

Talks at GS
Astro Teller, Captain of X,
The Moonshot Factory
George Lee, Moderator
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Astro Teller: We have to be excited about running the experiment in really scrappy ways and being intellectually honest about the outcome of every experiment we try so that we get super tight learning loops.

[MUSIC INTRO]

George Lee: Astro is the CEO, also known as Captain of Moonshots at X, which is Alphabet's moonshot factory. He is a serial successful entrepreneur, distinguished academic background, two degrees from Stanford, a PhD in AI from Carnegie Mellon.

First of all, describe for us a little bit the mission of X. And maybe give us one example that brings that mission to life.

Astro Teller: X is about 12 and a half years old. And so, it was set up before Alphabet was a holding company that Google is inside. But the founders were already thinking

about how something like Alphabet could come to be. And they established X as a place where we could try to not go solve Google's current problems. There are an incredible number of super creative people at Google already solving Google's current problems. But to try to find some really new problems far outside of Google's current space to have, and solutions to go with those that could hopefully over time become new business units as sort of little sisters to Google that could grow up over time and help what now is Alphabet continue to expand and help the world more. So, that's what X was set up to do, is sort of early technology explorations that have this combination of a huge problem with the world, a science fiction sounding product or service that, however unlikely we could actually make it, if we could make it, it would make that huge problem go away, and some kind of breakthrough technology that gives us hope that maybe we could actually make that science fiction sounding product or service real.

So, we're constantly in this learning mode and option buying mode. But when it goes really well, we set something up outside of X as a new business for Alphabet.

George Lee: I've heard you say is that you're a cultural

entrepreneur. So, why given all of the capabilities and things that you could be doing in the world did you tackle that angle. And what do you mean by that?

Astro Teller: Making radical innovation is easy if you don't care about efficiency. You find a bunch of very high energy people who have a kind of crazy sounding idea. And you throw money at them. A few of them will be right. And radical innovation will occur. Yay. But that's not very efficient.

It's also easy to be very efficient if you just sort of get really uptight and read a lot of business books and sort of, like, constantly put more process on top of things, you can squeeze most of the inefficiency out of almost anything. But you will not get any radical innovation in a situation like that.

X is a 12-and-a-half-year journey so far in trying to do both at the same time. To do things that are very audacious, highly creative, over the horizon kinds of technology innovations that can, ultimately, lead to really good for the world, but also really valuable businesses for Alphabet, while at the same time, systematizing that so we can do it

efficiently.

And I'm not saying that we know exactly how to do that. I'm not sure anybody knows how to do that. But that has been our arc over the last 12 and a half years, starting with a commitment to radical innovation and very slowly trying to turn up the rigor knobs in ways that don't kill off the radical innovation, so that we can become more and more efficient over time. This is back to your culture engineer, cultural entrepreneur question. Getting at that sweet spot, it's not actually that secret or that hard to know what the answer is.

Long time horizons. High audacity. High creativity. A commitment in humility to knowing that we don't know what the right answer is, so you have to get in these tight learning loops where you form hypotheses, you test the hypotheses. You're really dispassionate, intellectually honest about the results of the experiment. You stop if it doesn't make sense or pivot to whatever does. It's not the come up with a great idea about how to do it that's the hard part of X. It's creating the cultural infrastructure, the social norms, the incentives, the traditions, all of these hundreds of different things that actually make the path of

least resistance within the organization to be doing the things that I just said.

George Lee: You've talked a lot about the personal development challenges of people that work for you. And how should they think as entrepreneurs about scaling that spirit of innovation across the businesses they've built? Sustaining, lasting innovation?

Astro Teller: Here's an example. I'm going to put two options on the table for you. One, you just made a dollar for the company. The other option, you have a one in ten chance of making \$100 for the company. Everyone can agree, this second option is better.

Now imagine that your promotion is going to be based on what you choose here. There's a 90 percent chance that that turns into a zero. You all just said this was the better-- I see you all nodding. This one. The second one is the better choice. In your promotion system, in your company, not you, it doesn't matter what you think, are the people who are actually sitting in those promotion meetings, are they totally committed to rewarding people for running the right way of going at the world?

This is what innovation looks like. 90 percent chance you get a nothing. A one in ten chance, or probably not even, that you actually make huge progress. And you have to grade them. For example, in that moment of promotion on the quality of the experiment they ran, did they come up with one of these or one of these as the thing to try? And then, how well did they run that experiment to test their hypothesis? And how intellectually honest were they about the results? That's the question.

George Lee: What are some of the experiments that have worked really well for you, both actually maybe to the success and to the failure side of that? What have constituted really satisfying experiments for you?

Astro Teller: We had a decent sized group-- I mean, a decent size at X is actually still quite small. You might be surprised. A few dozen people is considered a serious X project that would be public. We're serious about the efficiency. But we actually under-resource them on purpose so that the only thing they can do is try to find a cheat in the video game of life. A Gordian knot shopping moment.

So, we had one of these sort of reasonably sized projects. And it was generally looking good. It was in the logistics space. They were, among other things, building-- sort of central to what they were doing was self-driving forklifts. And so, it was going pretty well. We had all kinds of good reasons why this was going to be a good beachhead into the logistics space. It was going to be able to help the world a lot. But we got into the following sort of stuck place, which was we were only kind of one and a half, two nines reliable. That is, our forklifts were pretty good. But they weren't perfect. Nothing ever is when you're doing radical innovation at the beginning. But we had made these forklifts with a partner. It was their forklift. We were just putting the sensors and the compute on it. There wasn't a place for the person to sit because it was supposed to be self driving.

So then, as we got into the warehouses, both the person, the group making the forklifts and also the warehouse owners said, "You can have this little, tiny sandboxed area, like a playpen, where you can go around in little circles. But you can't wander around this whole place because you're not good yet." And then we would say, "Well, okay,

but we're not good yet because we have to learn. You have to let us go in the whole place so we can get better." And they said, "Well, you're not safe enough to do that." And they were right about that.

And we never actually got a hill to climb because there was, like, this step function that we couldn't get past. So, that was a bad-- that's a learning moment. We ended up closing that project down because we just weren't getting the right kind of traction.

As opposed to, we have a project which is going exceptionally well in the computational agriculture space bringing automation to the farmers of the world. And one of the things they did which was so beautiful, is they said, "Okay. We want to get out, get perception into the field. Let's take four bicycle wheels, a couple pieces of metal, a laptop, a few cameras, and we want to get out in the fields so we can start learning. We need something that's pretty nearby us in Mountain View. Probably should be low to the ground. It needs to be something where the value per acre is really high, because, like, we can't be over corn. But even if we were tall enough, that wouldn't really work because there's just not enough value per foot per acre in corn."

So, we ended up finding a strawberry breeder who really cared about the ability to be able to count the attributes of the strawberries better than they could by hand. If we messed up, we were all over a strawberry. It was fine that we were only and a half nines reliable. So, we got in the field. We were helping them from the beginning. We were learning. And it became a virtuous cycle for them. And now they have much more sophisticated ways of helping farmers in, you know, 12 countries around the world. But they got going because they found a way into what we now call at X, their strawberry field.

So, that's an example where it's not just about having a hypothesis, it's having a hypothesis that you can test in a way that's good for you before you're great and before it can offer anything like a service. And great for the partner so that you can say to them honestly, we're on a learning journey here. Do not expect a service from us. Are you so excited about what we could someday give you that you are up for a learning journey?

George Lee: I love it. And this connects to something also. When companies think about innovation, there's this idea

of, you know, let 1,000 flowers bloom and really encourage people to have ideas. Terminating experiments is really hard culturally. And yet, you guys do it kind of freely. For instance, that forklift thing seems like, God, that was kind of a minor stumbling block. You had the wrong partner. But you just terminated. How do you create a culture in which termination is a feature, not a bug?

Astro Teller: Well, we start by saying if you need to be right, this is going to be a miserable place for you because what we're trying to do is really hard. If we're honest, most of the things we try, if you're looking for Gordian knot chopping moments, these sort of cheats in the video game of whatever industry you're trying to change in a radical way, you aren't going to be right most of the time. None of us could be right most of the time. So, if you need to be right, you're just going to be sad.

Whereas, if you can be excited about being part of a process that seeks these things out, and when we try something, whether it's two people or ten people or 30 people, if you can be excited to be part of this and understand you won't lose your job, you can just find something new to jump into, then tell me, honestly, is the

thing you're currently working on raising, is it pulling our average up the reward/risk ratio of our portfolio? Is it going up or going down because of the thing that you're doing?

And if you say, look, it could work, but it's not looking as strong as it was six months ago, awesome. Thank you for saying that George. Good for you for being intellectually honest. Let's close this down. We're going to get you a standing ovation at our all hands. And then you have a couple months to just sort of look around X and find the new thing that you're excited about doing, whether it's starting something from the beginning or jumping into a project that's already going that you're really excited about. What's the downside?

George Lee: Given your background, the things that you've built in the past, you could be cranking out companies of your own. Yet you've chosen very deliberately to spend your career in creating a platform for others. Why?

Astro Teller: If I want to help the world as much as I can in the years I have on this earth, I think I can help the world faster by helping others, by creating an environment

like the one that I'm describing, that creates a flywheel of efficient positivity seeking out over the horizon opportunities to make the world radically better. And then my job, as a sort of meta entrepreneur, cultural entrepreneur, is to be a coach, a mentor, a teacher. I have to hold them accountable sometimes. But a lot of what I do is trying to sort of shape and guide the system and help entrepreneurs to develop these things such that however many times they have to go around the merry go round, when it actually leaves X as a standalone business, either within Alphabet as another bet, or as a standalone business outside of Alphabet, which also happens regularly, they're prepared for it and they've got something really special. They have a tiger by the tail.

George Lee: You've started small companies. The activity in the platform you've created is target, in a large part, about transforming and continuing to add innovation and invention to a bigger platform. For a company that's, you know, 100 people, 200 people, would you adjust your philosophy and practices for that environment to make sure that these kinds of entrepreneurs can drive lasting innovation in and around their business? Like, what tweaks might you have if you combined your current life

with your former entrepreneurial life?

Astro Teller: It depends what stage they're in. You know? There are companies that are early enough stage, remember back to the \$1/one in ten chance at \$100. If you're at, you know, the early stages, you're a couple people, you're even tens of people, you might be in the first time on this experiment part of it. That's cool. Just do that. Do it as well as you can.

If you're a larger business, if you're an ongoing business, it can feel like you have to give up on all of this and just do the \$1 stuff over and over again. What I would suggest is commit to doing just-- we've all acknowledged that's where the alpha is. That's ten times the expected utility of this. So, you should do just enough of this, the first--

George Lee: To fund the other.

Astro Teller: -- That you keep the lights on. And everything else needs to be over here, number one. Number two, respect that these are culturally separate behaviors. They both deserve respect. The efficiency to run the engine room of, you know, the enterprise, it's hard. It's specific. You

can't mess up. And that is just as laudable to watch. And the weirdness, the craziness of Kirk [?] is part of how you make sure that you get to new, really big adventures. And so, you need to culturally separate them, even within your organization so that you can have them.

George Lee: Astro, thank you. What invaluable discussion for this group.

Astro Teller: My pleasure. Thank you everyone.

George Lee: Really fun. Really fun.

Astro Teller: Thank you.

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