The Story Of Boston Dynamics

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[00:00:00] **Dwain:** Hi Christoph.

[00:00:01] **Christoph:** Hi, Dwain. How are you doing?

[00:00:03] **Dwain:** I'm good. I'm almost ready to submit my PhD thesis.

[00:00:06] **Christoph:** That is great. What you got for me?

[00:00:09] **Dwain:** You know the company Boston Dynamics?

[00:00:11] **Christoph:** The one with the impressive YouTube videos of robots performing all sorts of tricks?

[00:00:17] **Dwain:** Yes, that one. Well, the latest robotic dog Spot featured in the super bowl commercial for the Sam Adams beer brewery.

[00:00:26] **Christoph:** What? Why? Robots don't drink beer!

[00:00:31] **Dwain:** Let me play some of the highlights for you.

[00:00:33] **Christoph:** Okay.

[00:00:45] **Dwain:** What do you think?

[00:00:47] **Christoph:** The camera was on the cousin while the Spot robot drank the beer.

[00:00:53] **Dwain:** Exactly. Nice editing wouldn't you say?

[00:00:56] **Christoph:** Yes, they nicely worked around the problem that a beer shower could short-circuit the robot. Plus Spot doesn't have a mouth. So there is no way to even catch the beer, let alone digest it.

[00:01:12] **Dwain:** Well, it gets better. How about this scene?

[00:01:19] **Christoph:** So the Spot robot shakes its head to indicate that he should not send the text message and then takes the phone off from the cousin from Boston.

[00:01:31] **Dwain:** Yes. Would you not take relationship advice from a robot dog?

[00:01:36] **Christoph:** Um, well, I'm not sure.

[00:01:40] **Dwain:** Hm. What do you think about the commercial?

[00:01:43] **Christoph:** It's funny. It even includes a robot photocopying it's ass.

[00:01:49] **Dwain:** Point taken. But how did a high-tech company that got it start producing robots for the U S military wind up as a novelty and a beer commercial.

[00:02:00] **Christoph:** Good question. Shall we talk about it?

[00:02:03] **Dwain:** I think we have to.

[00:02:25] **Christoph:** Dwain, you looked a little bit into the history of Boston Dynamics. How did they get started?

[00:02:33] **Dwain:** Well, the company was founded in 1992 by Mark Raibert while he was working at the leg lab at MIT. Raibert had been working on developing dynamic robotic products since the 1980s. Other members from the lab also joined the company. And in 1995, the company separated itself from the university altogether. So in terms of R and D funding during this time, Boston Dynamics was financed by the U S military and DARPA contracts.

It's worth mentioning also then in addition to developing robots, Boston Dynamics also developed 3d simulation software. According to current CEO, Robert Playter, this early funding allowed them to create their fundamental technology and enabled them to keep innovating.

Boston Dynamics was a spin out company from the MIT? What happened next?

Google Phase

[00:03:26] **Dwain:** Well, in December, 2013, the company was purchased by Google for an undisclosed amount. Google at the time had bought eight other robotic companies in the six months leading up to the purchase. Speaking about the acquisition, the CEO and founder, Mark Raibert said that he was quite excited by Andy Rubin and Google's ability to think very, very big with the resources to make it happen. Anyway, the nine robot focus companies became a new robotic division of Google called replicant, which was lead by Android. Co-founder Andy Rubin.

[00:04:00] **Christoph:** What companies did Google buy?

[00:04:03] **Dwain:** Among the companies acquired where shaft a startup developing a humanoid robot for helping out in disaster efforts. Industrial perception, a startup that worked on computer vision and robot arms for loading and unloading trucks. Mika, which built a humanoid robots for research purposes and Redwood robotics, which designed robot arms.

Returning to Boston Dynamics, as already mentioned up until this time they had been funded by government contracts. However, Google had no interest in being a military contractor. This meat, this revenue stream stopped. Turns out, owning Boston Dynamics is an expensive undertaking. It reportedly costs Google around 50 million annually.

Still under Rubin Boston Dynamics was permitted to continue its research. However in October, 2014, Andy Rubin, left Google. A year later, the co-founder of replicant James Kuffner also left.

[00:04:58] **Christoph:** This is Rob Cheek from Huyndai. Boston Dynamics is currently owned by Huyndai.

[00:05:08] **Rob:** So Google at the end of the day is a software company. They did dabble. They had that shopping spree a few years back where they were just buying everyone. And then I believe the chap who was running the robotics division, if memory serves, he left the organization and then Google had some other internal changes and then they kind of exit most of their robotics businesses. And then of course, Waymo was separated from the firm.

[00:05:36] **Dwain:** Shortly after, Google now alphabet, executives had realized that Boston Dynamics was not going to generate substantial revenue anytime soon. The new head of replicant, Jonathan Rosenberg declared that he could not afford to spend over 30% of their resources on things that would take up to 10 years to be commercialised.

[00:05:56] **Christoph:** I think Google could have also held on to Boston Dynamics in the same that Huyndai is holding onto it right now as well. You're not responsible for their decisions and maybe they made the wrong decision. But if you could go back in time and advise Google, what would you advise them?

[00:06:14] **Rob:** I don't know if I would have agreed with Google's decision. For Huyndai the outcome was good. If I were working on team Google then I probably would have advised against it.

[00:06:25] **Christoph:** It seems like Boston Dynamics move through google was largely connected to the people coming and leaving the organization. Still, Google did hold onto Waymo and they also created the everyday robotics group. Google's position is similar to that of Huyndais'. They both operate in the area of autonomous vehicles and mobile robots. The, every robotics robot is a wheeled platform with a robotic arm, just like the Stretch robot from Boston Dynamics.

[00:07:01] **Dwain:** Google could have just kept Boston Dynamics. Although the everyday robot is targeted at the home while Boston Dynamics is targeting logistic centers with their Stretch robot.

[00:07:12] **Christoph:** We can speculate maybe 20, 30 years. But it always just took companies in the past around three years to realize that we do no longer want to own Boston Dynamics. So Google must have changed their mind within three years. Would this not be a clear warning signal that maybe there's something wrong?

[00:07:32] **Stephen:** Well, it could be. And I guess if you were the board at Huyndai, you'd want to be taking a close look at that. And in particular, if you were shareholders of Huyndai you'd want to be asking the board about that. They're welcome to do with their money, what they wish.

But I guess, yes, you'd want to have a look and say, why is this asset been sold? Did the buyers find out that, in fact it wasn't as good as what they thought it was and now they want to flick it on. Very often when you buy something, it's a phenomenon in the market called asymmetric information. The seller knows something that you don't. So if you think about buying a used car, the seller knows something about that car that you don't, and it's hard for you to find that out. What that means is that you can end up overpaying for a car.

You wanted a good car, you ended up with a poor one because you couldn't really tell and potentially that's true here. Huyndai probably only find out what the real usefulness and value of their company is once they've bought it. And maybe they find out it's not as good as what they had hoped. I don't know.

[00:08:30] **Christoph:** This is Stephen Hickson from the University of Canterbury.

[00:08:33] **Dwain:** It is interesting to note that Google dropped their motto, "do no evil" in 2018, shortly after they had acquired Boston Dynamics. Given the Boston Dynamics was previously financed through the U S military, this does seem to be a logical step.

[00:08:49] **Christoph:** I remember that Google employees protested against Google working for the Pentagon and 2019.

[00:08:56] **Dwain:** Um. The true motivation for Google selling Boston Dynamics will probably remain unclear.

[00:09:02] **Christoph:** What happened to the other robotic companies that Google had bought?

[00:09:07] **Dwain:** According to the New York times, all the robotics startups purchased by Rubin were either sold or shut down by alphabet.

Softbank Phase

[00:09:22] **Christoph:** This brings us to the SoftBank phase of Boston Dynamics.

[00:09:26] **Dwain:** Eventually Boston Dynamics was purchased by SoftBank in 2017 for a reported 165 million. Both Boston Dynamics and SoftBank appeared to be happy about the deal with Mark Raibert expressing how excited he was to be part of quote SoftBank's bold vision and its position creating the next technology revolution.

So virtually the same thing you said about the Google acquisition. Perhaps most significantly, under SoftBank Boston Dynamics began offering its first commercial product, Spot in June 2020. Nonetheless, SoftBank struggled to commercialize the product. Some suspect that this may have been due to the particular look of the robots that Boston Dynamics builds, which may be undesirable to the consumer market.

[00:10:12] **Christoph:** We have to provide a little bit of context to make sense of SoftBank's purchase of Boston Dynamics. SoftBank had entered the robotics market with their purchase of Aldebaran robotics already in 2012. They pushed the development of the pepper platform, in addition to the Nao robot.

[00:10:34] **Dwain:** Didn't Aldebaran also have a walking humanoid similar to Boston Dynamics' Atlas robot?

[00:10:41] **Christoph:** Aldebaran develop the Romeo robot, but I don't think it ever sold in numbers. It remained a research project, largely funded through the European Union.

So before Huyndai bought a Boston Dynamics prior to that SoftBank bought it for 188 million us dollars. Is that the anchor you're talking about?

[00:11:05] **Stephen:** That might have some effect. I think any other buyers going to look at that and say, well, they bought it for 188 million, so we know it's not worth a million. That's market information. Now how much they weigh that that's entirely up to the individual person. They might look at that and go, that's crazy. I would never have paid that. Or they might go, well, that is so cheap. I would clearly pay more than that. I don't know how each individual buyer is going to weigh that information, but it's certainly market information that they'll take account of. What did the company last sell for?

[00:11:35] **Christoph:** And what is the anchoring effect?

[00:11:39] **Stephen:** When you're determining a market price and in a perfect world, you think that a, what economic agents would do is assess the value of all the information that they've got weigh up the future risks

and possibilities, and come up with a price that they feel comfortable with, including all of the risks which they are taking on the uncertainties, the things that are unknown and capsulating that in the market price.

However, People don't act independently and they see the way that others might also value something. And the anchoring effect is where you might see the valuation by someone else. And that influences your price. So we see this often in say real estate sales, where the real estate agent will advertise a house for say offers over $1 million.

They've just anchored the price for you. You now know that you don't go in under a million. And so it, even if, a little bit subconsciously you think, Ooh, that house must be worth a million dollars. They've anchored your price there. And so that can have a powerful effect. If you see others with what looked like bids ahead of yours, you might start to think maybe I've undervalued this company. Maybe they know something. I don't. Maybe I haven't got my assumptions right about the underlying information. So you start to anchor your price perhaps to theirs.

Huyndai Phase

[00:12:52] **Dwain:** In December, 2020, Huyndai purchased Boston Dynamics for 880 million for an 80% stake. SoftBank group pertains about 20% through an affiliate.

[00:13:04] **Christoph:** SoftBank paid $188 million for the company and Huyndai paid 880 million us dollars. Is it common for companies to quadruple their value within three years?

[00:13:19] **Stephen:** I'm not sure I could give you exact figures on that. I think that for high value companies, that's less likely because of course there's a difference between quadrupling from a company with a hundred thousand dollars to $400,000 and one worth 200 million to 800 million.

So clearly for small companies, it's much more achievable and you do hear that small companies who start with one person in their garage three years later, they're employing 20 people kind of thing. And wow, that's big growth. That's not like you're not likely to see Google grow like that in the same way.

So it does happen more. I would suspect with smaller companies, but if in fact a market sentiment has changed and people have realized that actually robotics are the next best thing then potentially you could see that could also be driven by somewhat hubris.

[00:14:07] **Christoph:** But the question that comes with it, it almost seems that's quadrupling of the value. It almost seems that way, that the vision of the future is what they bought. And as you said, maybe it's true. Maybe this vision will come to life. Maybe not, or maybe it will gonna take 20, 30 years maybe even longer to realize. As we agree that you can't really predict the future, right. We don't know what's going to happen. So we can't ultimately judge Huyndai for their decision. But the one thing that I'm personally concerned about is when rational decision-making is clouded by Not justified

[00:14:45] **Stephen:** by hubris.

[00:14:46] **Christoph:** Yeah.

[00:14:47] **Stephen:** Yeah. And that may well be true. They may well be overly optimistic about what this brings, but that's the nature of the dynamic capitalist system that we have. It's a process of discovery as opposed to mandating. Firms are having to try and work out where their next best option and alternative is in an uncertain world. So maybe robotics will be the greatest thing out, in which case Huyndai have bought this for a steal that's possible, or maybe they're overly optimistic about this and that it turns out not to be the thing, or it turns out that robotics is the thing, but not this expression of it.

Someone else emerges into the market with a better product, which just simply sweeps the floor. And so Huyndai go, well, we bet it on the right horse race. We just did a bet on the right horse. And so that could turn out to be the case, but again, that's the nature of the risk taking.

Have a look at the number of fortune 500 companies now compared to what they were 40, 50 years ago, it's a different set of companies. Some companies adapt some change, others don't how many Kodak products do you buy today? And yet Kodak was one of the world's biggest company. Back in the day. So that's the dynamic nature of this and some choices turn out to be fantastic. Other choices turn out to be if we had that time again, I don't think we do that.

[00:16:13] **Dwain:** Huyndai is positioning itself as the leading robot manufacturer, as well as a smart mobility solution provider. At CES this year, the company revealed its grand vision for the future of mobility, moving beyond the traditional view of transportation and using robots as a medium between the real world and the metaverse, among other. Speaking about this acquisition. Now chairman Marc Raibert said that quote, Huyndai and Boston Dynamics is a match made in heaven. Hyundai is a mobility driven robotics company, making robots that can go anywhere on earth and beyond.

He also highlighted that having all the resources of Huyndai is a quote, a huge asset for Boston Dynamics. Does this sound familiar?

[00:16:57] **Christoph:** It does.

[00:16:59] **Dwain:** Nonetheless, Hyundai appears to be focused on becoming a mobility solution provider and they have deemed robotics to be central to that vision. Mobile robots and warehousing manufacturing and infrastructure are expected to reach 64.9 billion in 2030. In turn Boston Dynamics are building for use cases such as mobile box moving via its Stretch robots.

Stretch is expected to go on sale this year through Boston Dynamics though Boston Dynamics has yet to disclose a price point. Computer vision software that power Stretch can also be purchased. Boston Dynamics is apparently working with a few early adopter companies, but would not disclose the identity of these companies.

The entry level Spot Explorer is $75,000. Boston Dynamics has allegedly, sold several hundred Spots. Accessories, such as cameras are sold separately and can be expensive. For example, $29,000 plus. They are apparently generating revenue from their robots, primarily Spot. The cost of development is covered by Hyundai and SoftBank Boston Dynamics is looking at other industries, including entertainment.

Interview with Rob Cheek

[00:18:21] **Christoph:** To better understand Huyndai's strategy I had the pleasure to interview Rob Cheek.

[00:18:27] **Rob:** My name is Rob Cheek. I work for the investment banking arm of the Hyundai motor group. I look at investments for the group both internally and externally. So what does that mean? On the one hand, we look at companies specifically robotics, some emerging technologies that may be of interest to the group for direct investment or for investing in or partnering with, or perhaps acquiring. And we also work with external clients as the banking arm for investments that some clients may want to invest in external out. When I say external, I mean, outside of the Hyundai motor group. It's a conglomerate of companies. The parent company is the motor company.

[00:19:12] **Christoph:** Why did Huyndai buy an 80% share of Boston Dynamics? You get extra points. If you do not use the words, synergy, strategic, sustainable, and future.

[00:19:26] **Rob:** Well, my, my first sentence had all those words. What am I going to do? Yeah. Without using those words, as you probably can tell from CES this year where we did not show any cars. It was all robotics. So we are as a group we're very interested in the obviously robotics, the Metaverse and other future technologies. Transformative technologies. And specifically with Boston Dynamics, I would have to say, we see it as part of a robotics value chain.

Where we see their technologies can be applied to manufacturing, construction, automation, logistics. So not only is it we believed a good investment for the group, but also as a business arm to serve other customers outside of the group. We also believe that the capabilities of the team at Boston, working with companies together can generate tremendous value for not only our organization, but for external customers as well.

[00:20:33] **Christoph:** Huyndai already has industrial robots since 1984. Why did Huyndai need Boston Dynamics?

[00:20:43] **Rob:** That's a good question. we do have a large presence in industrial robots. One of the biggest in the world. Having said that as you will know traditional industrial robots are a red ocean not terribly flexible. We see the technologies at Boston Dynamics and the team and what they can do in next generation, robotics being very promising in terms of where we can deploy those.

For businesses and we see use cases that are really what we believe are far beyond what the general market would see for perhaps Boston Dynamics and industrial robots in general.

[00:21:27] **Christoph:** Is Huyndai building the Boston Dynamic robots?

[00:21:31] **Rob:** I'm sorry, but I cannot comment on that question

[00:21:37] **Christoph:** I didn't expect that.

Boston Dynamics of course, is located in the US and

[00:21:49] **Rob:** correct.,

[00:21:49] **Christoph:** Huyndai robot manufacturing seems to be in Korea. I was just wondering, are there any plans to move any of the companies like moving Boston to Korea or moving some of the manufacturing to the US?

[00:22:09] **Rob:** I wouldn't be able to comment on that either. I apologize.

[00:22:15] **Christoph:** Well, maybe I'm more lucky with my next question. Boston Dynamics was worth 166 million when SoftBank bought it from Google. Huyndai paid 880 million, just three years later. How did Boston Dynamics quadruple its worth in such a short period of time without selling a single robot?

[00:22:40] **Rob:** That's a great question. And I think that might be answered in two or three parts. So the first part would be in terms of the value of Boston Dynamics growing over a three-year period. If you look at all asset classes, no matter what it is, over the past few years, you can see that valuations across the board, no matter what it is, have risen in particular technology companies, robotics and AI in particular have climbed at an even faster rate during the same period. When it comes to selling of a single robot, I can say that There could have been sales, but it's just something that wouldn't have been published.

[00:23:23] **Christoph:** Okay. My interpretation out of that would be since Boston Dynamics had so much to do with the military in the past that they provided some robots to the US military?

[00:23:36] **Rob:** I can't comment on that.

[00:23:40] **Dwain:** What are some of the primary value factors other than the sales of a single robot. Which is trying to understand what makes it so valuable?

[00:23:49] **Rob:** That's a good question. So really when you value a company like Boston Dynamics or any emerging technology company, you look at the potential of that technology of that team and where you could turn that or transform that into a business or into sales the end of the day.

And it doesn't necessarily have to be tomorrow or even next year. But when you look at it and I'm sorry, you used the word strategically, then it makes sense to value that for its potential. And you can see with any number of technology companies ranging from say an Amazon or who wasn't profitable for 20 years, but people continue to pour money or rather investors continue to pour money into Amazon until it finally hit BEP and then became profitable.

And then once it hit that tipping point we all know what happened. So when it comes to a company like Boston Dynamics or some other promising robotics or AI companies and investing in them you have to value on the potential is, and how you envision that business growing in the future.

[00:24:55] **Christoph:** So there are aspects of facts, I assume, but also factors of you mentioned vision. So how are these being calculated into a dollar value?

[00:25:09] **Rob:** When you value companies in emerging technologies, traditional valuation metrics are not particularly useful. There are several models that you can use, but generally we want to value the potential of the investment rather than a traditional metric, like PE or PD or some other metric, which may be used for let's say if I was investing in a steel maker or something like that. You can look at something like, for example, the effectiveness of the organization's marketing for robotics companies, Boston Dynamics has been very good at marketing themselves in the media. That's why they're kind of the rock stars with the general public, as well as with the robotics community.

And of course the second would be the growth potential. And there's really a common thread. As we see between these concepts, because often powerful marketing does transform into impressive growth. So you can have all the technology in the world, but if nobody understands it, if you can't find a way to sell it, then

there's no market. And then people will not be interested. They will not purchase your technology or invest in your idea.

[00:26:19] **Dwain:** Rob, what does Spot cost and what does Stretch cost?

[00:26:23] **Rob:** Spot runs about $75,000 is what we've announced. Stretch, we haven't published the price of that. However, as you probably know, we have a deal with DHL right now.

[00:26:42] **Dwain:** Yes. We'll talk about that in a second. I've got some questions about that. So is there a ballpark figure for Stretch?

[00:26:48] **Rob:** That would be based on the client needs. And really it would be tailored to that specific client. Because every client for a product like the Stretch would have a unique use case. So we wouldn't be comfortable giving a number.

[00:27:03] **Dwain:** So you would add different capabilities depending on the needs.

[00:27:06] **Rob:** You're correct.

[00:27:07] **Dwain:** So what makes them expensive?

[00:27:11] **Rob:** They're awesome. I'm just kidding. I mean, there's several factors. Expensive is a relative term, right? So there's a saying that says: well it's not really expensive, you don't have enough money. It's just how you look at it. You can buy a car and running the risk of like, let's say, I'm not going to say a brand, let's say a discount car, like one that starts with the V and ends with a w or you can go buy a McLaren or something like this.

They're both cars. They both can get you from point a to point B. That there's a tremendous difference in the underlying technologies that the engineering that goes into what they can do the moat really between those types of vehicles or those let's say companies and what they're building and for some people from some organizations, let's say a racing team or some individuals with the budget those differences make all the difference in the world. And so it's not expensive if you want to achieve a certain goal, like winning a race.

[00:28:13] **Christoph:** In this year's super bowl Boston Dynamics' robots, the Spot was shown serving a beer, drinking beer and giving relationship advice. Are these functions that you intend to develop further?

[00:28:30] **Rob:** If there's a market in terms of developing it as a product, then the answer would be yes. In terms of developing it for internal R and D the answer would be yes.

[00:28:43] **Christoph:** Great, thank you so much for your time. It's been a real pleasure

[00:28:47] **Rob:** Likewise.

Discussion

[00:28:48] **Christoph:** What is the winner's curse?

[00:28:51] **Stephen:** So the winner's curse can happen aware of the top bidder who makes the most optimistic assumptions about the value of something. It doesn't have to be a company. It could be anything that you're buying. Turns out they win the bid. Because there's a top bidder, they then find out that they made the most optimistic assumptions. So that clearly the highest paying bidder they're well above the mean valuation for the market.

And so it's potentially true that they paid well above the mean and well above what might the intrinsic value be, because if they wanted to sell that thing the next day, who could they sell it to? They beat every other bidder. So there's no one else in the market who values that asset or whatever it is that they're buying as much as them. And they're stuck with it because they have paid the highest price. It might turn out that thing is not worth as much as what they paid. That's the winners curse.

[00:29:45] **Dwain:** Huyndai could have bought Boston Dynamics to gain access to their IP and to the talented people.

[00:29:51] **Stephen:** There are many reasons why a one firm might buy another. Google and Microsoft and Amazon and so on have long since taken on the practice of deciding they need a particular thing and buying it instead of developing it in-house, it becomes cheaper to let someone else do the startup work. And then I

come along and, I'm Google and I offer some 22 year old university graduate $5 million for his latest app kind of thing.

So sometimes it's about buying the idea, the intellectual property. Sometimes it's about buying something which enhances what you've got and a potentially Huyndai could, for example, have found that it's come up against a roadblock or a wall if you like and things that they need. And it's cheaper for them to actually buy that and meld the two together.

And who knows? I don't know, but maybe Huyndai thinks the things that Boston Dynamics bring actually come together and combine in such a way that the two things are better together than they were apart. I don't know the answer to that question, but those are the sorts of things that Huyndai would be asking itself, which is what does this thing bring?

Their options are a little bit limited. They could have attempted to have bought that expertise by buying the people. Now, if you've got trade secrets, you can't take someone to court for using those trade secrets. If you can figure out a way to get them, that's not illegal. Stealing from people's hard drives or whatever is not legal. But tempting someone away. If they're not bound by a non-disclosure clause, which I'd be surprised if they weren't. That could be doable. But it's probably easier just to buy the thing.

And maybe that's what they've done. I would be pretty sure that as part of the negotiation process they would be pretty clear on what it was that they were getting. I doubt very much that they were opening up a lucky dip, surprise box of chocolates to find out what was in there at all, they've thrown $880 million at this. And they at least must believe that they've got something that they value. I'd probably share your view. I'm not really quite sure what it is, but they would appear to believe it.

Interview with Stephen Hickson

[00:32:03] **Christoph:** The reason why we asked you to contribute to this podcast is of course Boston Dynamics and its history. And one of the questions that we had where we really need an expert for is how is a company or the value of a company evaluated.

[00:32:22] **Stephen:** First thing I think to remember is that you're not buying past profits, you're buying future profits. So what has gone on in the past is largely now irrelevant. What you're buying is the future. And different people who might be interested in buying their company have to weigh up the information that they've got.

Now, it might be that everybody in the market who's looking to buy that company has the same information. But different people will weigh that information differently. Different people will have different views about what the future might hold. So there's risk and that nobody can look forward and say that this is going to be a sure winner, or this is not. That's the inherent nature of having to value that company. So some people are going to have different valuations. You'd think everyone would agree on the price. Not so. Some people are going to see that value differently.

[00:33:07] **Christoph:** Is it necessary for a company to have made any sales?

[00:33:11] **Stephen:** Now, remember what you buying is the future, not the past. What's gone on in the past is now largely irrelevant. It's what we call a sunk cost, if you like. So it's all about what am I paying now for what I'm getting in the future.

[00:33:26] **Christoph:** And how difficult is it to predict future profits?

[00:33:30] **Stephen:** This is saying that economics forecasting is difficult, especially when it's about the future. And I think that's a key problem. Most people are going to have. You have not only know about that, the product that you're buying into, but about future market conditions. And many of those things are going to be unknown. So what might be looking like the winner today is taken over by something else. So people are betting on say hydrogen fuel cell technologies for cars. Maybe I'll have it. Right. But what if there's another power source, which we haven't even seen yet that comes through and wins it? Well, you can't easily see that. So there's risk that you have to weigh up when deciding which horse to back.

Conclusions

[00:34:08] **Christoph:** What conclusions can we draw from all of this?

[00:34:12] **Dwain:** I do have some concerns about legged robots. Robots on wheels or tracks, or even drones can do similar things, but at a much cheaper cost. Other companies such as Honda already stopped their Asimo robot program.

[00:34:27] **Christoph:** They worked for so many years on this. And Honda is also a car manufacturer with experience in industrial robots.

[00:34:36] **Dwain:** Yes. They are similar in that respect and they stopped the two legged robot.

[00:34:42] **Christoph:** Huyndai also already indicated that Boston Dynamics' Atlas robot will not make it to the market. I asked Rob about.

Will Atlas ever be a product?

[00:34:56] **Rob:** We are considering that.

[00:34:58] **Christoph:** Okay. That's a, not a very long answer.

[00:35:03] **Rob:** My personal view towards humanoids in general the Atlas would be very expensive. It would not be an easy sell and the resources it would take would be considerable for most customers in the near term. In the longer-term mid longer-term then yes, there is the potential once we can figure out how to manufacturer something with scale and at a cost that makes it a compelling investment for most businesses.

[00:35:38] **Dwain:** This is what Boston Dynamics has. CEO said about Atlas in a recent CNBC interview.

[00:35:46] **Robert Playter:** I do think robots will ultimately have relationships with their owners that could be rewarding and interesting. I don't see Atlas as being that product.

[00:35:55] **Christoph:** Several other companies are developing for linked robots, but they're still very far away from commercialization. There appear to be only technology, demonstrators and hype generating machines.

[00:36:09] **Dwain:** Oh, yeah. Which ones?

[00:36:11] **Christoph:** We have the rideable robotic goat from Kawasaki and the rideable unicorn from XPeng, a Chinese electric vehicle manufacturer, both are automotive companies.

[00:36:25] **Dwain:** But what about commercially available four legged robots?

[00:36:28] **Christoph:** Ghost robotics is selling their vision 60 robot, which is very similar to Spot and there's even open source hardware project called mine robot dog and open dog version three.

A fundamental question is if and when Boston Dynamics will become profitable, this is what their CEO said about their income.

[00:36:57] **Robert Playter:** Really through the investment, uh, our owners, uh, such as SoftBank and Hyundai. They're really covering the cost. Now we do have significant revenue at this point, which is also helping. We're generating revenue currently from the sales of our robots. Primarily Spot. We have a little bit of time before we're profitable, but we're on a great trajectory. So far.

[00:37:14] **Dwain:** Boston Dynamics will of course be given a certain amount of time by Huyndai before they will have to become profitable.

[00:37:21] **Christoph:** How long do they have?

[00:37:23] **Dwain:** I asked Rob about this.

[00:37:24] **Rob:** Within the next couple of years. So it could be sooner and it could be at the tail end of that. But within the next couple of years.

[00:37:33] **Christoph:** The market for Spot in particular will be limited due to the high price. We asked Rob about their sales data. He told us that Spot currently costs between 90 to 250,000 us dollars.

[00:37:49] **Dwain:** So how many units have been sold? A Spot and Stretch?

[00:37:53] **Rob:** We cannot disclose that information, but we are selling them and it is ongoing.

[00:38:00] **Christoph:** At least we asked. Here's what Stephen had to say about this problem.

[00:38:06] **Stephen:** You'd think that doesn't sound like a very profitable model, but that same would be true of IBM back in the 1950s, they sold pretty much single digit numbers of machines. And yet today, everyone has one. In fact, everyone has one in their pockets. Your cell phone is really a computer. It's no longer a phone. So what's a high-end very expensive business. Only machine today is the consumer electronics of tomorrow. And who knows when that becomes the case? I certainly don't. But Huyndai are betting perhaps that it does, or at the very least there's enough of a market for relatively expensive industrial type robots for them to make money.

I don't think that's probably where they'd be going, or you do have to break into the consumer market at some point, just for sheer scale. But. We've seen it time and time again, things that were once the preserve of only the very wealthy become available to the everyday person at some point in the future.

[00:39:03] **Dwain:** It seems reasonable to assume that if Boston Dynamics was selling a large number of robots, then that would be inclined to brag about it. They do not present any sales data. They only say they intend to produce 40 to 50 Spots per month, and that they have a large contract with DHL, which includes a large budget for R&D.

[00:39:23] **Christoph:** They might start earning money with Spot, but it's unlikely that this will be enough. Stretch is the first robot that they started to sell after being bought by Huyndai. Stretch is much closer to an industrial robot that Huyndai was already selling since 1984. They have a large robotics division. The question emerges, why did Huyndai need Boston Dynamics, if they already have a strong robotics division?

[00:39:58] **Dwain:** Yes. And what happens if I can't become profitable?

[00:40:02] **Christoph:** That is a good question for Steven.

[00:40:05] **Stephen:** Nobody likes to admit that they were wrong. It's a human failing. We really should let people change their mind far more often than they do or they, at least than we let them.

There's a number of things at Huyndai could do. They might sell off the asset at least from what they paid for it and just simply where the loss. They have to decide at every moment in time I can't do anything about the $880 million I've paid. That's a sunk cost. The only question I can ask now is am I better to hang on to the asset or I'm a better to sell it for the market price I can get it. Let's suppose the best bid that they've got on the table is 500 million. They're going to take a bath for 380 million. That shouldn't stop them selling it. If a loss of 380 million is the best outcome. If they based outcome is to weigh that loss rather than hang on to it, then they should sell it.

[00:40:55] **Christoph:** It is important to realize what Boston Dynamics robots can and cannot. The YouTube videos of course show amazing skills, but that is not what the customer buys. Dwain asked Rob about this.

[00:41:12] **Dwain:** What can Spot do out of the box?

[00:41:15] **Rob:** Spot right out the box you could have it do like basic household tasks. Obviously it's too expensive for just a typical, household. .

[00:41:26] **Christoph:** What typical household tasks are we talking about? Can it catch me a a beverage from the fridge?

[00:41:34] **Rob:** It could get a beverage for you out of the fridge. You could actually have it go get a beer for you.

[00:41:38] **Christoph:** But can it do it out of the box? If I would buy a Spot today and I sit on the couch and I say, Spot, bring me a beer, would it be able to do it?

[00:41:48] **Rob:** You would need to set it up to do that.

[00:41:51] **Christoph:** So I would have to program it?

[00:41:53] **Rob:** Yes.

[00:41:55] **Christoph:** So would these Spot robots be like so many other robotic platforms that it has many abilities, but whatever you wanted to do, you still have to program it?

[00:42:05] **Rob:** Correct.

[00:42:06] **Christoph:** Hmm. So it would be like any other computer that out of the box that can pretty much do almost nothing. You always have to involve programming it.

[00:42:16] **Rob:** We are working on a solution to make that as simple as possible.

[00:42:21] **Dwain:** What can Stretch do out of the box?

[00:42:25] **Rob:** As it's use cases is clearer you can pretty quickly deployed into a warehouse and assign it's a job. It'll execute it pretty quickly.

[00:42:36] **Dwain:** The Boston Dynamics robots, like most robotic platforms cannot really do much out of the box. They have to be programmed first.

[00:42:44] **Christoph:** One of the use cases for Spot is inspections of dangerous areas, such as power plants, or construction sites.

[00:42:52] **Dwain:** It's likely that Spot wouldn't be any safer than a human at a faulty power plant. It would also die

[00:42:58] **Christoph:** if you are not sure about the safety of a power plant, you probably would not keep it switched on. Even if only a robot inspects it. The robots are also very expensive.

[00:43:12] **Dwain:** Um, but that is not the main problem, dangerous environments are typically very dynamic. Building materials are being moved around, for example. Hence you do not have an accurate map up front.

[00:43:25] **Christoph:** Well, that means that you cannot program Spot upfront. You need to remote control it.

[00:43:33] **Dwain:** And if you already have a person on site to operate the robot, why not just have that person do the inspection?

[00:43:39] **Christoph:** I'm also not convinced that a legged robot would be that much better A tracked robot could probably go almost anywhere a legged robot can, but it would be much simpler to build and to control. Not to mention flying drones that do not need to touch the ground at all.

[00:43:56] **Dwain:** And thereby much cheaper, but that is not the only concern. What about the battery?

[00:44:02] **Christoph:** A single charge would probably only last you for an hour. That means that you cannot go further than 30 minutes before you need to turn back. Plus, the robot is pretty slow when walking

[00:44:16] **Dwain:** Precisely. A human can operate for hours and you need them to be prisoned at all times.

[00:44:23] **Christoph:** I guess this whole endeavor only becomes beneficial. If you can scale it up. If one human operator could control many robots,

[00:44:33] **Dwain:** Unless you have to enter the Fukushima reactor.

[00:44:36] **Christoph:** That is right. But again, you can't program the robot for such an environment.

[00:44:43] **Dwain:** So in conclusion, Boston Dynamics, robots are expensive and they can do almost nothing out of the box. The user will still have to program any high-level behavior, which is also a cost in and of itself.

[00:44:54] **Christoph:** There are many technical challenges that will take a considerable effort to overcome.

[00:45:02] **Dwain:** Boston Dynamics have made excellent use of YouTube to promote their robots.

[00:45:06] **Christoph:** I asked Rob about it.

[00:45:08] **Rob:** I would say the YouTube videos, one of the things that Boston Dynamics was able to do with, by using these videos was to basically demonstrate what they can do. Right. It's very clear. You see it in robotics or in many businesses, there are lots of promises about, we can do this and we can do that and we can do this at the end of the day show me what you got. Let's see it work. And it doesn't matter what type of business it is. Cause this is not just with Boston Dynamics, but it's with, with most companies really. I would have to say the video get your attention and it does raise questions. It does help to stir the imagination of where you see this type of technology going. So I would say it carried considerable weight.

[00:45:55] **Dwain:** They certainly stir the imagination.

[00:45:58] **Christoph:** Maybe a bit too much at a time. While dancing like, Mick Jagger has some entertainment value, it is not practically useful.

[00:46:10] **Dwain:** As we discussed in the beer commercial, Boston Dynamics show Spot, giving relationships. Of course in reality, the robot is unable to do this. So this is no longer a technology demonstration, but fiction.

[00:46:22] **Christoph:** I agree. They crossed the line. The beer commercial is misleading. People will think that this is something Spot can do, but it cannot. Yes, advertising always promises too much. But people just don't know enough about robotics to be able to tell the difference. Spot cannot drink nor can, or should it give relationship advice?

[00:46:47] **Dwain:** Yeah. All this is starting to sound like an example of the greater fool theory. Perhaps Boston Dynamics has to continue to stir the imagination in order to sell to the next owner.

[00:46:57] **Christoph:** I asked Steven about this.

[00:46:59] **Stephen:** I'm always reluctant to ascribe foolishness to somebody's actions. Mainly because I at least start with the assumption that they know something about their interests that I typically don't.

I think Huyndai in the best position, for example, as the latest buyer to decide what's in their interests and I have much less information about their interests. So I'm reluctant to say that. But maybe they have. Maybe Huyndai have confident in buying this because they've perhaps too optimistic or there's a sense of hubris about this.

And they think, well, we're pretty confident that in the future of this thing will be worth twice as much as what it is today that could turn out to be right or wrong. Nobody actually knows that. So I don't know I'd call them foolish. They've made a set of assumptions. Those assumptions might turn out to be misguided or overly optimistic. It's still to be determined.

[00:47:49] **Christoph:** Is it a problem that Huyndai might have over paid?

[00:47:52] **Stephen:** Not for me. I personally don't care in the slightest. The only time I would care is if government started to step up and bail out companies that make decisions like this. So this could turn out to be a great win for Huyndai. In which case, good luck to them, right? They backed the right option. This could turn out to be a disaster for them. That's the nature of this game that they're in. So I don't mind if Huyndai put its own money up as long as nobody asks me or the taxpayer to dip into our pockets, to bail them out.

[00:48:21] **Christoph:** The question if Huyndai paid too much is difficult to answer. There is no good data that predicts the robot market. To date reports have been imprecise.

[00:48:34] **Dwain:** That is true though. It might well be the case that Huyndai with its bold vision for smart mobility and recently meta mobility in which robots act as digital twins for humans in order to bridge the physical and virtual worlds may see the sort of success with Boston Dynamics that Google and SoftBank failed to realize.

[00:48:54] **Christoph:** That is certainly possible.

[00:48:56] **Dwain:** Still. If we look at how it was that Boston Dynamics has been able to survive for 30 years without making any meaningful robot sales, it seems clear that if we take into consideration the origins of the company as a research initiative, in combination with the pattern of acquisitions to date, that they need a well-resourced, long-term focused and incredibly patient benefactor in order to operate.

[00:49:22] **Christoph:** Previously Boston Dynamics videos were technology demonstrators. They focused on showing off what the robots can do. In a recent interview Robert Playter said this:

[00:49:34] **Robert Playter:** Having a service department, having a sales team, those have all been new skills for us, marketing, you know, all new things for us that have encouraged us to really expand our staff.

[00:49:43] **Christoph:** You can see the difference. The more recent videos of Boston Dynamics showcase, dancing robots. Their production value has gone up dramatically. Which leads to the beer commercial.

[00:49:57] **Dwain:** Hm. You might think that this is the pinnacle of robot infused hubris, but it ain't.

[00:50:02] **Christoph:** What could be more fantastic than a robot drinking beer with you and giving you relationship advice?

[00:50:09] **Dwain:** Did you see that Elon Musk is planning to sell a humanoid robot called Optimus next year. In a recent Tesla earnings call, he declared that Optimus will be more important than Tesla's cars

[00:50:20] **Christoph:** During its first presentation, they used a human dancer dressed in a robot costume.

[00:50:27] **Dwain:** Yeah. Elon Musk is a master of selling dreams. Just think about the name Optimus. That is a clear reference to the transformers franchise. Optimus is a leader of the Autobots.

[00:50:38] **Christoph:** We will have to leave that to another podcast episode. Dwain, thank you so much for joining this episode.

Thank you for having me Christoph. It has been my pleasure.