Where Are The Robots We Were Promised?

Transcript of the Human-Robot Interaction Podcast Episode 33. Published on 18 November 2024 by Christoph Bartneck at:

https://www.human-robot-interaction.org/2024/11/18/where-are-the-robots-we-were-promised/

Christoph Bartneck: [00:00:00] Good evening, um, I'm Christoph Bartneck and I'm going to talk to you about robots tonight. And first of all, a bit about myself. Uh, I'm 95 percent certain that I'm not a robot. I'm not entirely sure about you. Sorry, are you a robot? Are you sure? Are you a robot? No? Okay. Well, um, You're probably familiar with this question these days, that if you go to a website and it asks you to, you know, prove that you're a human and you have to identify crosswalks and bicycles and these sort of things, it's a little bit less normal to get this kind of question in a bar.

It's a terrible pick up line. So, I'm a scientist and therefore I usually start with definitions. So, the question is, what is a [00:01:00] robot? So, Can we just hear some voices? What are your favorite robots?

3CPO, cool. Anything else? Marvin, right.

Walking robots. Vacuum robots. Okay, cool. Excellent. Yeah, what else? Lawnmowers, also good. All right, anything else? Robbie, okay. So what we see is that there are robots that we actually maybe encounter in real life, like the vacuum of floors or the mobile lawn, and then there's like the science fiction things, all the stories that have been told.

And today we're going to talk about this, the difference between science and fiction. So, I don't have any slides, so I'll have to take you a little bit on a, rely on your imagination. The year is 1966. The [00:02:00] BBC is producing a TV show, black and white, 3x4, and it's about the future. The future in 1976. And they are showing us Abel Mabel, the housemate robot, that can do all sorts of wonderful things for you.

Not just cleaning, but it can wake you up. It can alarm you that his lordship, Lord Arthur, has arrived. And you can tell him, please, Lord Arthur, Bring the Lord in. All kind of wonderful things it can do. Its inventor, Professor Meredith Thing, claimed that this robot is technically, certainly solvable, and it's all pretty much on its way.

And he had actually built a prototype that, you know, to scale, that could work. And, and the only problem, really the only problem left is that developing a full first version would take a million pounds, and he doesn't have a million pounds. Now, I'm a scientist, researcher. I've got this problem all the time, asking for money.[00:03:00]

Um, but the problem with his robot is that it was completely puppeteered. There was no robot. There was actually, you know, things that could drive around a bit, and whenever the robot would do a task with a hand, it was just a stick kind of wiggling, and that was it. It was just a clever, clever, um, let's say, camera work, but that's it.

That's it. And so, shh, we should probably learn from this. Like, surely, like, inventors and scientists and CEOs will probably have learned from this that, you know, making these wild promises might not be such a smart idea. Now, why do you think how that got it on? Anybody listen to Elon Musk recently? So, Elon Musk recently, Announced not just his humanoid robot Optimus, but also that it would like do all the household work It would teach your kids and we'll do [00:04:00] all of these things so Essentially, he's promising us an Abel Mabel just like in 1966.

Nothing really has changed So and by the way tesla anybody here driving a tesla? I see one. Yes two dress. Okay So tesla by the way is no longer a car company You So, Elon Musk announced that, No, Tesla is now a robotics and AI company. That's the future. And, Optimus, by far, is the far more important product than their cars.

Because, well, if you, according to him, there's a limitless market for this. And everybody would want one. And, therefore, Tesla would get even more rich. So, again, nothing has really changed. So, the interesting thing is that our vision about what we want is crystal clear. Like, we want a robot that is [00:05:00] obedient, it can do all our work, and we've seen it in the movies.

Fundamentally, we want a Mr. Data that is smart and does all our work. And it's crystal clear. We know what we want. And that's not true for many other technologies. Very often we don't know exactly what we want. But this one is quite clear. So, I myself, you know, have worked with robotics for around 25 years now, and recently I visited, um, um, the university where I got my PhD from, in the Netherlands, in Eindhoven.

And, um, I also worked at Philips Research, um, for about three years. And you, you might know Philips from the televisions and, and several other products, but back then we actually developed the first social robot. And I'm not sure if I should be happy about it, but this robot that we developed, iCat, is now in the Phillips Museum.

It's a museum piece. And in a way I'm honored, but it also [00:06:00] makes me feel like a museum piece. And we don't call these robots failures, we call them first attempts at success.

And right now, there is a whole new generation of these robots coming out, and particularly about humanoid robots. Something like Optimus, something like Boston Dynamics Atlas, um, uh, Figure, and there's a huge amount of robots now coming from China. Like in the last one or two years, it's really ramping up quite dramatically.

And they all make a lot of claims, and one of them is that they will start these robots. And on mass production, very soon. So it's not just like a little robot in a lab somewhere, no. Mass production, which means they're going to sell them. And somebody's actually going to buy them. Which means they should be useful in one way or the other.

So that is what's happening right now. So, before I move [00:07:00] on, again, I like definitions, I'm a scientist. So I need to clarify three scientific terms. Puffery. Bullshit and lies. Let's start with puffery. Now puffery is a legal term that exists. And its purpose is to protect companies for the advertisement they do.

Because they make all sorts of wild claims. So, are you Can anybody from the bar here? Can I have a Red Bull? Okay. Okay. They're not here, I'm not sure where they are. Anyway, if you order a Red Bull, is it going to give me wings? Okay, so they lie. And they get away with it, right? And we, uh, we accept it. We think that, yeah, this is okay if advertisers do this.

So, that is puffery, in general. Now, how is this being done in robots? So when Optimus was first introduced, [00:08:00] um, Um, Elon Musk and Tesla pulled off a little stunt. They had a person, actually a robot that came up on stage, kind of doing the robot moves and then switched over to some wild dancing. And yeah, I mean, for the first couple of seconds he got me.

I thought like, wow, they already have a version. It's already done. Well, fantastic. You know, but then it was just turned out guy in a suit. And yeah, that is puffery. Anybody familiar with Boston Dynamics? Yeah? You've seen a couple of videos? A lot of them are dancing. Right? Dancing videos or parkour videos.

And it looks fantastic. And they actually did it. I mean, this is not CG or some sort of fake. The robot actually did it. Looks good, so far. However, this is an extremely controlled environment. And they, robots, they fail a hundred times before they get [00:09:00] it right. Just the one time, and that's the one, of course, they capture on video and show you.

So it's not the whole story. It's puffery. It's not real. Now, overall, Boston Dynamics, what a company. Fantastic. They've been working on robots for over 30 years, without barely ever selling a single robot. I mean, a fantastic company. A company that doesn't sell anything. Now, one of the first robots they are selling now is the robot dog called Spot.

And, well, you can buy this. It's quite expensive. Um, um, so, and this particular robot, for example, has been used, um, in a commercial. In a Super Bowl commercial. And what they were advertising for was beer. Now, in this commercial, that I cannot show you right now, um, they actually showed how this robot drinks [00:10:00] beer.

And how the robot is giving relationship advice to one of the security guys. Yeah, you can film that, you can pretend it's real, but it's not, it's puffery.

So, overall, I mean, they have done really good progress, the stuff they've done is fantastic. But can I ask, does anybody own a Boston Dynamic Robot, a spot or anything? Supposedly Trimble owns a couple of them and they are in Christchurch. Anybody from Trimble here? Okay, so what does that mean? I mean, maybe it's the wrong sample here, but it really means that it hasn't penetrated the market, the mass market at all.

So, what is the problem? So if you have this robotic dog spot and one of the premises like it can go somewhere where you don't want to go, or it's dangerous, like a power plant and it can walk and it can read [00:11:00] off a gauge and then it can report that back. Fantastic. Good idea. But if you start thinking about it.

Well, they are remote control gauges. You can just, you know, have a link with communication. You don't have to send the robot there. You just replace the gauge with something slightly more up to date. And you're there, you don't need the robot at all. Also, you need a person that actually controls the robot.

So, and if you already have a person in the back controlling the robot, then what's the advantage? You can just send out the person to do it. Well, you could argue, well, we make them autonomous and they can do all this task without a person. Yep. Maybe. But the effort you put into getting that done is probably better paid off by just buying a remote control or remote sensor gauge and you're done.

So that's puffering. Now let's move over to the next scientific term, which is called bullshit. And the scientific definition of this is that a person who's talking like me [00:12:00] and who doesn't care about the truth, slightly less than me. And. This person may or may not excellently be right or wrong. That doesn't really matter.

Um, but essentially it makes usually quite optimistic, uh, statements about himself or somebody else. But the person doesn't care about truth. Truth doesn't matter. That is bullshit. Now, examples of that. There's this TV channel called Al Jazeera. And they did an interview. Thank you. with the robot Sophia.

Sophia is an android, you might be familiar with it. And they ran a whole interview with this ask question and came back and the answers were really, really good. Really good answers, even humor in it, some jokes, really fantastic. And most people will be like, wow, look at that robot go. Fantastic. Problem is, if you're a roboticist like me, you kind of go like, [00:13:00] wait a minute.

It is extremely unlikely if that robot actually did this on the spot. The much more likely scenario is that the questions of a reporter were given to the robot upfront. The engineers crafted probably together with the PR department, some really nifty answers. They animated the whole thing and then played back.

It's puppeteering, nothing but puppeteering. Okay. That's not so much different from what we're talking about before, but the difference is here is that. Al Jazeera at no point did they acknowledge that this is just puppeteering. People were under the impression that this is an AI talking to them, right?

So they really don't care about the truth at all. Now let's go back to Tesla and the Optimus. They showed us a robot who could fold a t shirt. Now that's fantastic. I mean, I would love somebody to do it for me, but also it's a really, it's a task that's quite almost [00:14:00] trivial for us. But if you're a roboticist, you know, it's really, really hard for a robot to do.

It sounds trivial, but it's not. It's incredible hard. So they published this video and then people start to realize like, Hey, wait a minute, what's this guy doing there on the side of the frame? And it turns out it was just puppeteering again. They had a person and they motion captured the movement of this person who controlled the robot.

Puppeteering. Beginning to end. No autonomy. So. Bullshit. Now. Tesla is also currently in hot waters around some of the other claims they make. If we look at their cars, right? Full self driving. Autopilot. All these claims they made about what this car can do. And, and we've got some people here who got Teslas.

So, uh, did you buy the autopilot feature? Yeah. And how are you? Is it, is it completely autonomous? Right. If you don't mind dying. [00:15:00] Yeah. Okay. So there are several lawsuits going on right now that calling Tesla out on this is just wrong. You're making wrong promises. You're misleading people. Bullshit. Now Elon Musk himself, Almost every year, he claims, next year we'll have autopilot completely working.

Right now, they had robotic taxis, uh, announced for August 8th, I think it was. It was pushed back now, and it's gonna be pushed back probably again. And the problem is that we're letting him get away with it for far too long. I would argue that Elon Musk is hysterically optimistic. Now, let's move on to lies.

And, I'm sorry, going back to Tesla. They know how good and how bad their cars are. They know exactly what they can and cannot do. And they still choose certain terminology, [00:16:00] certain messages. They have intentions. They want to mislead people. Because that's how you sell cars. So, that is lies. You have the intention, you know the truth, and you want to mislead.

That's it. So has anything really changed in the last 60 years since we had Mabel Abel? So overall, the robotics that are currently being prepared, they make a lot of claims and the claims are usually about where it is going to be useful. And well, there are certain jobs that are maybe less desirable and we maybe don't want to do them.

And the argument is that robots have to fill this gap. An example here is Rodney Brooks, a professor from MIT, who started a robotics company, um, and they brought out a Baxter. And the argument was that due to the change in our society, with the aging society, we don't really have a choice. [00:17:00] Because there's not going to be enough people to take care of the elderly.

And therefore, we must develop robots that will help out. Now, figure, uh, and that sounds pretty good, you know? Sounds almost plausible. Baxter was on the market for maybe five years, and then they stopped because it was not financially viable. Figure is doing a whole big claim about labor shortage, particularly in logistics for like working in Amazon warehouses, and they've got troubles finding staff.

And I have to start wonder what, why is that? Why do we have such a problem for recruiting nurses, recruiting people in elderly care, recruiting people to work in the warehouses of Amazon? And the answer is, well, how about paying them better? Or how about giving them better working conditions? I think that is the key here.

And so, the technology is [00:18:00] not always a solution. It can be, but not always. And they are just using whatever they can, whatever shortage there is right now, and they say, yeah, you know, robots can solve this. So, ultimately, robots are solutions looking for problems right now.

Now, don't get me wrong, automatization in general has been going on for For hundreds of years, we try to automate those things that we don't like to do ourselves. Repetitive work, uh, hard labor work, we built machines to do this for us. And this will continue for physical, but also more recently for information.

A lot of these things now being automated by software and we don't have to do all these tedious calculations anymore ourselves. Another thing that, uh, to be raising up right now is AI and large language models. And if you think about it, we've got the robot hardware now, and we've [00:19:00] got the large language model and AI put them together, Mr.

Data, right? It seems like we're so close. And that is exactly what they thought back in 1966, that we're so close. It's almost there. And well, it hasn't happened. And the other question that we really have to ask ourselves is, do we want that robotic future? So, when you have robotic companies, one of the major players in the area of industrial robotics, who sells thousands of robots, KUKA, they make, occasionally, advertisement video, propaganda, and they show you robots, how these robots play instruments, like instruments for humans.

Piano, or bass, or any of these things. So robots playing instruments. Do you want that? Why not? Takes the fun out of it. [00:20:00] Quite right. Why would you want to automate something that is fun for us, that we do because we want to? It seems silly. It's also extremely inefficient. If you want a machine to make music, just use a synthesizer.

You know, just make computer music. It's so easy. Why would you go all the way of bringing in these clunky robots and doing things with real things? It's not necessary. All of this cannot be done with software. So, pretty bad idea. So, who's got a floor cleaning robot, Roomba, or anything else? One, two, three, four.

Wow, good. Something useful. Right? It actually does something. Isn't that wonderful? Do we want that? Probably? Yes. So overall, we want to automate things that we don't want to do ourselves. And that's perfectly legitimate. Now, coming back to taking care of the old elderly. [00:21:00] So that's what we want. We don't want to take care anymore of our elderly, because that's what we're trying to do.

We're trying to automate it. So, and yeah, I have an issue with that. How do you feel about that? Very mad. How would you feel about, you know, so the thing is with elderly care, it is not just about delivery of food or, or a little bit of cleaning. There's so much more to it. The human contact, the conversation, the checking in, there is so much more to it.

that really, can you replace it with a robot? Yeah, of course, you can make a conversation with a robot. You can put it there and they can talk to elderly. Sure. You can do it. But are we not just replacing one loneliness with another? And then of course you can argue, well, you know, what does it matter if your brain is so [00:22:00] toasted, you can't tell the difference anymore.

Who cares? Make a friend every day. Yeah, I have issues with that. So we have to ask our question, where is this coming from? Puffery, bullshit and lies. Why has this become such a big topic and so normal, it has been normalized? Well, if you are a company and like Boston Dynamics, never sell a product and just continue working on it, you need to attract funding.

And the funder that wants to hear an optimistic view of what you can do and how the future will be. Otherwise, why give you money, right? So it is a necessity to some degree. Same applies to me. I'm a scientist and I'm expected to apply for funding all the time. And I have to admit that in my applications and in many other applications that I get to review, it's full of [00:23:00] bullshit.

We have to make promises about the future, about the impact of our work, that we're almost pretty certain that either we don't really know if it's going to happen or not, or we're actually too optimistic. So we all agreed on playing this game of boasting about the importance of ourselves. Because if we don't, You don't get the money.

If you make a funding proposal about realistic, what Lee, what you can actually do and what can actually be achieved and what impact this will have on society. Realistically, you won't get money. And my research itself, I don't think is going to have any impact on New Zealand for the next 20 years. That's just truth.

Now, overall, I think we just have to become a little bit more patient. This idea of next year, two years, until the next election cycle, or [00:24:00] whatever it might be, is just too short sighted. If we look back to what robots and computers and AI has done over the last 50, 60 years, yes, massive progress. So, we're getting somewhere, but it does take time.

And so, we should really think about, not about what can robots do next year, but what can they do in 100 years? What can they do in 500 years? And this is the time scale that we really have to think about. So to some degree, it comes down to the marshmallow test. Are you familiar with a marshmallow test?

No. Okay. So the test works like this. Usually it's done with young children. You bring them into a room, let them sit in front of a marshmallow and you tell them, I'm going to leave the room now. You can eat the marshmallow or you can wait. And if you wait and I come back, I give you two. And the question is, does the [00:25:00] child wait?

Does the child have the self control to wait and get more? And whatever it turns out this child does is actually strongly correlated with future success in life. And as far as you can measure it. So, and that is our society today. We can no longer wait for a development to take 10, 20, 30 years. It has to be in two years time.

We have this Tesla's autopilot is always just one year away. Overall, all these hypes that we see today, they come and they go. Is anybody still in the metaverse? Anybody? Anybody locked into the metaverse in the last half year? Anybody's owning NFTs? Blockchain? Anything? So, these topics come and go, and what we [00:26:00] need is really a longer term vision about it.

So, overall we really have to dial back on the messages we send out.

And, see, as I said, I'm a scientist, and I'm in the business of not knowing anything. And that's quite hard, really. Because it's so easy to like, Oh, I know this, I know this, to bullshit your way, any way through. As a scientist, you know how little you actually really know. And that is hard. And that is actually the business of science to start with.

If I do a scientific project, and I know the answer, it's not science. The idea is to do something you haven't done before, to find an answer to a question that you did not know the answer before. If I write a funding proposal right now, it should be about something that I don't know. And if I don't know the answer, how can I [00:27:00] possibly make a projection about how this is going to impact New Zealand, how many dollars it's going to save, or anything like this.

Science is about doing things we do not know. And scientists need the space and the room to do this. We need to have time. And this place and the money to tinker, to try things out. And for that, we need patience, patience and trust. See, as a scientist these days, I am pretty much cut up from any responsibility about who getting funding in a sense of deciding on a topic.

Usually topics are given usually by the government who says, now this is the topic, here's the funding call, please apply for it. And therefore they steer. kind of, uh, science in certain directions. And the idea is that you cannot possibly trust scientists to decide for themselves what is important. No, that would be far too dangerous, and we have to be accountable.

So therefore, we have to kind of give them the topics they are supposed to work on. [00:28:00] And usually, these days, science happens not because of this, but despite of this. So, overall, Please be patient with us. It's going to take us another hundred years to give you a Mabel Abel And until then you will have to make do with humans

That was totally fantastic, please put your hands together for Chris I definitely want robots to do all the menial labor So I can do all the fun things like play music and make art and all the things that are important, right? Great. Um, well, we have a few minutes for questions You So, does anybody have a question for Christophe?

Yes? Oh God, I don't need the microphone. Okay. You [00:29:00] speak very out. You say scientists need

time to tinker. If you're going to

Okay. So, the assumption here is, again, like, how can we trust scientists to do good work that is relevant to society and that they actually progress something and, or that they do anything at all? Well, you know, they could just spend all this money on drinking coffee. Right? That's Well, see, you really misunderstand what it means to be a scientist.

To become a scientist takes such an enormous amount of time and effort and work, and whoever actually gets through and makes it are usually intrinsically motivated. So, people are scientists, they don't, they don't Sit around, do nothing. There are usually possessed. So it's not about [00:30:00] how do we get them to work?

It's more like, how can we make sure that they don't, let's say, burn out? That is actually the bigger problem here. Um, how do they align with society? Well, again, the assumption is, well, we're humans too. You know, we, we want good things and we've got a good judgment about what is important for society. And just not trusting us and telling like, No, you have to work on this topic and you have to work on that topic.

Kind of really limits us to the imagination of these people who make the funding calls. And they're not the scientists who actually have a better understanding of what, where knowledge is at. It's usually aligned with industry. So whatever major industry you have in this country, agriculture, so major industry, so how can we make more of that?

So that's usually the main, main thrust.[00:31:00]

Yeah, so I'm not always sure whether, so your argument is like, look, if we actually, the people who make these kind of decisions about what kind of topic to Research like and I've seen honestly too many examples of where I have no idea where that idea came from and why they're doing that Um that I am not convinced that there are any better at it than we are Well,

it's mysterious sometimes The mysterious things happen. How suddenly a certain funding call happens, um, mysterious ways. Yeah, sometimes they make a panel and they make calls, but really, to me, to large degrees, it's a [00:32:00] mystery. But,

so, computer science and information theory has always followed Moore's law. So, why do you think engineering doesn't, in that respect? Or do you think engineering has not followed Moore's law?

So Moore's law, for those people who are not familiar with it, is essentially a guy back in the 60s, 70s, made an observation that the number of capacitors on a chip kind of doubles every two years or something like this. That was the prediction. And it's based in hard way on the development of chips. And it's been more generally, uh, considered as a sort of indicator for progress.

Like computers get faster. Essentially that's the major, major idea. So Is computers and they're getting faster any different from from robots? Yes, there are actually I've been wondering this myself like why don't we make the same amount of progress and to some degree it is really just[00:33:00]

Nature really motors haven't become any cheaper or any more powerful. There is not really much of a new development around motors. They have been what they've been for a long time and not much improvement, not even in terms of bringing down the price. Motors are still quite, quite expensive. Um, but the other problem is like, even if you've got, let's say the hardware things kind of, okay, they, they are still expensive, but tasks like folding a t shirt, incredibly difficult.

for a robot for a variety of reasons. Um, the most medial tasks that we do in like an instance turn out to be extremely complicated. And that really shows us how claiming that we'll have a robot that'd be how useful in the household and being able to deliver one or two different things doesn't necessarily mean we should stop working on them, but we should working on them.

But please dial it down[00:34:00]

in the back.

An industrial robot that sprays cars to Andy from Bicentennial Man. Where is your belief in robotics on that scale? Belief in what? Where would you like it to be going towards? Well, there are two components here. One is that something that's purely focused on function, that does something pretty good, and we do that.

And for that, you don't need a human shape. Essentially, it's actually quite disadvantageous to have a human shape. Walking on two legs, it's a pretty bad idea. Gravity's a bitch. So, being able to roll around, much safer and easier. So, that is pure function. The other extreme, where you say it's like, something like a social character that fulfills companionship, you can talk to, build relationships.

We call them usually social robots. Um, and it's much easier to find a good justification for things that actually work [00:35:00] and that do things. Much easier. For social robots, much harder. What, what purpose do they serve other than, yeah, okay, you can talk to them, but then so what? Why does it, what, what, what's the added value?

That's, that's much harder to define. So where do I want it to be? Of course I would love to have Mr. Data. That would be fantastic. Um. And, and personally, I'm quite fascinated with trying to make robots polite. And it sounds trivial. Oh boy, is that difficult. Yeah. Let's say a C3PO versus an R2D2. R2D2 is dense.

C3PO is more of a social interaction. So[00:36:00]

is there a sort of a, a distance perhaps

Well, to have communication, you don't really need a body. You can literally, you can, yeah, you can just have a face on your phone. You already have a phone, so put a face on it, talk to it, be happy. Is that going to solve loneliness? It depends on how you, so, I would have an argument. I predict that you've got more physical contact with your phone than with your partner.

So in that sense, they are already succeeding, right? Does that [00:37:00] make you, does that make us feel less lonely? Uh, debatable. My phone doesn't make me feel good. Ah. It's

So

has, who's seen the movie Her?[00:38:00]

So, is the protagonist in Her less lonely?

Debatable. Do we have other questions? In the back. Advances in robotics. So I'll just read. Advances in robotics. And I guess there's really two ways you can look at advancing robots. One is obviously making them smarter, better, faster. And the other side of it is controlling the environment. Yeah. Do you see us going down another route like

that? Sure. So overall, so the idea is like these days when you have a robot and you have it in a factory, let's say, the idea is you build a cage around it. And don't let any human in. Because these robots have no idea [00:39:00] about the presence or about the fragility of humans. Right, they just, boom, smash in you.

The first recorded death by robot, I think by industrial robot, was around 1983. You know, worker climbed over the fence, got hit, done. So, So the idea is control the environment, then separate them, and then the robots can operate more easily and can do the work they're supposed to do, and that's better.

Okay, sure, that's, that's one way of going about it. And for cars, it's the same thing. It's like, you know, make the roads better, do them in a way that's easier for the machines to perceive or to deal with, and that will make things better. And yeah, sure, that, that is a good thing. Of course, um, The idea with these humanoid robots is that they're supposed to come into our house.

And the assumption here is that in order to be able to operate in our homes, they roughly need to have the shape like us, because we already modelled our environment to our needs. So you need to have a robot that's, you know, this high, that can [00:40:00] reach here, can, you know, reach into the drawers, that can all of these things.

So they should adapt to us rather than we adapt to them. Um, how is this going to end up? Well, again, ideally we want them to adapt to us. That's the, the preferred scenario. Uh, right now we can't do it. So we do the other way around. So we build them like, you know, let them drive around on the floor because that's the thing they can do.

Uh, walking around, any of these walking robots. Battery life, maybe an hour or two, and they're done. So, yeah, it's going to take a while.