

Hello, everyone. Welcome to another episode of Q&A about business, innovation, and Managing Life.

And I see a bunch of questions saved up here.

Sammy is asking, which is better, companies that do one thing, or companies that focus on many things? Pros and cons.

Well, better for who? Better for returns for stockholders, better for people working at the company, better for the world. There are always different, places where you can have benefits or not. I mean, a company

Generally, in some sense, the most profitable companies end up often... well, depends what you mean by profitable. Most genuinely profitable, based on selling products and things, end up being companies where they do one thing, they do it well, they have a machine, it's well-oiled, you turn the crank.

things happen, it's not... there's not a lot of separate stuff that has to be figured out at every moment. It's just a machine that does things, and that can generate significant profits. And I think companies that have set themselves up

To just be, we'll do one thing, we know how to do this, we built the machine, the machine runs, it makes money for us.

that's a good way to have a very profitable company. It's, you know, maybe not the most interesting life if you're interested in, kind of, sort of intellectual kinds of things, for example. If you're interested in running an operational business, that can be a fantastic thing to be doing, but if you're interested in, kind of, ideas and so on, it may not be the thing that needs the most ideas per unit time.

Probably isn't.

then... once you have a company that is a machine that's sort of doing a definite thing, it can be awfully hard to do other things. I mean, I know in my own experience with our company and so on, that every so often you have to build a special projects group that's doing a crazy thing.

that many people at the company won't believe in, but that has to be kind of led by the CEO, that's me in our case, to do that thing with lots of sort of leadership energy, and one has to then grow it to a certain size before it can be released into the wild for the rest of the company, otherwise it just gets killed, because people say, oh, that's just wasting money relative to the main

thing that we're doing.

And I think, you know, with larger companies or other companies, you know, the typical way that works is not necessarily build a special projects group internally, but to just buy companies that, you know, which have gotten to the point where they can add something useful. But in terms of

companies... so, as I say, the one approach is you have this machine, and it just does one thing and generates good profits.

There's a quite different model of companies, which is that the machine is mostly a financial machine. It's a thing where you have a bunch of assets that are themselves companies or brands or something like this, and the machine that you've built

is a machine that handles the money and management of those companies. So, for example, I don't know, the,

You know, there are... there are companies that are holding companies that own lots of different companies, you know, Berkshire Hathaway being a famous one, where my impression is that the

main thing that the core company adds is kind of, we provide the money, we manage how that works.

You know, every week, people deliver their money back to the parent company, and, you know, that's how things are controlled, and the main machine

is this machine that involves the management of money in that case, or in some cases, it might be if you have some, you know, magazine publisher that has lots of different magazines, and every separate magazine has its own style, its own... its own, you know, editor-in-chief, and its own publisher, and so on and so on, but the main thing that's added by the parent company is this machine for just, this is how we get magazines.

out, even though the details of particular magazines might be very different characters. So again, in a sense, you might say, well, there's a magazine company, and it's got 100 magazines, and, you know, one magazine is about, you know, keeping turtles, and one other magazine is about rocketry, and, you know, another magazine is for, you know, I don't know, nurses or something. You might say, that's a lot of very different things the company is doing.

but from the point of view of the central management of the company, the story may be very much a... it's a machine for getting magazines out, and then the details of the magazines are up to the individual groups that work with them. I mean, another good example of a company like that are publishing companies, where what comes out are books, and every book is its own story with its own author and its own...

kind of developments and so on. But in the end, the publishing company is this machine that has a production line for getting out books and procedures, often in the case of that industry, very kind of long developed and perhaps rather long-in-the-tooth procedures for getting books out with rather long timelines and so on.

When it comes to

things like tech companies and so on, and let's say startups. If you're dealing with a startup company, and the startup says, we're going to do 5 things.

it's not gonna work. That's a very unlikely to work kind of thing. You know, typically, to get one thing to work is hard enough. To get five things to work is implausible.

Now, occasionally, you'll see situations where people say, I've got 5 things I'm going to try, and I think one of them is going to work out. That's a very, very, very rare case.

The one case that comes to mind, for me is a company, Autodesk, which, was started by my, sadly, late friend John Walker, who,

was, you know, who had the idea, well, I'm gonna try out a bunch of different projects...

products. One of them was a thing that's sort of a little bit, kind of like Microsoft Office, another one was some kind of... I don't know what some of them were, but one of them was a CAD program.

And, you know, Autodesk was the name for the Microsoft Office-like thing, and I think they literally took these Proto products to a consumer electronics show, or I think it was Comdex, actually, the big computer show, and they just saw which things people cared about. And it turned out that of the five Proto products, people cared about their CAD product, which became AutoCAD, which

Spawned a big company.

And... but that's, I think, a very rare case, and maybe that's in the very prototype phases of a company. By the time you're actually building something, you know, building five things is quite implausible.

And certainly, in the case of our company, you know, we built one thing, namely Mathematica. Over the course of 38 years, we built a number of different things, like Wolfram Alpha, like various aspects of the Wolfram language stack, and so on.

But it's not... it's not a huge number of different kinds of things, and many of the things we built... I mean, we built things like apps.

Where we might have built 50 of them, but in a sense, what we built was a machine for building apps, and each individual app needed its own special expertise and people, but the main thing we built was the machine for building the apps. So I think that's,

It's a little bit on my point of view about this. What you're mostly doing with the company is building one sort of main machine, and... which can potentially produce things that are a very different character. Like, for example, in a very different domain.

things I'm doing in science, for example, working on biology, working on foundations of computer science, working on foundations of mathematics, and so on. These all appear to be very different things, and they have very different applications, but in the end, the machine underneath

for doing these things that involves computer experiments and kinds of philosophical thinking, in particular frameworks for thinking about things, it's the same kind of machine. It just happens to have different applications.

I think sometimes people... with companies, a very common pattern is there's a product that's pretty successful, and then you say, let's diversify, let's have other kinds of products.

And, you know, sometimes the reason for that is that the core product has maybe made a bunch of money for a bunch of years, but you can kind of see the writing on the wall that the domain that that product is in is not going to last forever, and you better be diversifying into other kinds of things. Often, that diversification

is really just a story of, let's use the money the company has made and invest it in other kinds of things. That's sort of one form of diversification of sort of the portfolio of what you own.

Another is, let's take the core skills that we developed from the first thing we did, and let's apply those core skills to other things.

I think that's an interesting thing if you can make it work.

It is not a thing that often works. It's, it's something where people say, well, we had... I mean, sometimes I think it's sort of almost a psychological thing. People built a product, it was some kind of consumer app, and it took off.

And it was surprising that it took off. And it's like, it would have been hard to predict from the outside that it took off. It just was... people happened to like to do that particular kind of thing, and it... and it worked.

And then people say, well, let me, you know, I've got the magic touch. That proves I have the magic touch. Let me... I have an idea about something else, let's try that one.

Well, you know, it's rare that the touch is really the magic touch. It's often, you know, things came together in the right way at the right time, et cetera, et cetera, et cetera.

And the next thing that's come up with, even if you think you have the magic touch, isn't as magic.

And ends up being a kind of a thing where often a huge amount of money is spent on the thing, because after all, there is money available to spend, and one kind of knows that, you know, let's not do it the shoestring way this time, let's do it the full luxury way.

And it often doesn't... doesn't end very well.

I mean, I'm kind of a little bit reminded of, of Steve Jobs, and, you know, having done the, you know, the Apple II, and then the Mac.

And then left Apple, started a company Next. I knew him at that time, actually.

And next, his idea was, I've done two computers, I know how to do computers. I'm gonna do this, the kind of, the full, you know, get the best people, set the things up in the best way, and I'm going to do the great computer.

I think one of the things psychologically there was, perhaps, that it was like, oh, I know how to do computers, it's going to be easy, I can just sort of run the machine, it'll work, and that wasn't, you know, that wasn't what ended up happening, although in the end, Next sort of sold itself to Apple and, sort of became the revitalization of Apple.

But I think that was, perhaps that's not really an example of the phenomenon I was describing. I mean, perhaps I'm more thinking of things, though, from the ancient history of the computer industry, of things like,

Lotus123, the first very successful... well, second very successful spreadsheet program after VisiCalc. Lotus as a company, bet on various things like Lotus Notes, for example, which was supposed to be the next great diversified thing, and it didn't work out very well.

And I think that's... that's been repeated many times.

Let's see, another question here.

Ayla is asking.

When you market yourself or your company, do you enjoy interviews? What have been some of your favorites?

You know, I think the least favorite are when I feel like I'm marketing something.

And when... I feel like I'm sort of trying to sell a thing.

I... for me personally, I'm just not particularly into that.

The best... are usually...

when I'm talking to somebody who is genuinely interested in the conversation that's going on, and particularly when they're getting me to think about and talk about things that I don't usually think about and talk about.

I mean, in a sense, that's... that's why I like to do and do these kinds of livestreams. You guys ask me all kinds of things, like the question you just asked, that I haven't, sort of, systematically thought about.

And, you know, I like that. I suppose, from some sort of egotistical point of view, I have the... I have the thought that if you extract more things from, sort of, this brain of mine, and I kind of externalize them, those are sort of useful things to have out in the world.

And to have me kind of repeat the same things I've said a zillion times is not so useful.

So I think the things that,

you know, do I like doing interviews? Yes. When it's with... when I think I'm going to have an interesting conversation. When it would be something where if I just ran into the person, we'd have an interesting conversation, but it's a conversation in public, so to speak, which has a different kind of cadence and character to one that you might have, sort of, privately. But it's... you know, if the private one will be interesting, the public

The public one will also tend to be interesting.

I think that when it comes to, people doing interviews.

It's, you know, preparation always helps. You know, you need to know a certain amount to know what to ask. If you know too much.

So that every answer you're going to get is one where you already know the answer. It's hard to be interested as an interviewer. It's kind of like, well, I already knew you were going to say that, type thing. It's also, there is a tendency, you know, everybody, including myself.

has a certain set of sort of schticks that one's said many times, for one reason or another. And I think the thing that is always disappointing in interviews is when the button is pushed that causes a particular schtick to come out. Because usually, at least for me.

I'm kind of like, I've said this a zillion times, I don't really need to see it, say it another time.

There isn't that same spark of enthusiasm that there would be if you were asking me a question where I've just... like, I've never thought about that, I've never answered that question before.

This is a new thing for me. I think also the,

You know, I've done many kinds of interviews with many kinds of people,

I think that, there are ones that are quite technical, where I know that people are going to understand all the technical nuances of things I say. There are ones that are very non-technical. It doesn't, those have their different interests or lack of interest. I would say, one of the ones which is not my favorite.

Is when you're dealing with somebody who is sort of

Somewhat technical, for example, in my case, and thinks they know a bunch of stuff, and actually it turns out they just don't understand it, but they're really sure they understand it.

And they keep on asking these questions, which are kind of constructed in these kind of goofy ways, where you have to take the question apart before you can say anything, and then you can tell the person didn't really understand the answer anyway. Those are not my favorite kinds of situations. And, you know, it's better to have somebody who really, you know, doesn't think they know anything about the topic, and is just genuinely asking questions that they're curious about, including perhaps outlandish questions that might seem like, you know, oh gosh. you know, is he going to think I'm a nut when I ask this question? I don't mind. You know, those questions, the outlandish questions, are interesting, and they get me to think about something different. And I'm not going to judge the person as a nut because they asked that outlandish question, so to speak.

The only thing that... that one might judge in some cases is that person sort of thinks they know a lot more than they do, and they're kind of trying to... trying to say things like, don't you think that? Or, you know, doesn't your theory say that?

And then the thing that comes after that is something that's just totally muddled, and it's like, well, no, actually. That's always a slightly difficult situation.

Let's see... follow-up here was, do you enjoy giving talks at universities? What have been memorable moments?

University talks vary.

I would say some... You know, one thing that I've noticed about physical talks

Is the physical arrangement of the space actually matters, at least to me.

You know, these cases where you have these kind of very amphitheater-raised seats, and you kind of feel like everybody is on top of you, those are good.

the ones where it's kind of like a mass of people flat on the floor, so to speak, those have, for some reason, less energy. I really like the ones where it feels like you're actually, you know, engaged, talking to people, so to speak, rather than just you're broadcasting to a piece of blackness out there. That helps.

I would say it's very easy when you're doing talks in person, there's definitely feedback that you get. You know, is the audience kind of rustling around because they're totally bored with what

you're saying? You know, as you wonder, you know, as you look around at the audience, does it look like people are finding it interesting? That really helps me, for example, to give a better talk. You know, if I... if I'm, if I'm giving some talk, and it's kind of like, it's clear that everybody's tuned out.

Then it's very hard to feel motivated to, you know, keep going and try and bring life back into the whole situation.

I would say that, at universities,

The... there are different demographics that you see.

Like, for example, there's some kind of talks where there's an awful lot of grey-haired people in the audience, and there's other talks where there are lots of students, lots of young people,

And, those are... those are a bit different, and I think they both have...

they both have their interests, as far as I'm concerned. I suppose I'm... I'm, some... sometimes the, you know, the young pay, you know, do more with

ideas that are fed to them than the old who already kind of set in their ways. But that's not always true.

And sometimes, for me, I get interesting feedback, well, from both groups. Like, the people who, sort of, are less seasoned will ask the unexpected question that gets me to think about something I've never thought about before. The season, so to speak, will sometimes say, oh, by the way, did you know about this thing that was done 25 years ago in our field?

Whatever, and that's useful too.

I think, in terms of,

Memorable things that happen in,

in talks at universities. Actually, I was just in the UK, giving a number of talks.

I think there were two memorable things that happened in talks I gave there. One was, in London, was giving a talk, there was a fire alarm in the middle of the talk, and I don't know, sometimes I feel like in olden days.

in a British setting, people would just be like, oh, let's check if there's a fire. If there's no fire, we're just gonna keep going.

But I think perhaps it's modern times, so everybody's like, we've got to leave the building, it's, you know, it's a... those are the regulations type things, so everybody did. Fortunately, it was a fairly nice day, and so everybody sort of spilled out onto the sidewalk, which happened to be quite big, of the... of the street. And, you know, after a little while, I realized it's going to be a while here, so I kind of started,

Having... having at first a discussion, and then more of a kind of impromptu kind of talk on the sidewalk, which was something a little bit unusual and interesting.

Another thing that happened was another place, Cambridge, actually, I was giving a talk, and, mostly student talk.

And, you know, people are asking, frankly, not great questions. Some of the worst questions I've seen in any talks I've given. It's interesting, by the way, when it comes to questions and talks and so on, it's, people...

you know, sometimes people ask these questions that some of the audience says, that's a goofy question, you know, oh my gosh, you're asking about this, you know, that's kind of an incendiary and goofy question. As far as I'm concerned, those questions are perfectly interesting. They are, you know, I like to be able to respond to anything.

And those are sort of good questions, as far as I'm concerned, even though some people might sort of roll their eyes and say, how could they really be asking this question? But the ones that

aren't so good, and it's similar to the interview situation, is where people kind of think they know a bunch.

And kind of a slightly showing off what they know, and ask some questions that just doesn't make any frigging sense.

And it's like... and... but they... you're not... you don't have the feeling that they ask that because they just don't know enough, and that's fine. It's... it's... it's a different kind of thing, and that happened, and there was one particularly interesting one about something to do with, quantum gravity or some such other thing, where, you know, it's like, okay, does your theory, kind of, you know, give you a way to solve this? And I'm like, yes.

And then it was like, you know, there was a kind of a cackle in the audience. And I was like, you know, this is an interesting moment.

Because 100 years ago, with respect to this kind of thing, people were primed with the fact that progress could actually be made in physics.

What you're telling me now is that, kind of, the student crowd of modern times has given up.

They just don't think progress can be made. And so, for somebody to stand there and say, yes, I think we just made progress, is something that seems humorously absurd.

And so that was sort of an interesting thing to make that point, and to realize that... and again, that's actually a rare situation to have happen.

But it was sort of interesting for me that, you know, it's a sign that sort of things... people have given up in that area. It's like, we couldn't possibly make progress. In the course of the next 50 years, you know, we'll all be doing whatever we're doing in physics or whatever, and we couldn't possibly make progress. And it's absurd for somebody to say that progress has been made.

So that was a slightly memorable thing. I have to say, in the past.

There are great many, kind of, talks I've given where...

where interesting things have happened. Occasionally, some person will ask some very insightful question. It's like, how did you know to ask that question? That's been... that's been a fun way to meet some interesting people over the years. In other cases, it's like, you know, I've been giving, kind of, computer demos now since probably I first did that, live computer demos in 1981 or so. And the dynamics of being able to do that across all these different venues and all kinds of different countries and situations is always interesting, and one of the things that's just... just cracks me up, I suppose, is that you go to these places where it's like, you know, is there really going to be a projector that works? Is it really going to be possible to connect my computer and so on. Works perfectly.

in some...

place where, you know, it's a... it's a... it's... it's not sort of a fancy place. And you go to some very fancy setting where, you know, it's the latest, greatest, expensive equipment, you plug the computer in and it doesn't work.

And it just... I've... I've learned that there is... it's a... it's a kind of a uniform thing of the chance that things don't work relative to sort of the fanciness of the setup.

Let's see...

There's a question here...

From Ben, asking, is there a chance that Wolfram will implement LLM models running locally? And, saying that it seems like big companies are pushing for larger models, but there's a lot of room for innovation with local tools. I think one of the things that has happened with LLMs is

the realization that you can slim things down and still get good performance. And absolutely, we already have available in our neural net repository a number of locally runnable models, and, There's sort of a... I mean, I think the idea that you bloat the models so that they know more doesn't make a lot of sense. The knowing should come from tools like Wolfram language and Wolfram Alpha and so on being called by these models, rather than somehow encoding somewhere in the weights of a model

You know, the population of,

of London in 1972 or something. That's not the right kind of thing to be encoding in the model, and the model is going to mess it up. It's the right thing to be calling an external source of computational knowledge, which we happen to provide, I think, the leading example of.

So, and for us, it's this kind of notion of computation augmented generation, where the LLM is generating its stuff, but there's computation that we are providing that augments that with facts and results and so on.

I think...

the, the question of, sort of what the LLMs are really providing versus what should be provided by tools, I think that the LLMs are really

providing kind of this linguistic interface layer, it's very valuable. You have to know a certain amount, you have to have a certain amount of linguistic knowledge, a certain amount of common sense knowledge, and so on, to be able to provide that layer.

But that's the value, and that layer, I think.

will have sort of thinner and thinner hardware requirements as things go forward, and when we'll be able to have that layer running, for example, locally on mobile devices, all kinds of things like this. That's certainly the coming story, and presumably, that will be a thing that's part of, essentially part of operating systems and so on, just like graphical user interfaces are part of operating systems. And it was the case

back in the day, that every program had to sort of mount its own sort of full-stack graphical user interface. That hasn't been the case for decades now, a couple of decades at least now. How long has it been? It's been, maybe since the 90s, since sometime in the 1990s, that there was enough standardization in the kind of GUI tools that existed that, yes, you have to build a specific GUI for your application.

but you're not building a thing that represents Windows on the screen and so on. That's all provided by the operating system. I think we can expect the same thing to happen with the linguistic user interface.

I mean, I think this idea that we'll build a neural net, bigger neural net, and it will suddenly do amazing things, I just think the data is against that happening, and also the science is against that happening.

And I think, from the point of view of corporate strategy, it's a very different story, because, you know, there is a moment in time right now where there's a belief that that could happen.

And that means it makes sense to raise, you know, incredible amounts of money against that idea. That's something that the world believes in enough that you can raise immense amounts of money in that direction, and that's a good business strategy for folks who are running companies that are capable of doing that, because, you know, you have the money, then you can decide what to do with it. It's a good situation to be in. It's a challenging situation to be in, because you have to use the money

wisely, and not invest in something we were talking about earlier, investing in sort of the second-tier thing, or whatever, or the second thing. How do you do that wisely? And there are many



examples where it hasn't been done wisely, but, you know, the giant war chests give you the possibility of doing something really, really interesting there. I mean, I have to say, I've been using this analogy recently.

It's perhaps a little bit of an unfair analogy, but I think there's a sort of tale from the Middle Ages about a person who said, I'm going to teach a horse to talk.

And they got a king to put up money for the project of getting a horse to talk. Of course, it didn't work, and so they said, well, it hasn't worked yet. Give us more money, and we'll be able to get the horse to talk.

And, of course, you know, in the end of that story, either the horse dies, the person who's getting the money dies, the king dies, but you never get to the end of that story.

I would say that I view LLMs and so on a little bit like, sort of wild horses that have been discovered. It's kind of this wild animal that's discovered that does all these interesting things.

And the real value ends up coming by putting harnesses on the wild animal. And, you know, whether it's the horse, you know, pulling along a carriage, or pulling a plow, or something like this, or whether it's the LLM providing some something that provides, sort of, support for writing code, or whether it's doing some education system, or doing medical history taking, or whatever it is.

These are... these are things where I think a lot of the value is going to be in the harness, not in the... in the thing itself.

I think that this is always a question, you know, in these stacks of value, where does it actually lie? For example, in computers, you know, does the value lie in the microprocessor? Does the value lie in the packaged computer? Does the value lie in the operating system? In the application program? Where is the real value in that stack? And sometimes companies will... will have a piece of the stack that can be quite unique, and they can promote that, and then that becomes a very valuable piece of the stack. Sometimes it's like, well, actually that part, it's like, well, the operating system isn't really worth much, kind of, maybe. You know, Linux is sort of a thing where everybody just gets it, more or less, and then whereas macOS is a little bit more of a, it's something unique, and so on.

And I think it's... it will be interesting to see in the AI space, kind of, where the value lies, but I think that one thing that's pretty clear is a bunch of value is going to lie in the harnesses that get built.

and then distribution channels for those harnesses of, you know, how do you actually deliver whatever it is, kind of medical technology or something to people? My thoughts on that, at least. Let's see...

The question here from Des.

Have you had any media training?

I would say no.

But let me qualify that.

two... two things. When I was a kid.

in high school, actually, well, actually, even in elementary school, I did have a habit of doing a fair amount of public speaking.

And,

I don't know, I think I was, maybe not the shyest kid or something, or somehow, or maybe just a kid who wanted to yak a lot. But so I did those kinds of things, and the one dynamic, I was in high school.

went to a school called Eaton, which at that time had about 1,200 students, I think. And the sort of morning assembly, which I did many times, you know, is a big room.

And in those days, there weren't microphones and public address systems and loudspeakers and things like that. So, you're talking to a big room, and the question is, can anybody at the back understand what you're saying? And so, I did spend a few hours,

With, actually the person who was the headmaster of that school at that time, who, was like, you know, you should learn how to do this, you know, project your voice so people at the back can actually hear what you're saying. And so, so I sort of learned to do that. I'm not sure if that's a skill that, survived as being useful, but that was, my, my first kind of quotes media training effort, not perhaps the most useful media training.

Then one time, I was going to do,

That was when my book, *New Kind of Science*, came out, and I had just a zillion interviews lined up, including a bunch of television interviews and things like this, and somebody convinced me, you know, spend an afternoon doing media training.

I didn't find it particularly useful. I think that, a, you know, I'm sure there are lots of tricks about, you know, how to tip your head or whatever. There are also lots of tricks about, kind of, I think... but I think a large part of that story is, do you actually know what you're going to say? And, you know, crispening up the message that you're trying to give.

And that's, that's something I kind of like to do for myself type thing, and I didn't find that particularly useful. I think it's one of these things where,

Well, and then, by the way, you know, I did a bunch of television interviews and things like this. I've done those a bunch of times in my life. One thing that I often notice about those kinds of interviews

that's... it was true for kind of broadcast TV. It's not really true, I think, for podcasts, but I don't know. Is I'd be in these situations where I was with some quite, let's say, well-known, you know, sort of interview, discussion type thing, and I would feel like I was pretty energetic.

And I would feel like the person who was doing the interview was kind of like, you know, kind of not particularly energetic. And then I watch a clip of the final interview, and...

they would just do the right thing, whatever the right thing is, to just seem very energetic on camera, and I was like, oh, I'm okay, but, you know, it just felt very different from the way it felt, kind of, in the room, so to speak. I'm not sure I can explain that, and that's probably something that I'm... I don't know.

But in terms of whether such things are useful for people, I think

that any of these kinds of things, practice helps. I mean, when I was first giving scientific talks, I would say

I would have these transparencies, and I would write many words on every transparency, and it was all, you know, too tightly prepared, and I think probably didn't...

didn't flow as well as it might have done. I guess I had always given sort of non-technical talks where it was very... tended to be very freeform, and for me, you know, I learned various kinds of things. Like, for example, one thing I've learned is

if I have just notes for what I'm going to say, and if the notes are very vague, like I've got 5 lines of notes for the whole thing I'm going to talk about, that works fine. I can kind of notice, oh, there's another topic I need to mention here, let me mention that. It also works in cases where I just... I have something where I have a very limited amount of time, I'm going to tightly just write out what I'm going to say, and it works to just read what I'm going to say.

That works fine. The intermediate case, where I have a bunch of things written out, and it's fairly detailed.

But it's not verbatim. I find that very difficult, because I find it very difficult to kind of multitask decoding what my notes meant, but not saying the actual words that are in the notes.

but then kind of saying the words that are kind of like the words that are in the notes, but not what's actually in the notes. So I tend to try to avoid, well, often try to avoid this sort of partially detailed notes.

I think the other thing that, for me, is sort of a killer for these things is if I wrote the notes a week earlier, I'll never remember what I was thinking when I wrote those notes. And for me, whenever I can sort of prepare a talk

in, you know, as close to when I'm gonna give it as possible.

those end up being the best talks. I have to say, I'm pretty bad at not preparing talks, and you know, I usually really don't prepare very much. If I prepare, it's for a minute or something of thinking, how am I going to start this? What's the arc of the talk I'm going to give?

And then I start sort of yakking away, and that works much better than something where I've kind of tried to prepare it in semi-detailed form. And then, for example, I realize that I can tell, if it's an in-person audience, I can tell, well, this thing that I'm talking about, they clearly don't care about this thing.

But I've prepared this direction, so I've got to keep going, giving that talk.

I mean, I've had a few amusingly disastrous talks, at least in my view. I think other people didn't think they were quite as disastrous as I did, where I'd prepared things which I thought, this is going to be great for this audience. And then I get there and I realize this is...

You know, this audience just doesn't get it, they don't care, it's not, it's not really a thing.

You know, I would say that

in, another thing that's sort of a trick, I suppose, for giving talks is, you know, what slides do you use for your talk? What do you actually show in your talk? So I often do live demos and talks.

that's a pretty good thing to do. It's a little bit scary, because maybe it doesn't work, and there's a bug, and you have to debug in front of the audience, and so on, but...

it's... I think people find it quite engaging to see something that is really happening in real time.

It's like a performance, and that's, I think, you know, engaging and interesting.

Plus, you really can respond to what's happening with the audience, and things you're thinking of. I think it has a lot of dynamism to be able to do that.

Another thing that I tend to do is, I do have lots of, you know, here's a picture of this thing, here's a slide, effectively, but instead of having preset, kind of, this is the list of slides I'm going to use,

I have a giant slide farm, which has, you know, probably, well, by now, it must be thousands and thousands of slides that are organized, typically organized by things that I've written at different times, and the pictures that were in those things, and as I'm sort of talking away, I'm kind of, you know, there'll be a section I might be talking about, I don't know, something about metamathematics, and I will have opened up, on a second screen that I have, that part of the slide farm, so to speak, and then I pick the right slide and put it up.

And that works. One thing that's very nice there is there's a very smooth transition to Q&A, because people start asking about things, and those weren't my... you know, if I had prepared slides, it's like, oh, whoops, I don't have a slide for that. But it's like, I always have a slide for that, if I ever am going to have a slide, because it's somewhere in my slide farm.

And, you know, I've gone through different technologies. I was using an actual second monitor plugged into my computer. I think I... because that monitor literally blew up on my... well, basically literally blew up on my most recent trip.

I've, I, I switched,

to using an iPad with some software connection, and that finally seems to work properly. I have to say, in the subject of computers blowing up, probably my... somebody asked about my experiences in giving talks. I remember this must have been 1991. I was giving a big series of talks about Mathematica version 2,

This was a... one was in... and in those days, you couldn't bring around with you the computer that was going to run what you were talking about, so there had to be a locally provided computer.

And so there was some fancy Mac computer that had been provided, and I switch it on at the beginning of the talk, and boom, it blows up, quite literally.

And, you know, smoke comes out, a little bit of smoke comes out.

And that was kind of an interesting thing, because it was non-trivial to get a second computer, and it took, like, I don't know, an hour or something to get to arrive, and that was a... it was a kind of a notable moment, giving a talk about very computational kinds of things.

Where you're kind of warming it up for an hour without any computer in sight.

And just one of those things that happens. You know, I have to say, when you give talks that involve, for example, live demos.

There is a certain... You know, things will go wrong.

And the main challenge is not to freak out when things go wrong. And I think people find it interesting to see the recovery from things going wrong. I think, particularly when people are trying to learn something about, sort of.

how to do this kind of computation themselves. Seeing the recovery, seeing things one hadn't figured out, where one was throwing some kind of thing to solve, is really, really an educationally valuable thing to see.

You know, the person who's the one doing the solving in front of the audience does have to have the confidence and eventually capability to deal with that, and not to sort of spend, you know, 20 minutes looking for some simple bug that everybody's really bored seeing one try to debug.

So one tries to achieve that. You know, I was thinking recently.

when people ask about, kind of, education and STEM education and K-12 education and so on, that, in a sense, one of the things that would be, let's say, for science education, one of the things that would probably be the most educational thing people could see is, you know, beginning of the lesson, there's a question that arrives from somewhere.

And the lesson consists of the teacher trying to figure out the answer, along with the students.

it's a... it's a complicated ask from the point of view of the teacher, but I think it's a very educational thing, because not only do you get to understand, you know, some particular content, but you also get to understand the even more valuable thing of how to think about thinking about a question, so to speak. And, you know, I kind of had this thought, it feels like for some people who, like, teach science to kids or whatever else, this might be a super fun thing to do. To others, it might be a daunting, horrifying thing to do. I suppose that I'm trying to model that

in the livestream series I've been doing for the last, what is it, 5 years or 6 years now, about science and technology Q&A for kids and others, kind of, I'm modeling that idea of, throw me a

question, and I'll try and answer it. I think in a classroom setting, maybe one would do that more with an actual computer and so on, and more with Wolfram language or whatever. than I've been doing it typically in these, in these live streams.

Let's see...

Well, actually, that feeds right into a question asked by Christopher here, who says, I view you as a super learner, thank you.

That's always... I haven't read the rest of the question here, or the comment, so it might... it might go downhill from there. How do you think about creating enabling environments for learning for others? Some have tried educational games, but recreational video games are usually going to win if the goal is to optimize for fun.

How would you embed meaning such that more people are encouraged to learn actively?

you know, I would say that, you know, tricks for getting people to learn

Usually seem to go splat.

I mean, there is endless gamification of learning that I would say, on a large scale, hasn't worked.

I mean, it depends on your metrics. If you say, did the person, kid, whatever, spend a bunch of time in front of the computer in this app? Perhaps if the game was good, perhaps the answer is yes. Did they actually, you know, learn that second language, or learn that piece of algebra, or whatever? It's much less clear what the answer to that is.

So, you know, the question is, what is the essence of what happens in teaching? Is it...

really a human-to-human activity, where it's, you know, for most people, where it's the human is communicating something, and the person who's learning is motivated to learn by the fact that there's an enthusiastic human presenting those kinds of things. I may not be the best example of a learner in this respect, because a large fraction of what I learn

I learned by, sort of.

doing things myself, by trying to, sort of do projects, figure things out for myself, read documents, you know, read the literature or whatever, which I just sort of spontaneously do.

I guess that my other kind of trick for learning is talking to experts on things. That's... to be able to do that well is itself a thing one has to learn. I mean, you know, a very typical scenario is, for me at least, is I'm thinking about some foundational question about some field.

I go talk to an expert in that field. I ask the foundational question. They say, oh, yes, of course, that's been figured out 50 years ago.

Okay. At that point, I might just say, oh, I guess I'm kind of stupid, I give up.

But usually I'll know enough and be confident enough that I'll say, well, wait a minute, let's just try to understand that. What do you really think the answer to that question is?

And then it will be like, well, okay, we think this, and they'll say, well, but what about that? And they'll say, well, okay, yes, all right, well, maybe it hasn't been figured out. And then you can have a real conversation.

But it takes some... some skill, I would say, and some confidence, and some knowledge.

to be able to break through, often, the, oh, that question is easy. And I always think that, and I give myself a hard time whenever I hear myself saying this, whenever you say, obviously, blah blah blah.

that's the time when there's something soft in there, and it doesn't really make sense. It's kind of like, you're not explaining... I don't want to explain it. I'm going to say, it's obvious that, whatever, you know, that's the weak spot.

But I think, in terms of... of sort of teaching other people to learn, I think

One of the most important things is to teach people to think.

And once you think, kind of, You know, learning for me, I suppose, in many respects, is an adjunct to thinking, in the sense that, and maybe it's partly me, I learn pretty much only when I'm trying to figure something out. If I try and, in the abstract, learn something, I find that very difficult.

And I don't know about other people. I think, you know, other people

Look, when I was a kid, for example, I suppose there were things I learned just because, well, I've got to learn this, it's part of some class that I'm... that I've got to do. You know, I'm going to learn Latin irregular verbs, because that's what this class, you know, that's what I have to do. And I suppose, for me.

In cases like that, I kind of, you know, I kind of liked the fact that I could kind of do well at doing that.

For some people, I suspect the competitive element of, am I going to come top? You know, back when I was a kid in England, you know, the class rankings were always published, and they were in the... even in the school magazine at the end of the term, you know, who came top in, you know, Latin, Greek, whatever else.

You know, the whole ranking. For me, that was a... neither a motivator nor a demotivator. I think that's maybe different from other people. You know, they're definitely people who are like, I'm gonna come top, it's the most important thing. And, you know, that's a worthwhile motivation.

But I think, you know, for me, often, learning things that I was not really that interested in, at some fundamental point of view, was not interested in learning, for me, I kind of liked doing things well, and that was sort of the motivating angle for that. Plus, I would say that you know, when I had teachers who clearly cared a lot about the things they were teaching, that definitely was a significant uptick in my, you know, it sort of nudged me to really pay more attention to those kinds of things. So I think, you know, this question of you know, having... it's great if you have teachers who really care about the things they're teaching, or care about other people understanding the things they're teaching. I mean, it's a... I think it's fun, and, you know, that's why I do these livestreams and so on, to try and communicate things to people, and there are plenty of people who teach who think that way as well. I think the sort of the enemy of a lot of this is sort of production line mechanized teaching, where it's like, okay, we've got to get, you know, everybody here's got to be able to apply the Pythagorean theorem.

Okay, well, you've got this triangle, and there are these three spots you fill in, and you put numbers there, and then you do this and that, and it's... it's very mechanistic.

Or even, you know, if you're doing, you know, if you're kind of learning business or something, it's like, yes, every business has to have, you know, a minimum viable product, and an elevator pitch, and a this and a that. And, you know, you're basically learning this form-filling approach to things. And, you know, what will tend to happen with that is, yes, at the end of the day, you can sort of walk it and talk it, so to speak. You can fill those forms.

Do you really understand what's going on? Probably not. And if you are confronted with something that's a little bit away from the original thing you were asked, it's like, oh, I... I don't know.

You know, and that happens a lot, for example, with math education. It's like you learn the specific mechanics of how to do this or that thing, but, like, did you actually learn the basic point of this? Well, no, and therefore you can't transfer that to anything else. So the question is, how do you learn to, like, think, understand.

And then, once you can think and understand.

sort of learning things, facts and so on. It's very useful to learn facts, very useful to learn actual techniques and so on, but that kind of gets pulled in by the fact that you're doing thinking and sort of trying to move forward with solving problems or whatever else it is.

So that kind of raises the question, well, how do you learn to think about things?

And like everything, there's sort of practice that can be had, and I suppose it's very typical. I mean, I've done plenty of this because I find it interesting to actually even, you know, work with kids when I have a chance, and so on, and it's like, you talk about things, and people will say, oh, but, you know, isn't this true?

And it's like, you know, you know perfectly well, that's just one of these things people say, and it isn't, in fact, true. But, you can say, well, you know, kind of, how would you know that? You know, what's the way of thinking about things that would allow you to figure out that that is true or that that isn't true?

And it's kind of people, like, say, oh, I didn't think of that, you know, let me try and think about why that might be true or not. And that's, you know, one piece of the story of, of thinking about things. I mean, the other place is, you know, there's a... there's a what-would-you-do-about-this type thing, and the this is something where there isn't a right answer. there's a... you've got to come up with a thing, and you kind of think around the edges, and you... and you say, this is what I might do. Now, quite often, those kinds of what we do about this, they end up being sort of trick questions.

Where somebody had this bright idea that, oh, there's this very clever thing you could say.

And, and, like, are the kids gonna figure out this very clever thing that you might say about, you know, I don't know, you know, why a manhole covers circular rather than square? Oh, it's because, you know, then they wouldn't... they don't fall into the hole type thing, and that's sort of the clever answer to that.

But, you know, a more... I think it's more interesting

to not go for the, oh, there's a clever answer that somebody figured out, and can this kid see their way to the clever answer? It's more, this is really something open-ended, where there isn't a right answer. The person posing the question doesn't know the right answer, and it's really a matter of, you know, can you figure out

Can you talk through and bring in different kinds of things? Maybe this is the right answer, maybe that's the right answer, maybe this is the way to think about it, maybe that's the way to think about it, and so on. I mean, modeling this kind of how to think about things, I think, is really useful.

And, as I say, my kind of slightly crazy idea of the class consists of random question comes in, and teacher plus class try and answer that question, I think would be an interesting kind of way to stimulate, sort of, actual thinking about things.

As far as,

Yeah, I mean, you know, to me, a large part of learning things is sort of the motivation to learn, and and also having... okay, I guess two more things to say.

Sometimes people think, oh, you can learn the abstract methodology of something, don't worry about the facts. Facts are old news, you can just look them up on the web, just learn the abstract methodology. I think that's wrong.

I think that learning facts, that is the... the kind of the kind of the structure, the skeleton on which you can build conceptual understanding.

if you know no facts, the conceptual understanding just sort of waves around in one's mind, and it just doesn't... it doesn't anchor to anything. Knowing those facts gives you something that is sort of the anchor that lets you then start thinking about things in a kind of conceptual way.

I, I think, that's, and I guess...

The other... another thing to say is, that

You know, there's always different ways to think about things, and different fields have different ways to think about things, and kind of, you know, immersing yourself enough in these fields to be able to think the way that that field thinks is interesting and useful.

I mean, I suppose another thing is being able to explain what you've learned. I mean, in other words, you can do that multiple-choice question about, you know, is this true or that true, or that true? But, like.

What about, let me write an essay that explains it to somebody, or let me stand up in front of the class and try and explain this idea to people? You know, people say, oh my gosh, that's so difficult.

Well, really, I think if you understand the idea clearly, then you know, there's a good chance you can explain it. Now, you might be shy standing up in front of the class, so on. Maybe you get over that, maybe you don't, maybe you, you know, write it on a computer, whatever else, but... but that's not the most important part. The most important part is if you're going to tell people, you know, what do you have to say about this thing? And, you know, I've seen

kind of... I always find it kind of interesting. I see people who are very good at... who don't have a hell of a lot of practice at it, but are very good at just, like, I'm going to explain this to you. And,

And then there are people who are very educated, et cetera, et cetera, et cetera, who say, can you explain this? And it's like it's a... it's a pile of mud.

You know, it's completely, you know, it's... it's... and I don't know, you know, sometimes maybe you can... you know, I think... I think it's, like, if you really understand it clearly, you should be able to explain it. And I think when you really, really can't explain it, it's a... it's a bad sign in terms of one's understanding of the thing.

you know, I have to say that,

you know, again, ask the question about learning actively, I mean, explaining things, figuring things out, this is, I think, kind of learning actively in a way that, sort of, answering the multiple-choice questions certainly isn't.

I mean, there are some new games in town here. I mean, the whole question of whether AI and the kind of linguistic interface of LLMs and so on can help in teaching is an interesting question. Certainly, the, you know, the dynamic of, I was supposed to learn this. Hey, LLM, ask me questions about this thing. That seems to work quite well.

It's not a particularly sophisticatedly... sophisticated problem to get that to happen, but it's something that works and is quite useful.

And then, maybe it's a little bit of explain this thing to me for some level of things that may be... that may be possible. We've been trying to build a, sort of, a full-featured kind of automated teaching system that can actually get... lead students through courses with the interface, with a sort of AI interface,

And, it's... it's still unclear to me. I mean, we built a wonderful technology stack. It's still a little bit unclear to me how well or not this is going to work, and to whether it... to what extent, kind of, the kind of engagement and conversation that one's able to have with an LLM is enough.



or whether actually having the human, where the student thinks, you know, this human is going to care whether I learn this or not, is necessary. Now, of course, in the kind of thing we're building, we're viewing it as a piece of additional leverage for humans at the other end, so to speak. So, you know, it's a student on one side, it's this kind of automated system in the middle. And then, at the other side is teachers, parents, professors, whatever else, who are still kind of paying attention to what's happening, and perhaps connected enough that whatever that extra boost of, is there a human who cares about me learning this, that that will actually be a thing that's injected there.

Alright, maybe one...

One more question here, and then I need to go back to my day job.

There's a question here from Eri.

How do you pick the right business partners, character-wise and technology-wise?

I've never had great business quotes partners.

And that may be more a statement about me than about anybody else.

I... I wish I had.

I've had lots of amazing people that I've worked with for many years.

But they haven't really been, sort of, peer partners.

My very first company, I brought in people as people to run the company. That did not work well.

Subsequently, a number of times, I've

You know, and this may be more a statement about me than about anybody else.

You know, I do... you know, I can do decently well when I'm kind of in charge, when I'm, like, sort of...

collectively doing things, I don't think it works as well, because, you know, it's like, am I doing this, or are you doing this? And it's kind of like, I'm not really motivated to do it if you're going to do it anyway. And it's kind of like, how do you divide the labor between those kinds of things? Now that's probably just more a statement about me than, than, than other things.

I see people start companies and so on, find partners... I'll say a few things.

First thing is, people get together, they're gonna start a company, it's amazing, they're going to, they're all friends, it's all, you know, we're gonna do wonderful things.

If... You know, if things go amazingly well, they could keep saying that for decades.

Usually, there are bumps in the road. And usually, particularly when the people who are sort of partnering that way are quite young, things change in their lives. And, you know, I think it is realistic to have some group of people who are sort of all pointed in the same direction for a few years, 3 years, maybe 5 years.

To imagine that you're going to have people who are all going to be pointed in the same direction for a really long time is unrealistic, particularly when the people are quite young, they sort of don't know themselves that well.

different things happen in their lives, different priorities develop, and so on, it's hard to keep everybody aligned for that long. When it's a question of the sort of short alignment, which I think is the main thing you can really plan on in these kinds of situations, and if the company does fantastically well, then there'll be a place for everybody somewhere, at least if the contracts weren't set up so bad that everybody is fighting with each other. And I have to say, along those lines, the extent to which whatever you set up is such that if somebody just decides, I'm bailing out.

that that isn't a big trauma. That it isn't like, oh, then they own this big chunk of stock that is now dead, and everybody's annoyed about that, or that they feel like, if I... if I leave, I'm gonna lose everything type thing. You know, you have to have tried to set something up where people get something sort of proportional to the effort they put in, and they don't...

kind of, end up with something which, to everybody else, looks like, kind of, they... they ripped us off. They said they were going to do this, they did it for a year, and then they bailed out, and they got the same as what this person who's been doing it for 5 years did.

You know, those are... but those are sort of, structural things about how you set up those kinds of arrangements. But in terms of the... the people.

I would say...

It can go in many different directions. I've seen it work in different ways, and I've seen it fail in different ways. You know, you can have very similar kinds of people who are, like, can finish each other's sentences, and...

Where, so long as they can divide the labor properly, that works well. I've also seen cases where people are very, very different.

I mean, I suppose it's true in marriages as well as in business partnerships.

The, you know, there are situations where there'll be one person who's, like, the quintessential salesperson, who's going out and just telling everybody how wonderful things is, they have no idea how it actually works, and then there's another person who's the techie, who is, you know, who hates actually talking to other people.

And the two of them together makes sort of a whole good thing, so to speak.

you know, I would say that, when it comes to To working with people, the more you understand about the people you're working with, I think the more likely it is to work well.

In a situation where it's like, well, I just don't really understand why you're doing this. You're doing it.

this company, whatever else it is, and because you say you're doing it, and you're doing it, and you're showing up to work every day, or whatever it is, but I don't really understand why you're doing it. Like, I don't see why it floats your boat, so to speak. I don't think that's a good situation to be in. And I think it's important for people to be

fairly, you know, like, people who start a company, they could say, well, I'm in it to make money, or I'm in it because I think I have this amazing idea and I want to see that idea out there in the world, or I'm in it because I want to have kind of the trappings of being, you know, a tech executive, or whatever else.

the, you know, I think the more realistically you can understand that motivation structure from the people you're working with, the better off you are. And the more you can understand, kind of, the strengths and weaknesses of people you're working with.

the more, you know, that's going to work well. I do think that having a person in charge is typically an important thing. Having, like, the, the sort of... the circle of people who are all in charge, I just don't think... I don't think our species is built very well to deal with that.

I think it's, like, you know, in the end, the company has to decide to do a definite thing.

And that is easier for one person to do than from some whole circle of people to do. And the worst thing is when it's kind of, as I was saying, it's kind of like, well, I'm not going to figure that out, I'm sure somebody else will figure it out. And then turns out.

The thing... nobody figured it out, and something really stupid got done, because actually nobody thought about it, because everybody thought somebody else was thinking about it.

You know, there are questions like, should you do business with your friends?

That's complicated. I've seen that work, and I've seen it not work. So, you know, it's not a very useful answer, but it's,

It's a thing where... I would say... Well...

In situations where there are no great stressors.

Friends who you can count on and trust are a good thing.

sometimes when there are big stressors, even the friend you thought you knew for however many years, I've seen this happen a bunch of times, the one you thought, the person you thought you knew, you knew them under normal operating conditions, and a stressor develops

That is something that pulls them out of their normal operating conditions, and then they behave in a way that is not at all what you expected from the way that you knew them.

I mean, I would say that the more common thing that happens in that situation, that I've certainly seen, is when people have, you know, they operate in their normal environment, they do what they do, they're used to certain kinds of things happening, they're used to responding in certain kinds of ways. When something out of left field happens.

the... the... if they had any model for it in their lives, they will revert to that model. So, if there was something that happened, you know, when they were a kid, and something with their parents happened, and they... this happened, and they saw this go on.

then, you know, they will revert to that, because that is their reference point. And, you know, and... but that may be something that you

Never knew about, because, you know, you're dealing with the person and their normal operating conditions.

Now, you know, you can't... again, sometimes people will know enough about the people they're sort of friends with, or whatever, that they'll kind of know that whole stack, and they'll kind of, you know, know all the influences that are going to happen to a person in a different situation.

But most often, you don't know that.

Most often, it's, you only know the sort of normal operating conditions that you've encountered the person in. And I would say that's a,

That's a thing. I mean, I would say that another thing is...

when people don't know what each other knows, or people have kind of postured themselves as, I'm the expert in this.

And the other people working with them are like, oh, they must be the expert in that. But that wasn't really probed, and it turns out they're not the expert in that. And, in fact, they could have done a great job if everybody had known, oh, when something about, I don't know, some finance thing comes up.

oh, just because this person went to, you know, business school, they didn't actually listen in that class, so to speak. They don't really know anything about that. You know, it's, it's okay because somebody else does, but if you think that person is the expert in that, it tends to, you know, fall on the floor.

I would say another question is, should you like the people you work with? That's an interesting question.

I think the answer to that is, you know, you have to get on with them. Are they necessarily people that you would socialize with? Not necessarily.

I've, you know, worked with people for many years, I like working with them very much, I think it's mutual, but

you know, I wouldn't... we have different, sort of, social interests and worlds, and that's not, you know... the socializing thing isn't the thing we do.

And sometimes when one's thrust into that situation, it's like, what the heck do we talk about now? And you better, best revert to talking about something to do with the work you do together, because that's the thing you have in common, so to speak.

And there are other cases where you're working with people, you know, there are people...

Where you're sort of friends with them, and that's a separate module of your life, of you socialize with them, and then maybe, you know, they're...

people... I've worked with them where they're not in particularly senior roles, let's say, at the company, our company, or something like that, but I happen to be friends with them, and that can work just fine, too. It's not, you know, then...

you know, it works badly if somebody tries to say, oh, we're friends, so, you know, can you make sure I get a raise, type thing. That tends not to go well. But, you know, so long as those things are compartmentalized, I think it's a fine thing. And I don't think it's the case that you have to sort of socially hang out with the people you work with.

I'm, you know, some people do, some people, and I do, to some extent, some people don't.

And I think both things are decent models, and I think, you know, if you... if you think, I mean, like, like, for instance, you know, people may have very different views about some socio-political kind of thing.

They can work together just fine. You know, if those things come up, they just sort of both know, we shouldn't talk about this. You know, we just don't agree. Fine. But they might agree tremendously when it comes to the things that they do in their kind of working life.

Now, it could be the case that if the origin of those sort of socio-political differences is some, you know, deep

ancestral route somewhere, that when some stressor arises that causes people to have to, you know, search for a basis for thinking about something they never thought about before, that they go to that and then people start disagreeing, that can obviously happen.

Anyway, a few thoughts there. I mean, I would say that, in terms of...

the... do you have a founding team for your company that covers the thing you need... things you need to cover? You need that to some extent, but usually there are...

things you can hire for, although the people who run the company need to understand what it is that's going on there, even if they couldn't actually do that job well. But

you know, I think that's, that's kind of a... another thing. When it comes to, sort of, technology types of things, it's like,

you know, I don't know, the... you know, you're trying to build a product. In the end, you're going to need... if you're trying to build a product, let's say, maybe you're trying to do services or something like this, but in the end, you're going to need people who fill in all those different pieces.

Which people are the senior management and which people are the hired guns is... doesn't have to always be the same.

And it's, you know, it's always been amusing to me that over the course of time, it's, like, the most important person in the company is their CTO, their CIO, their CEO, their CFO, their CMO. You know, at different times in history, the business magazines will tout different roles in a company as being the key one, that is the make-or-break role.

I think it really varies with the company and with the personalities, which one is the sort of one on top, and which one can be the one that is the lead rather than the leader.

Anyway, a few thoughts on that.

Well, thanks for some, interesting questions, and, back to my J-job.

Talk to you another time. Bye.

UNEDITED TRANSCRIPT