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Welcome to episode 19 of The Brainstorm.
I've just got one topic for you today, robots.
Nick, last week we went long this week.
Let's experiment with a short and snappy and just dive into robots.
I'll set the stage here.
The history of robots and robotics automation has been fairly specialized.
So if you think of the most successful robot to date, Nick, what do you think about?
Those pizza-making robots?
The one that went bankrupt.
No, I'm thinking more right.
I think the most successful ones have been so integrated into our life, we don't even think about them.
So something like a washing machine, dishwasher, those are pretty solid automations.
That's very...
Yeah.
Very...

Dishwashers don't work, though, if we're being totally honest.
That's a whole separate discussion.
Brainstorm.
Hold on.
This is a big...
I know this goes both ways with a lot of people here, but do you pre-rinse before going into the dishwasher, or you just don't even use the dishwasher?
No, definitely still use the dishwasher pre-rinse, but it's dependent on what type of food.
Like if you make a bowl of oatmeal, I think you have to pre-rinse, otherwise the dishwasher useless.
There are people out there who say with modern dishwashers and soap, you're supposed to leave the food on because that allows the soap to activate and do its job.
I saw that.
There are techniques to help the dishwasher, but why don't we just make dishwashers that do the job?
Right.
But needless to say, the dishwasher does not look like a human being.
I think this is a big debate and one that's worth diving into and one that we did in our Brainstorm, because right now we've got a handful of companies that are pursuing humanoid robots.
You've got Tesla.
They released a pretty impressive video of their Optimus robot, which looks like a human.
Figure AI is a startup.
They just released a video of their humanoid robot.
You've got Boston Dynamics, who's had a humanoid-ish robot as well.
There's the Chinese company that I'm blanking on their name, but they have a pretty crazy video.
They say it costs like $60,000 for a humanoid robot.
This big question is, we're at this point in time where we've got AI and computer vision getting to such a point where maybe it makes sense to design a more generalizable robotics platform.
Do you tackle this opportunity with a human-shaped robot, or do you think the future of robotics is still along that specialized route where you're going to have automation systems doing tasks in a more efficient way than a human could?
I think the history of technology and how it's progressed will point towards generalized robotics, and it will likely be in a humanoid form because it backfits to how we interact with the world.
I feel like we've said that in brainstorm a few times.
My one question is, because I think all of the robotics hype outside of the specialized models you gave a few years ago all focused on Boston Dynamics.
They're not humanoid.
You think they feel a little silly.
They took the dog-shape robotic approach.
Well, they've got one that looks like a person now.

Do they?
Oh, yeah.
You've seen the one do parkour.
That's them.
Yeah, the parkour one.
Yeah.
Okay.
So never mind.
They'll have dogs and humans and cats.
But I think a big difference there is, a lot of people say for Boston Dynamics it's very hard-coded, and so not necessarily as generalizable as using something as vision.
Yeah, and I think it actually ties back to what we were talking about last week with AI.
I do think, I mean, we talk about it, it seems like every week, but it feels like the progressions we're seeing on natural language processing, LLMs, that ties into this story because if you're going to give verbal commands to a humanoid robot, it can't be Siri or Alexa level smart.
It needs to be much more capable of understanding the nuances of human language for it to then be able to carry out the various tasks it's meant to do.
So I feel like the software side of the equation, I guess, well, I'll ask you a question.
Do you think the hardware or the software is currently holding back the market right now?
Great question.
I think hardware to a certain extent, and you see this with all of these companies that are doing the humanoid form, and they're like, why are there no parts for this, right?
We had to make these actuators ourselves in-house, miniaturizing them down to that level of, say, a joint and having them have appropriate torque and power and all of that, I think, was something that people hadn't really explored.
So I don't think it's a insurmountable hurdle.
I think that's the problem with all these startups, and they're just like, oh, we got to do this in-house, and they knocked that out.
But then I think almost certainly the barrier is going to be on the software side.
Yeah.
I think that follows with what we're seeing out there.
My next question for you, not to put you on the spot, but I think people would enjoy having you think aloud, how would you go about trying to model this opportunity?
What would be the steps you would take to think about what this market looks like?
Sure.
And that's actually a...
I can help.
I can help.
Yeah.
No, that's great.
Well, two things.

One, that's what I'm doing right now for our big ideas presentation.
Two, I'm going to have to get a new interview question, because I've been asking all of our candidates so far to do this.
But you can look at a few things.
One, it's like, what should the cost of this robot be?
And I think there, if you just look at the parts, if it is really just vision and motors and things like this, comparable to a car, I think is reasonable and justifiable for its use cases, especially if it can do manufacturing work and take over a shift or something like that.
I do think early applications are likely going to be in the manufacturing space, just given the companies that are developing these and the inherent benefits of them.
So if you do something like that, I think there's like 12 million manufacturing employees in the US.
Does each manufacturer, what if each person gets their own robot?
That's possible.
Or it's like, in the long-term scenario, why doesn't one person supervise three human-oid robots doing things?
And that's where I think looking at what it can actually be capable of is super important in sizing the market here.
What about when it is capable?
I think we've actually talked about this.
If you are able to create an app store, and you basically get to a point where the hardware is good enough to do most human function today and maybe even more, and then you could develop applications for it.
How would you go about, I assume that just increases the TAM significantly because you probably move outside of manufacturing and maybe actually into the household.
Maybe it becomes a consumer product.
The iRobot.
There's a robot that can take laundry out of the dryer and fold it.
That's a fair amount of time that you can save, and you could probably pay for that.
We were joking, right?
It's like you're sitting watching TV, the human-oid robot comes over, it just starts brushing your teeth.
Right.
Well, I'm actually tying it back to our joke before.
If you do have a generalized human-oid robot, you don't need a dishwasher or some of these specialized robots that you have in the house.
Right?
I mean, you probably still need a washer dryer, but I think you can get rid of the dishwasher.
Yeah.
Although, to me, that seems further out.
Or maybe it's like, why would you waste the robot's time dishwashing when you already have that in your house, like send it out to walk your dog or something?
But what do you think about?

So this was Brett Winton, our chief futurist, and he was making this comparison, which is the future of the robotics industry could emerge similar to the way early computers and calculators did, in that the very first computers were essentially calculators, and calculators are still and grew into its own industry, and that's fine.
You can operate in that segment and make money, but it's like general purpose computing grew into something far, far greater.
And so the future of robotics is probably a assortment of these calculator specialized tasks that can grow into sizable markets and be interesting.
But then there's this massive opportunity that, if you can achieve it, is much greater.
Yeah.
I think that makes sense.
And one idea that just popped into my head, because I was thinking about calculators, at least when we were back in school, the TI-80 models, we were going back and forth on this on Twitter.
But do you remember when they had, there was one version of the calculator that you could swap in and out different pads that did, they had different functions.
And if you think about a humanoid robot, there's no reason why it needs to have hands and arms in the same way that we have hands and arms.
You could, in theory, create specialized hands and arms for a specific task.
Yeah.
But then that gets to the question.
It's like, OK, so then...
I think it is specialized and then...
Right.
It's specialized completely to the exact purpose it needs.
Well, I think if you have the body and legs and then, obviously, the compute power, you can then specialize the individual functions of, or the adaptations of the arms, or maybe even the legs.
Yeah.
I think there's...
You can specialize on the hardware side and the software side, and you can generalize both on the software and hardware side.
So I think I agree with you.
I was just that kind of, I hadn't thought of that before until hearing you speak about it in this way.
All right.
Nick, as long as we're brainstorming some ideas here, is it a crazy idea for there to be...
Right now, it's like best in class toothbrush, right?
You got your son of care, your Oral-B, whatever.
Why isn't there like a mouth guard that's just like you put it in?
It's got like a little battery pack outside.
Who knows what?
You don't need to do anything.

It's just in your mouth with little electric motors vibrating some bristles or whatever.
Boom.
Brushes your teeth.
Done.
I feel like that's probably a thing.
I've seen toothbrush specs that are like multi-multi-bristle heads all the way around.
I think so.
I might just be making that up on the spot, but I'm pretty sure I've seen an Instagram ad for that.
And then I don't want to go on too long, but just another concrete example of how different visions of the future of robots change to different companies, and this is happening right now.
So it's like a long time, people are like, okay, how do I put sensors on a robotic hand so that it can pick up any item without crushing it?
How does this robot pick up an egg versus picking up a dumbbell?
It needs to know how much force to apply, all of this.
And is that a sensor problem or some other mechanical solution at the hand level?
Or in this new age, is it all computer vision?
And the computer recognizes what the object is, knows the amount of force, and can identify that.
And those are two very different approaches to robotics, and I've heard very recently just from different people that it's still an ongoing debate here.
I think I would very much lean towards the AI computer vision as the simple solution for what the future of robotics looks like and that generalizable platform.
Yeah.
I'd imagine it has to be both, right?
Like you need censoring for some things, and you need vision for most, if not all.
If you think about the egg example you gave, right, there's a difference between an uncooked egg and a hard-boiled egg, and you can hold those in very different manners, and vision doesn't tell you if an egg is hard-boiled or uncooked.
So you'd have to have some type of sensor in it.
Just a nose.
That too.
I guess you could...
Yeah.
Wow.
Yeah.
All interesting questions.
Yeah.
So if you're seeing this video, if you know someone in robotics, send it to them, have them comment.
We'd love to further this discussion.
We're doing active research on this area and trying to dimension these opportunities, the technologies involved, cost declines, and yeah, we'd love to interact with people

in the field or interested parties.
And I'll end on ultrasonic electric toothbrush.
You shaped automatic toothbrush for adults, 360, whole-mouth toothbrush.
It exists.
It's on AliExpress for $9.
So exactly what you said.
I think you saw that product and then said, wow, I have a great idea two weeks later when you forgot that you saw it.
Are we about to start a drop shipping operation?
No.
Really?
Not for that product.
All right.
Thank you everyone for joining and we'll see you next week for episode 20.
Episode 20.
See you everyone.