cover so many different topics, we've covered
supersonic planes and quantum computers and
2:43 - particle colliders, it means that millions
of people come into every episode without
2:48 - any prior knowledge whatsoever. You might be
talking to an expert in their field who doesn't
2:53 - know the difference between a CPU and a GPU or a
12-year-old who might grow up one day to be you
3:00 - but is just starting to learn. For my part,
I've now been preparing for this interview for
3:06 - several months, including doing background
conversations with many members of your team
3:11 - but I'm not an engineer. So my goal is to help that
audience see the future that you see so I'm going
3:18 - to ask about three areas: The first is, how did we
get here? What were the key insights that led to
3:23 - this big fundamental shift in computing that we're
in now? The second is, what's actually happening
3:29 - right now? How did those insights lead to the world
that we're now living in that seems like so much
3:34 - is going on all at once? And the third is, what is
the vision for what you see coming next? In order
3:42 - to talk about this big moment we're in with AI
I think we need to go back to video games in the
3:48 - '90s. At the time I know game developers wanted
to create more realistic looking graphics but

3:56 - the hardware couldn't keep up with all of that
necessary math. NVIDIA came up with
4:02 - a solution that would change not just games
but computing itself. Could you take us back
4:09 - there and explain what was happening and what
were the insights that led you and the NVIDIA
4:15 - team to create the first modern GPU? So in the
early '90s when we first started the company
4:20 - we observed that in a software program inside
it there are just a few lines of code, maybe
4:27 - 10% of the code, does 99% % of the processing
and that 99% of the processing could be done
4:33 - in parallel. However the other 90% of the code
has to be done sequentially. It turns out that
4:40 - the proper computer the perfect computer is one
that could do sequential processing and parallel
4:45 - processing not just one or the other. That was the
big observation and we set out to build a company
4:52 - to solve computer problems that normal computers
can't. And that's really the beginning of NVIDIA.
5:00 - My favorite visual of why a CPU versus a
GPU really matters so much is a 15-year-old
5:05 - video on the NVIDIA YouTube channel where the
Mythbusters, they use a little robot shooting
5:11 - paintballs one by one to show solving problems
one at a time or sequential processing on a
5:16 - CPU, but then they roll out this huge robot
that shoots all of the paintballs at once
5:24 - doing smaller problems all at the same
time or parallel processing on a GPU.
5:30 - "3... 2... 1..." So Nvidia unlocks all of this new power
for video games. Why gaming first? The video games
5:41 - requires parallel processing for processing
3D graphics and we chose video games because,
5:47 - one, we loved the application, it's a simulation
of virtual worlds and who doesn't want to go to
5:52 - virtual worlds and we had the good observation
that video games has potential to be the largest
5:58 - market for for entertainment ever. And it turned
out to be true. And having it being a large market
6:04 - is important because the technology is complicated
and if we had a large market, our R&D budget could
6:10 - be large, we could create new technology. And that
flywheel between technology and market and greater

6:17 - technology was really the flywheel that
got NVIDIA to become one of the most important
6:21 - technology companies in the world. It was all
because of video games. I've heard you say that
6:25 - GPUs were a time machine? Yeah. Could you tell me
more about what you meant by that? A GPU is like a
6:31 - time machine because it lets you see the future
sooner. One of the most amazing things anybody's
6:37 - ever said to me was a quantum chemistry
scientist. He said, Jensen, because of NVIDIA's work,
6:46 - I can do my life's work in my lifetime. That's time
travel. He was able to do something that was beyond
6:52 - his lifetime within his lifetime and this is
because we make applications run so much faster
7:00 - and you get to see the future. And so when you're
doing weather prediction for example, you're seeing
7:05 - the future when you're doing a simulation
a virtual city with virtual traffic and we're
7:11 - simulating our self-driving car through
that virtual city, we're doing time travel. So
7:17 - parallel processing takes off in gaming and it's
allowing us to create worlds in computers that
7:24 - we never could have before and and gaming is sort
of this this first incredible cas Cas of parallel
7:30 - processing unlocking a lot more power and then
as you said people begin to use that power across
7:37 - many different industries. The case of the of the
quantum chemistry researcher, when I've heard you
7:42 - tell that story it's that he was running molecular
simulations in a way where it was much faster to
7:49 - run in parallel on NVIDIA GPUs even then than it
was to run them on the supercomputer with the CPU
7:56 - that he had been using before. Yeah that's true. So
oh my god it's revolutionizing all of these other
8:00 - industries as well, it's beginning to change
how we see what's possible with computers and my
8:07 - understanding is that in the early 2000s you
see this and you realize that actually doing
8:14 - that is a little bit difficult because what that
researcher had to do is he had to sort of trick
8:18 - the GPUs into thinking that his problem was a
graphics problem. That's exactly right, no that's
8:23 - very good, you did some research. So you create
a way to make that a lot easier. That's right

8:29 - Specifically it's a platform called CUDA which
lets programmers tell the GPU what to do using
8:34 - programming languages that they already know like
C and that's a big deal because it gives way more
8:39 - people easier access to all of this computing
power. Could you explain what the vision was that
8:44 - led you to create CUDA? Partly researchers
discovering it, partly internal inspiration and
8:53 - and partly solving a problem. And you know a
lot of interesting interesting ideas come out
9:00 - of that soup. You know some of it is aspiration
and inspiration, some of it is just desperation you
9:06 - know. And so in the case of CUDA is very
much this the same way and probably the first
9:13 - external ideas of using our GPUs for parallel
processing emerged out of some interesting work
9:19 - in medical imaging a couple of researchers
at Mass General were using it to do CT
9:26 - reconstruction. They were using our graphics
processors for that reason and it inspired us.
9:32 - Meanwhile the problem that we're trying to solve
inside our company has to do with the fact that
9:36 - when you're trying to create these virtual worlds
for video games, you would like it to be beautiful
9:41 - but also dynamic. Water should flow like water and
explosions should be like explosions. So there's
9:50 - particle physics you want to do, fluid dynamics
you want to do and that is much harder to do if
9:56 - your pipeline is only able to do computer graphics.
And so we have a natural reason to want to do it
10:02 - in the market that we were serving. So
researchers were also horsing around with using
10:08 - our GPUs for general purpose uh acceleration and
and so there there are multiple multiple factors
10:13 - that were coming together in that soup, we
just when the time came and we decided
10:20 - to do something proper and created a CUDA as
a result of that. Fundamentally the reason why
10:25 - I was certain that CUDA was going to be successful
and we put the whole company behind it was
10:31 - because fundamentally our GPU was going to be
the highest volume parallel processors built in
10:38 - the world because the market of video games was so
large and so this architecture has a good chance

10:43 - of reaching many people. It has seemed to me like
creating CUDA was this incredibly optimistic "huge
10:51 - if true" thing to do where you were saying, if we
create a way for many more people to use much
10:58 - more computing power, they might create incredible
things. And then of course it came true. They did.
11:04 - In 2012, a group of three researchers submits an
entry to a famous competition where the goal is
11:09 - to create computer systems that could recognize
images and label them with categories. And their
11:14 - entry just crushes the competition. It gets way
fewer answers wrong. It was incredible. It blows
11:20 - everyone away. It's called AlexNet, and it's a kind
of AI called the neural network. My understanding
11:24 - is one reason it was so good is that they used
a huge amount of data to train that system
11:29 - and they did it on NVIDIA GPUs. All of a sudden,
GPUs weren't just a way to make computers faster
11:35 - and more efficient they're becoming the engines
of a whole new way of computing. We're moving from
11:40 - instructing computers with step-by-step directions
to training computers to learn by showing them a
11:47 - huge number of examples. This moment in 2012 really
kicked off this truly seismic shift that we're
11:54 - all seeing with AI right now. Could you describe
what that moment was like from your perspective
11:59 - and what did you see it would mean for all of
our futures? When you create something new like
12:06 - CUDA, if you build it, they might not come. And
that's always the cynic's perspective
12:14 - however the optimist's perspective would say, but
if you don't build it, they can't come. And that's
12:20 - usually how we look at the world. You know we
have to reason about intuitively why this would
12:25 - be very useful. And in fac, in 2012 Ilya Sutskever,
and Alex Krizhevsky and Geoff Hinton in the University
12:33 - of Toronto the lab that they were at they reached
out to a gForce GTX 580 because they learned about
12:39 - CUDA and that CUDA might be able to to be used as
a parallel processor for training AlexNet and
12:45 - so our inspiration that GeForce could be the the
vehicle to bring out this parallel architecture
12:51 - into the world and that researchers would somehow
find it someday was a good was a good strategy. It

12:57 - was a strategy based on hope, but it was also reasoned hope. The thing that really caught
13:03 - our attention was simultaneously we were trying to solve the computer vision problem inside the
13:07 - company and we were trying to get CUDA to be a good computer vision processor and we
13:13 - were frustrated by a whole bunch of early developments internally with respect to our
13:19 - computer vision effort and getting CUDA to be able to do it. And all of a sudden we saw AlexNet,
13:25 - this new algorithm that is completely different than computer vision algorithms before
13:31 - it, take a giant leap in terms of capability for computer vision. And when we saw that it was
13:38 - partly out of interest but partly because we were struggling with something ourselves. And so we were
13:43 - we were highly interested to want to see it work. And so when we when we looked at AlexNet we were
13:49 - inspired by that. But the big breakthrough I would say is when we when we saw AlexNet, we
13:57 - asked ourselves you know, how far can AlexNet go? If it can do this with computer vision, how
14:04 - far can it go? And if it if it could go to the limits of what we think it could go, the type
14:11 - of problems it could solve, what would it mean for the computer industry? And what would it mean for
14:16 - the computer architecture? And we were, we rightfully reasoned that if machine learning,
14:25 - if the deep learning architecture can scale, the vast majority of machine learning problems
14:30 - could be represented with deep neural networks. And the type of problems we could solve with machine
14:36 - learning is so vast that it has the potential of reshaping the computer industry altogether,
14:42 - which prompted us to re-engineer the entire computing stack which is where DGX came from
14:49 - and this little baby DGX sitting here, all of this came from from that observation that we ought
14:56 - to reinvent the entire computing stack layer by layer by layer. You know computers, after 65 years
15:03 - since IBM System 360 introduced modern general purpose computing, we've reinvented computing as we
15:09 - know it. To think about this as a whole story, so parallel processing reinvents modern gaming and

15:16 - revolutionizes an entire industry then that way
of computing that parallel processing begins to
15:22 - be used across different industries. You invest
in that by building CUDA and then CUDA and the
15:29 - use of GPUs allows for a a step change in neural
networks and machine learning and begins a sort
15:38 - of revolution that we're now seeing only
increase in importance today... All of a sudden
15:45 - computer vision is solved. All of a sudden speech
recognition is solved. All of a sudden language
15:50 - understanding is solved. These incredible
problems associated with intelligence one
15:54 - by one by one by one where we had no solutions
for in past, desperate desire to have solutions
16:01 - for, all of a sudden one after another get solved
you know every couple of years. It's incredible.
16:07 - Yeah so you're seeing that, in 2012 you're
looking ahead and believing that that's
16:12 - the future that you're going to be living in now,
and you're making bets that get you there, really
16:17 - big bets that have very high stakes. And then my
perception as a lay person is that it takes a
16:22 - pretty long time to get there. You make these bets -
8 years, 10 years - so my question is:
16:30 - If AlexNet that happened in 2012 and this audience
is probably seeing and hearing so much more about
16:36 - AI and NVIDIA specifically 10 years later,
why did it take a decade and also because you
16:43 - had placed those bets, what did the middle
of that decade feel like for you? Wow that's
16:48 - a good question. It probably felt like today. You
know to me, there's always some problem and
16:55 - then there's some reason to be to be
impatient. There's always some reason to be
17:03 - happy about where you are and there's always
many reasons to carry on. And so I think as I
17:09 - was reflecting a second ago, that sounds like this
morning! So but I would say that in all things that
17:16 - we pursue, first you have to have core beliefs. You
have to reason from your best principles
17:25 - and ideally you're reasoning from it from principles
of either physics or deep understanding of
17:32 - the industry or deep understanding of the
science, wherever you're reasoning from, you

17:38 - reason from first principles. And at some point you have to believe something. And if those principles
17:45 - don't change and the assumptions don't change, then you, there's no reason to change your
17:50 - core beliefs. And then along the way there's always some evidence of you know of success and
17:59 - and that you're leading in the right direction and sometimes you know you go a
18:04 - long time without evidence of success and you might have to course correct a little but
18:08 - the evidence comes. And if you feel like you're going in the right direction, we just keep on going.
18:12 - The question of why did we stay so committed for so long, the answer is actually the opposite: There
18:19 - was no reason to not be committed because we are, we believed it. And I've believed in NVIDIA
18:28 - for 30 plus years and I'm still here working every single day. There's no fundamental
18:34 - reason for me to change my belief system and I fundamentally believe that the
18:39 - work we're doing in revolutionizing computing is as true today, even more true today than it
18:43 - was before. And so we'll stick with it you know until otherwise. There's
18:51 - of course very difficult times along the way. You know when you're investing in something and nobody
18:58 - else believes in it and cost a lot of money and you know maybe investors or or others would rather
19:05 - you just keep the profit or you know whatever it is improve the share price or whatever it is.
19:11 - But you have to believe in your future. You have to invest in yourself. And we believe this so
19:17 - deeply that we invested you know tens of billions of dollars before it really
19:25 - happened. And yeah it was, it was 10 long years. But it was fun along the way.
19:32 - How would you summarize those core beliefs? What is it that you believe about the way computers
19:38 - should work and what they can do for us that keeps you not only coming through that decade but also
19:44 - doing what you're doing now, making bets I'm sure you're making for the next few decades? The first
19:50 - core belief was our first discussion, was about accelerated computing. Parallel computing versus

19:56 - general purpose computing. We would add two of those processors together and we would do
20:00 - accelerated computing. And I continue to believe that today. The second was the recognition
20:06 - that these deep learning networks, these DNNs, that came to the public during 2012, these deep neural
20:13 - networks have the ability to learn patterns and relationships from a whole bunch of different
20:18 - types of data. And that it can learn more and more nuanced features if it could be larger
20:24 - and larger. And it's easier to make them larger and larger, make them deeper and deeper or wider and
20:29 - wider, and so the scalability of the architecture is empirically true. The fact
20:40 - that model size and the data size being larger and larger, you can learn more knowledge is
20:47 - also true, empirically true. And so if that's the case, you could you know, what what are the
20:55 - limits? There not, unless there's a physical limit or an architectural limit or mathematical limit
21:00 - and it was never found, and so we believe that you could scale it. Then the question, the only other
21:05 - question is: What can you learn from data? What can you learn from experience? Data is basically
21:11 - digital versions of human experience. And so what can you learn? You obviously can learn object
21:17 - recognition from images. You can learn speech from just listening to sound. You can learn
21:22 - even languages and vocabulary and syntax and grammar and all just by studying a whole bunch
21:27 - of letters and words. So we've now demonstrated that AI or deep learning has the ability to learn
21:33 - almost any modality of data and it can translate to any modality of data. And so what does that mean?
21:42 - You can go from text to text, right, summarize a paragraph. You can go from text to text, translate
21:49 - from language to language. You can go from text to images, that's image generation. You can go from
21:55 - images to text, that's captioning. You can even go from amino acid sequences to protein structures.
22:03 - In the future, you'll go from protein to words: "What does this protein do?" or "Give me an example of a
22:11 - protein that has these properties." You know identifying a drug target. And so you could

22:17 - just see that all of these problems are around
the corner to be solved. You can go from words
22:24 - to video, why can't you go from words to action
tokens for a robot? You know from the computer's
22:33 - perspective how is it any different? And so it
it opened up this universe of opportunities and
22:40 - universe of problems that we can go solve. And
that gets us quite excited. It feels like
22:48 - we are on the cusp of this truly enormous change.
When I think about the next 10 years, unlike the
22:56 - last 10 years, I know we've gone through a lot of
change already but I don't think I can predict
23:02 - anymore how I will be using the technology that is
currently being developed. That's exactly right. I
23:07 - think the last 10, the reason why you feel that way
is, the last 10 years was really about the science
23:12 - of AI. The next 10 years we're going to have plenty
of science of AI but the next 10 years is going to
23:18 - be the application science of AI. The fundamental
science versus the application science. And so the
23:24 - the applied research, the application side of AI
now becomes: How can I apply AI to digital biology?
23:31 - How can I apply AI to climate technology? How can
I apply AI to agriculture, to fishery, to robotics,
23:39 - to transportation, optimizing logistics? How can
I apply AI to you know teaching? How do I apply AI
23:47 - to you know podcasting right? I'd love to
choose a couple of those to help people see how
23:53 - this fundamental change in computing that we've
been talking about is actually going to change
23:58 - their experience of their lives, how they're
actually going to use technology that is based
24:02 - on everything we just talked about. One of the
things that I've now heard you talk a lot about
24:07 - and I have a particular interest in is physical
AI. Or in other words, robots - "my friends!" - meaning
24:16 - humanoid robots but also robots like self-driving
cars and smart buildings or autonomous warehouses
24:23 - or autonomous lawnmowers or more. From what
I understand, we might be about to see a huge
24:29 - leap in what all of these robots are capable of
because we're changing how we train them. Up until
24:37 - recently you've either had to train your robot in
the real world where it could get damaged or wear

24:43 - down or you could get data from fairly limited sources like humans in motion capture suits. But
24:50 - that means that robots aren't getting as many examples as they'd need to learn more quickly.
24:56 - But now we're starting to train robots in digital worlds, which means way more repetitions a day, way
25:03 - more conditions, learning way faster. So we could be in a big bang moment for robots right now and
25:11 - NVIDIA is building tools to make that happen. You have Omniverse and my understanding is this is 3D
25:19 - worlds that help train robotic systems so that they don't need to train in the physical world.
25:26 - That's exactly right. You just just announced Cosmos which is ways to make that 3D universe
25:34 - much more realistic. So you can get all kinds of different, if we're training something on
25:39 - this table, many different kinds of lighting on the table, many different times of day, many different
25:44 - you know experiences for the robot to go through so that it can get even more out of Omniverse. As
25:52 - a kid who grew up loving Data on Star Trek, Isaac Asimov's books and just dreaming about a future with
26:00 - robots, how do we get from the robots that we have now to the future world that you see of robotics?
26:08 - Yeah let me use language models maybe ChatGPT as a reference for understanding Omniverse and
26:17 - Cosmos. So first of all when ChatGPT first came out it, it was extraordinary and
26:24 - it has the ability to do to basically from your prompt, generate text. However, as amazing as
26:32 - it was, it has the tendency to hallucinate if it goes on too long or if it pontificates about
26:40 - a topic it you know is not informed about, it'll still do a good job generating plausible answers.
26:46 - It just wasn't grounded in the truth. And so people called it hallucination. And
26:55 - so the next generation shortly it was, it had the ability to be conditioned by context, so
27:03 - you could upload your PDF and now it's grounded by the PDF. The PDF becomes the ground truth. It
27:09 - could be it could actually look up search and then the search becomes its ground truth. And
27:14 - between that it could reason about what is how to produce the answer that you're asking for. And

27:21 - so the first part is a generative AI and the
second part is ground truth. Okay and so now let's
27:28 - come into the the physical world. The
world model, we need a foundation model just like
27:35 - we need ChatGPT had a core foundation model
that was the breakthrough in order for robotics
27:41 - to to be smart about the physical world. It has to
understand things like gravity, friction, inertia,
27:50 - geometric and spatial awareness. It has to uh
understand that an object is sitting there even
27:57 - when I looked away when I come back it's still
sitting there, object permanence. It has to
28:02 - understand cause and effect. If I tip it, it'll
fall over. And so these kind of physical
28:08 - common sense if you will has to be captured or
encoded into a world foundation model so that
28:16 - the AI has world common sense. Okay and so we
have to go, somebody has to go create that, and
28:23 - that's what we did with Cosmos. We created a world
language model. Just like ChatGPT was a language model,
28:29 - this is a world model. The second thing we have to
go do is we have to do the same thing that we did
28:35 - with PDFs and context and grounding it with
ground truth. And so the way we augment Cosmos
28:42 - with ground truth is with physical simulations,
because Omniverse uses physics simulation which
28:49 - is based on principled solvers. The mathematics
is Newtonian physics is the, right, it's the math we
28:56 - know, all of the the fundamental laws of
physics we've understood for a very long
29:02 - time. And it's encoded into, captured into Omniverse.
That's why Omniverse is a simulator. And using the
29:09 - simulator to ground or to condition Cosmos, we can
now generate an infinite number of stories of the
29:19 - future. And they're grounded on physical truth. Just
like between PDF or search plus ChatGPT, we can
29:30 - generate an infinite amount of interesting things,
answer a whole bunch of interesting questions. The
29:37 - combination of Omniverse plus Cosmos, you could
do that for the physical world. So to illustrate
29:43 - this for the audience, if you had a robot in a
factory and you wanted to make it learn every
29:49 - route that it could take, instead of manually
going through all of those routes, which could

29:53 - take days and could be a lot of wear and tear on the robot, we're now able to simulate all of them
29:59 - digitally in a fraction of the time and in many different situations that the robot might face -
30:04 - it's dark, it's blocked it's etc - so the robot is now learning much much faster. It seems to
30:10 - me like the future might look very different than today. If you play this out 10 years, how do you see
30:17 - people actually interacting with this technology in the near future? Cleo, everything that moves
30:22 - will be robotic someday and it will be soon. You know the the idea that you'll be pushing around
30:28 - a lawn mower is already kind of silly. You know maybe people do it because because it's fun but
30:35 - but there's no need to. And every car is going to be robotic. Humanoid robots, the technology
30:44 - necessary to make it possible, is just around the corner. And so everything that moves will be
30:50 - robotic and they'll learn how to be a robot in Omniverse Cosmos and we'll generate
30:59 - all these plausible, physically plausible futures and the the robots will learn from them and
31:05 - then they'll come into the physical world and you know it's exactly the same. A future where
31:11 - you're just surrounded by robots is for certain. And I'm just excited about having my own R2-D2.
31:18 - And of course R2-D2 wouldn't be quite the can that it is and roll around. It'll be you know R2-D2
31:25 - yeah, it'll probably be a different physical embodiment, but it's always R2. You know so my R2
31:32 - is going to go around with me. Sometimes it's in my smart glasses, sometimes it's in my phone, sometimes
31:36 - it's in my PC. It's in my car. So R2 is with me all the time including you know when I get home
31:43 - you know where I left a physical version of R2. And you know whatever that version happens to
31:49 - be you know, we'll interact with R2. And so I think the idea that we'll have our own R2-D2 for
31:55 - our entire life and it grows up with us, that's a certainty now yeah. I think a lot of news media
32:05 - when they talk about futures like this they focus on what could go wrong. And that makes sense. There
32:10 - is a lot that could go wrong. We should talk about what could go wrong so we could keep it from from

32:14 - going wrong. Yeah that's the approach that we like
to take on the show is, what are the big challenges
32:19 - so that we can overcome them? Yeah. What buckets do
you think about when you're worrying about this
32:24 - future? Well there's a whole bunch of the
stuff that everybody talks about: Bias or toxicity
32:30 - or just hallucination. You know speaking with
great confidence about something it knows nothing
32:37 - about and as a result we rely on that information.
Generating, that's a version of generating
32:45 - fake information, fake news or fake images
or whatever it is. Of course impersonation.
32:50 - It does such a good job pretending to be a
human, it could be it could do an incredibly good
32:56 - job pretending to be a specific human. And so
the spectrum of areas we
33:05 - have to be concerned about is fairly clear and
there's a lot of people who are
33:11 - working on it. There's a some of the stuff,
some of the stuff related to AI safety requires
33:18 - deep research and deep engineering and
that's simply, it wants to do the right thing it
33:24 - just didn't perform it right and as a result hurt
somebody. You know for example self-driving car
33:29 - that wants to drive nicely and drive properly
and just somehow the sensor broke down or it
33:36 - didn't detect something. Or you know made it
too aggressive turn or whatever it is. It did
33:41 - it poorly. It did it wrongly. And so that's
a whole bunch of engineering that has to
33:47 - be done to to make sure that AI safety is upheld
by making sure that the product functions properly.
33:54 - And then and then lastly you know whatever what
happens if the system, the AI wants to do a good
34:00 - job but the system failed. Meaning the AI wanted
to stop something from happening
34:07 - and it turned out just when it wanted to do
it, the machine broke down. And so this is
34:13 - no different than a flight computer inside
a plane having three versions of them and then
34:19 - so there's triple redundancy inside the
system inside autopilots and then you have two
34:25 - pilots and then you have air traffic control
and then you have other pilots watching out for