**EPISODE 624**

[INTRODUCTION]

**[0:00:00.7] TO:** Tim O'Reilly's book, *What's The Future* is an overview of business, technology and society. As the founder of O'Reilly Media, Tim has been steeped in technology trends for the last 40 years. From his vantage point running conferences and publishing technical content, Tim has been able to make informed predictions about what is coming next.

In today's conversation, Tim gave his perspective on how artificial intelligence will impact our world in the coming decades. More importantly, Tim emphasizes the role of human agency. The future is not something that merely happens to us as we sit back and eat popcorn. Today we make decisions and those decisions could help make our technology utopia or contribute to the fall of our great technological empire.

On the subject of business, Tim gave a radically different perspective than some of the entrepreneurs that have come on Software Engineering Daily. In our conversation he raised the question of why entrepreneurs raise massive amounts of money and get on the treadmill of startup hype and build a company around negative cash flows.

For that model, the only possible outcomes are going public or being acquired or flaming out completely. O'Reilly Media has been cash flow positive since the beginning and the company has steadily compounded, growing successively bigger businesses. From publishing to conferences, to online learning.

This episode gave me a lot to think about, just as the O'Reilly Conferences have given me a lot to think about throughout the years, O'Reilly Media has graciously partnered with SE Daily since we were very small, since three years ago. I have great admiration and appreciation for the company and Tim O'Reilly himself.

It was a real pleasure and an honor to get to meet him in person.

[SPONSOR MESSAGE]

 

**[0:01:49.4] JM:** Before we get started, I want to mention that we're hiring. Our hiring positions include writers and a researcher and a videographer and you can find this positions along with other jobs at softwareengineeringdaily.com/jobs. Some of these are part time roles, some are full time and if you yourself are hiring, you can also post on our job board, it's easy and free and we'll be sharing some of the job postings with our listeners.

Just go to softwareengineeringdaily.com/jobs and you can see how to post a job.

Every team has its own software and every team has specific questions about that internal software. Stack Overflow for teams is a private secure home for your team's questions and answers. No more digging through stale Wikis and lost emails. Give your team back the time it needs to build better products.

Your engineering team already knows and loves Stack Overflow. They don't need another tool that they won't use. Get everything that 50 million people already love about Stack Overflow in a private, secure environment with Stack Overflow for teams.

Try it today with your first 14 days free, go to s.tk/daily. Stack Overflow for Teams gives your team the answers they need to be productive. With the same interface that Stack Overflow users are familiar with. Go to s.tk/daily to try it today with your first 14 days free.

Thank you Stack Overflow for Teams.

[INTERVIEW]

**[0:03:43.4] JM:** All right well, Tim O'Reilly, you are the founder of O'Reilly Media, thanks for coming on Software Engineering Daily.

**[0:03:48.1] TO:** I'm glad to be here.

**[0:03:49.1] JM:** Your book, WTF, it's about WTF technologies, these are things like augmented reality, artificial intelligence, on demand services. It's been a year since you published WTF, out

of these topics which we're going to explore, what are the things that you've changed your mind about?

**[0:04:08.4] TO:** You know, that's a very good question. I think that if I were to spend more time, if I were to rewrite the book now, I would probably put a little more emphasis on genetic engineering. You know, I stayed away from it mainly because it's not really my field. But I do think that when we think about the 21st century, there's going to be a huge amount there.

**[0:04:33.9] JM:** How long 'till we have an O'Reilly conference dedicated to genetic engineering?

**[0:04:37.9] TO:** Well, we've actually taken a run at it two or three times. We did a bioinformatics conference back in 2001. We ran that for a number of years and we obviously, we have our science food camp which is basically an un-conference so we do every year, we've been doing that since 2004. In fact, it's this this weekend, Google X.

**[0:04:57.3] JM:** Okay. Well, one contrast I see to your book is that Kevin Kelly book, *The Inevitable* where he talks a lot about the same trends that you explore but he describes it in this position of inevitability where as I see your book is more about the human agency involved in these technologies.

How do you contrast the role of human agency versus the positioning of these technologies as being inevitabilities?

**[0:05:27.6] TO:** You know, I think some ways this goes back to this disagreement I had many years ago with Ray Kurzweil. Where he would draw these graphs and say, "Well look, progress goes up into the right," and I said, "Well, yeah, from a distance," sure but you know, if you look for example at architecture, the Hagia Sophia in Istanbul was for a thousand years, the largest building in the world.

Because we lost the knowledge of how to build something like that. You could have on human time scales, an immense slowing down or reversal of progress. I think part of what we need to understand is that first of all, nothing is inevitable. I think that we face enormous discontinuities and anyone who looks at history will see those even in human timeframes where there were

great empires that fell. Where there were civilizations that collapse and I don't see any reason why ours might not be among them. In fact, I think it's more likely than not that ours will be among them and so the notion of progress is also something that I think is profoundly suspect.

You know, are we really more advanced? If you think about adaptation to the environment, maybe humans are not so very advanced after all, we are kind of destroying our environment in 10,000 years of our rise and will we effectively foul our nest sufficiently that we won't be able to continue to prosper?

I think I like to focus, yes, there are long term trends that have momentum that have a powerful vector behind them but that doesn't mean that they're inevitable because first of all, there are other intersecting vectors. It's so interesting, one of the said people I've invited to our science bootcamp event or a couple of scholars who have been researching the interaction between climate change and the fall of civilizations.

Both of them - there's a group at Harvard that has basically done ice cores in Greenland then it's just basically correlated historical events through roman and early medieval civilization with climate change events. We have also one of the other people while study is the fall of ancient again civilizations and again, looking at the combination of climate change, you know, triggering a disease and then triggering migration, triggering warfare and that kind of being this toxic stew that brings civilizations to an end.

We're about to face one of those kinds of events. Part of - the hopeful part of my book though is really that if we look at the big technology systems we're building, they teach us about decline and fall, they teach us that you know, nobody's guaranteed a place in the sun forever.

But we also see stories of renewal and stories of better choices. Some of this might be because of the intervention of customers, it might be because of the intervention of competitors, it might be because of the intervention of government. You know, great, we've seen great example you know, in Microsoft, you know, which basically, you know, if you look at it from an evolutionary point of view, kind of grew because with the personal computer, there was this new inclusive opportunity for growth, lots of people came swarming into this market.

One company, you know, figured out the rules of the new ecosystem better than others, became better adapted. Came to dominate and then squeezed all the life out of the ecosystem. All of the entrepreneurial energy then moved over to the internet and of course we're watching the same story recur but then meanwhile, Microsoft went and reinvented itself and I think it's a much more interesting, humane company.

That's sort of in some sense, a metaphor for the broader choices that we can make as an economy. There have been times when our economy is very inclusive, and then there becomes a time when it becomes extractive. Right now, I think we're actually in a fairly extractive period and there's less opportunity.

If you look at the research of economist Raj Chetty at Stanford, he's been looking at the – what's the likelihood that children will be better off than their parents and if you were born in 1970 versus 1940, you know, you are now kind of entering the period where, this is where they measured, you know? If you are now, 50 years old, approaching 50, you go, you can see that they're actually less well off, our economy is becoming less robust for most people.

That's exactly what happened - you know, again, part of what I try to do in my book is to have this cross talk back and forth between what we learned from the history of technology platforms and what we learned about the economy.

Right there I go, okay, great. That's exactly what happened to Microsoft, I predict it will happen to Google because I look at the stats on Google and it's sort of a bit more of a slow motion consumption of its ecosystem than it was with Microsoft. It's just as obvious. In 2004, Google got half of its revenue and nearly half. 49.5% from advertising on third party websites, it's down to 18%. Google has grown its own properties, you know, far faster than its grown, the opportunity for other people on the web. You know, which is exactly what happened in the PC industry with Microsoft.

They basically took more of the value than they should have, it became a less robust ecosystem. Now, they've done some things that are very smart to counter that, you know? For example, in the smart phone market, giving away Android and creating a lot of value for others,

kind of gave them a bridge into the new mobile ecosystem so they kind of understand that creating value and not just capturing it is a secret of success.

But I think they've also aren't clear enough about that. Part of what excites me about AI and effectively algorithmic systems is what they're really good at is taking more and more data into account to get better results. You know, in the book, I spend some time, what did we learn from the history of Google search quality?

You know, when you look at the idea that they started with a couple of breakthrough insights that would give you better search results, things like page rank and then they also used anchor text and a lot of the things that were already starting to be understood but they've added hundreds of factors including AI which is now the Google brain ranking is the third most important after page rank and anchor text or actually anchor text I think is still number one.

People don't quite realize that and you know, as a result, they continue to have pretty good search results, despite sort of fairly robust attacks on the system by spammers, by people who are trying to gain the system.

We also take the lesson that this is a constructed system, they are managing it, there are people managing the algorithms. Now you look at Facebook and you say, they're now in the middle of a series of attacks on their algorithmic systems.

You also see the other problem with Facebook is that the objective function that they gave their algorithm existence may have been incorrect. You know, they thought that showing people more of what they engaged with deeply would bring people together and it turned out it could be used to drive them apart.

Some of that was attacks by people trying to gain the system and manipulate others. But some maybe, they just had the wrong objective function. I think it's a really interesting lesson here. They're sitting there going, how do we fix this? What I try to do in the book by kind of telling these stories is then go to okay, now look at our overall economy and how it is also an algorithmic system.

Where we have told companies to optimize for share price, with the theory that it would make everybody richer. Just as we see with Facebook, maybe they were wrong, you know? Because we see the hollowing out of the economy, we see the decrease in opportunity. We see the increase in inequality.

We see all of the negative externalities that are being created as people are saying, "Well, we're going to sell – we're going to hack the system and sell more opioids," you know, they will take the high most as to what the consequences are. It goes. That's clearly a rogue objective function.

Of course that brings me to the big metaphor of the book that in some sense, we've already built the human hostile AI. You know, the one that says, humans are at cost to be eliminated. You know, we don't have to look forward to some far future, we can say, maybe this is like a kind of a hybrid AI combined of humans and machines and it also has this problem that Nick Bostrom merge originally identified of you know, this runaway objective function where you tell the machine –

**[0:15:16.9] JM:** Paper clips.

**[0:15:17.8] TO:** Yeah, the paperclip optimizer or Elon Musk's strawberry picking robot that eventually decides that humans are in the way of strawberry fields forever. We built one of those, it's this massive system where all of the incentives are, get rid of people, treat them as a cost to be eliminated.

I think that we have to actually reign in and debug that system in the same way that we're asking Facebook to reign in and debug the system that they built.

**[0:15:47.6] JM:** The company you haven't mentioned yet but is a centerpiece in your book is Amazon. Amazon, what I think distinguishes it from the other companies you've mentioned so far is, it has been augmentative to both people in the technology industry and people outside of it. So in the technology industry, it's responsible for the massive boom in the lowering cost of technology companies because of AWS.

I think people, it's very easy to forget that. People sometimes do forget that. That how influential AWS has been but also just the fact that it's such a massive employer of low skilled labor.

It's augmentative for low skilled laborers. Why are there not more enterprises that manage to be augmentative to the low skill labor class? Because this seems like something that we would need to bridge that gap. I mean, putting aside the AI question for a second, just taking to the first question around the income and equality stuff.

If you can augment the – or augment that the skills of low skilled workers, I seem to be valuable opportunity.

**[0:16:55.2] TO:** Well, the other company I talk a lot about in the book that does that is Uber or Uber and Lyft. You know, they are also using technology to augment workers so that they can do things that you couldn't do before. I mean, you know, if when you think about the street hail aspect of taxis, you go, well, anybody could do that but you know, it's like now, you can actually be summoned by the app and –

But more than that, anybody can be a driver because there's an app that knows how to get from anywhere to anywhere. You think right here is an augmentation technology. I think that Silicon Valley though - well first of all, there's two things that are wrong, one is that we focus too much on some of the negatives of these jobs that they're you know, for example, not great jobs.

Same thing through Amazon warehouse jobs. Without recognizing that they can get better over time, you know, in fact, that that's what we should be shooting for, we shouldn't be trying to make – go back to the old ways, we should say, "How do we get our values expressed in these new ways?"

But also, we need to be looking at, well how do these same technologies augment higher and higher opportunities? A great example of this that I point to at the very end of the book is a company called Zipline. They are using on demand drone delivery to reinvent healthcare in countries that have – don't have a well developed healthcare infrastructure? You know, they are now – I mean, you know, Keller Renaudo, the founder was telling me they know that they have saved in the last couple of years, last two years, 1600 lives in Rwanda.

That's a small country where they started. Just signed a deal I believe or on the brink of signing deals and you know, in the Philippines and Ghana and four or five other countries and they're running some pilots even here in the US.

Here's this opportunity to do something that was previously impossible and you can really see it in this international context. The old way was, "Okay, you're going to have – in order to be able transfusions," and what they started with was literally the leading cause of female mortality in Rwanda was a post-partum hemorrhage.

You go, "Okay, you don't have the infrastructure for there to be blood everywhere in the country," because it means, you have to fairly big blood bank to have all the rare blood types and they go, we can just, there's bad roads and you just can't get it to people in the old way.

But we can get it to them in the new way and so then of course that builds a new workforce where they've got, again, this is still a small company but you know, hundreds of people who are drone engineers, who are drone operators, who are, you know, running the airfields where you know, they're basically doing these deliveries of blood and critical medicines and it really is a beautiful story of why you use this term 'WTF'.

Because that WTF, the first time you see something kind of fades away and I use the analogy, there's a great quote from Tom Stoppard, the playwright where he talks about a unicorn and you know, first it's incredibly magical and then it becomes as he says, as thin as reality, you know? Even more and more people sit and you go, that's just the way it is.

Keller's like, totally clear about that you know? If you're in Rwanda and you see a drone flying overhead and you know, dropping a little package, you know, you take it for granted. Yeah, they're delivering blood, you know? They're delivering medicine, you know?

It's just like - that to me is real progress and we do these things that used to be impossible and we come to take them for granted and anyway, I think there's so much more opportunity and when I think about kind of the design pattern as I like to say, of the 21st century, it's to use

technology, not to replace people but to augment them so they can do things that were previously impossible.

You know, things about all the great tech companies, you know, Google, enabling us to have access to all the world's information. That didn't used to be possible and now it is. You know, we take for granted, our ability to communicate with people all over the world.

You know, we are now increasingly have an infrastructure where products from all over the world can be you know, sold in exchange, it's kind of astonishing, I don't think a lot of people know the scale of the Amazon store. I assume, same thing's true of Alibaba in China. There are 600 million unique SKUs, stock keeping units, a unique product in Amazon US, about three billion unique SKUs worldwide.

You know, imagine that we have a store with three billion SKUs, you know, hundreds of millions of customers who can really get pretty much anything.

**[0:21:54.0] JM:** Yeah.

**[0:21:55.7] TO:** Again, that's enabling commerce, yes, it's putting some people out of work in small stores, although, I think that the evidence is that the number of jobs lost in retail is actually outstripped by the number of jobs that are created in delivery and in warehousing. There's actually been more jobs created by e-commerce than destroyed.

The problem is for a society, is that this jobs are in different places. You know, the lumpiness of the future is actually more of a problem in some sense than the absolute value of what is being created.

**[0:22:34.2] JM:** Right, lumpiness meaning the radical difference in value accrued to the people who are the providers of these services versus –

**[0:22:42.8] TO:** Well, that's one kind of lumpiness but it's also just lumpiness about where the jobs are for example. I do think, you know, again, there's some really interesting, work Michael Mandel at The Progressive Policy Institute where – let me put this as a broader economic theory

where they talk about the history of what they call frontier firms, companies that you know, one of the drivers of increased wages is that some companies become way more profitable than others.

Over time, they end up paying their people more. This has happened with you know, automobiles app and with energy companies, it's happening with tech. They just kind of pointing out that even you know, like over time, it's not just the machine learning engineers at Amazon or the top programmers.

It's actually wages arising for all the people including other warehouses. The theory is that over time, we're actually going to see these jobs get better, we'll see whether that's the case. I do think one of the problems that I, you know, talk about quite a bit in the book is that we have built a system with a set of incentives that tell companies to pay people less.

You know, because of this rogue objective function that says, increase your stock price, that's how you will win. Align the incentives for your executives with this overriding objective function. We've created a situation where you know, companies are incentivized to share less with their employees and we have an economic theory that says, some people are worth paying enormous amounts of money to and some people are disposable.

I think we actually need to understand that our goal in the economy can't be a winner takes all goal. It can't be, you know, some people get incredibly outsized gains and other people get next to nothing.

[SPONSOR MESSAGE]

**[0:24:45.6] JM:** At Software Engineering Daily, we have user data coming in from so many sources. Mobile apps, podcast players, our website and it's all to provide you, our listener with the best possible experience. To do that, we need to answer key questions like what content our listeners enjoy, what causes listeners to log out or unsubscribe or to share a podcast episode with their friends if they liked it.

To answer these questions, we want to be able to use a variety of analytics tools such as MixPanel, Google analytics and Optimizely. If you have ever built a software product that has gone for any length of time, eventually you have to start answering questions around analytics and you start to realize, there are a lot of analytics tools.

Segment allows us to gather customer data form anywhere and send that data to any analytics tool. It's the ultimate in analytics middle ware. Segment is the customer data infrastructure that has saved us from writing a duplicate code across all of the different platforms that we want to analyze. Software Engineering Daily listeners can try Segment free for 90 days by entering sedaily into the how did you hear about us box at sign up.

If you don't have much customer data to analyze, Segment also has a free developer edition. But if you're looking to fully track and utilize all the customer data across your properties to make important customer first decisions, definitely take advantage of this 90 day free trial, exclusively for Software Engineering Daily listeners.

And, if you're using cloud apps such as MailChimp, Marketo, Intercom, Nexus, Zendesk, you can integrate with all of these different tools and centralize your customer data in one place with Segment. To get that free 90 day trial, sign up for Segment at segment.com and enter sedaily in the how did you hear about us box during signup.

Thanks again to segment for sponsoring Software Engineering Daily and for producing a product that we needed.

[INTERVIEW CONTINUED]

**[0:27:15.6] JM:** I hear you vacillating between these two sides of the optimistic case for the future and the pessimistic case for the future. I mean, in each of your answers -

**[0:27:24.7] TO:** Yeah, I don't consider vacillation, I consider it – there are these two alternatives that we are choosing between.

**[0:27:33.2] JM:** Yes.

**[0:27:33.6] TO:** Okay, sure.

**[0:27:34.7] JM:** The two core problems that you've mentioned I think are the AI objective function or maybe you can bucket that with the economic, problematic 1980s mentality –

**[0:27:44.3] TO:** Sure, they're the same thing.

**[0:27:45.9] JM:** Objective function. Then the other problem is, okay, we've got dramatic disparity in sectors of the economy who are you know, making dramatically different amounts of money which translates to dramatically different realities.

Dramatically different perspectives on where this present is taking us. Which future this present is taking us towards. You're involved in a lot of different areas where you could be mending that future, that gap in the equality and I think you know, one of those is education obviously through O'Reilly you produce so many educational materials, some of them free, many of them free.

I know you're heavily involved in government, we're at Code for America right now and I'm also curious about your perspective on alternative methods of income redistribution, the UBI stuff. What are the - in the optimistic case that we're able to make this work, that we're able to avert the great roman collapse 2.0. What is it going to take, what are the thing, what are the different policies, what are the different things that tech companies are going to need to do, what are the strategies that we need for the optimistic case to work out?

**[0:28:58.0] TO:** Yeah. Well, I think, first off, we really need to reject these ideas that took hold in the 80s of basically if you optimize for the winters, everyone will become prosperous, you know, the trickle down idea. We need to understand, I think as my friend Nick Hanover said, we all do better when we all do better. You know?

We actually had that, there was a period of prosperity where that was in fact the philosophy that governed government policy and economic policy was like, we want people to be working, we want, you know, it's sort of interesting. This historical seesaw that you see, we had the 20s

which was a greed is a good period, led to a Great Depression and World War and then we went, we really screwed up.

We have to actually have a much more inclusive economy, we have to invest in people, yeah, you think about the GI bill here at home and the martial plan in Europe, you know, the equivalent in Japan, the rebuilding of the world after World War II, that made us all prosperous and then we kind of went, we start to get inflation and then we said, well, we make this big correction because our economy is getting inefficient and that we're due for another correction, you know?

I think one off the things that tech teaches us is at the scale and speed of the modern world, it's not a matter of a big correction every 50 years. You know, we need to have continuous monitoring and feedback loops. That's kind of what I've been trying to raise as an issue for government is how do you have, you know, delivery driven policy in the same way we have delivery driven, you know, development in tech.

We sit there and we try things and we test in it and if they work, we do more of them, if they don't work, we stop doing it, these new changes in the environment, either competition or people trying to gain the system, we go, we have to adapt. There is this continual complex adaptive system in modern apps.

Whereas government is you know, sort of, kind of fire and forget, you know? We're still operating on policies that we may have developed 70, 80 years ago. Maybe we've kind of added more- you know, we've double down on them, we've tweaked them a little bit but we haven't really reinvented government and I think there's a real opportunity to take the lessons of tech and to say, how would we do some of the things that you know, if we say, what's our objective to make –

You know, we want to make a prosperous economy that's got opportunity for all, what would we do differently if we were starting over today?

**[0:31:48.2] JM:** Well, the GSA stuff and Mikey Dickerson and all the stuff that went on under Obama, that seems like cause for optimism if we take a time horizon beyond the current administration, right?

**[0:32:02.9] TO:** Yeah, absolutely. Just to be clear, my wife Jen Pahlka started the United States Digital Service, she actually went to the Obama White House. It was basically this idea – she was basically originally, Todd Park had started something called the Presidential Innovation Fellows which is modeled on the code for America Fellowship and he wanted Jen to come run it and she said, "No, I want to do something like what the UK is doing, the UK government digital service," that is you need to have an elite core of tech people.

She went and developed the framework for that and 18F and then of course, the healthcare.gov crisis is what brought the political will to actually do it, you know? But we've been continuing to work on it and yes, it is incredibly hopeful, the United States Digital Service is continuing even under trump and it's kind of amazing, you know?

I mean, Mikey left the end of the Obama administration but Matt Cutts of Google, you know, went and took over the role. Now, of course, he agreed originally when every thought it was going to be Hillary was going to be the next president and it took a lot of guts to say, "I'm going to stick this out."

You know, because you realize that look, you know, getting veteran's benefits is not a political issue.

**[0:33:14.1] JM:** Right.

**[0:33:14.9] TO:** Getting the social services to work is not a political issue. You know, service delivery is a big part of what government does. Well below the political layer. In fact, you can make the case that, you know, one of the reasons why people have lost faith in government and keep saying "Well, we should just shrink it," is because it's not doing a very good job at a lot of things.

If we could actually make government work better, people would be more willing to pay their taxes, they'd be more willing to support programs and to do that, government has to have these new tools that we have, to understand in real time, are things working or not?

**[0:33:54.9] JM:** Yeah.

**[0:33:57.2] TO:** There's so much that you know, we feel excited about, the tech can teach government, at the same time my wife, Jen Pahlka, who started Code for America, you know, likes to say we also need to bring the values of government to tech. That is the values that we are trying to build something that works for everyone because what is unique about government is it's an institution that when it works well is effectively trying to manage the platform and the society for the benefit of everyone.

You know that is sort of an anathema to a lot of people. They like to say, "Oh no, the free market is what we are depending on." And I just call bullshit on that. First off, it is in the free market. It's got rules and those rules are tilted one way or the other to affect the outcomes. You know we tell people, "We are going to give you this, we are going to charge you this much tax for this kind of thing," I mean if you think about there is a lot of incentives for making financial investments.

You know it is a lower tax rate than there is on paying people. Anyway, there is a lot of design in the system. You know we have things like, "Oh we are going to favor housing with tax breaks," what are all of this huge amount of tax nipping and tucking and shaping of the economy in the same way that Google shapes its search algorithms and here is the thing that we now can do those things way better than we did before. You know we sit there and we look at this idea of the more free the market the better.

That's looking at the contrast between you know really bad experiments in the 30s and 40s in Russia and China you know in the 50s of centralized control and what actually happens today. I look at the information market enabled by Google for example and you tell me that that's a free market. It's a centrally managed marketplace. Google's algorithms decide what things show up on the first page of your results. It is not the market.

It is Google is actually managing that. It's a centrally planned economy and it's centrally planned and it works because Google is using data to actually say, "What are people really looking for?" so they are kind in some sense replicating what we traditionally think of as the role, the coordinating role of independent free markets by taking much, much, much more data into account and I think one of the things that we fail to understand, you know when we look at what I like to call today the Adam Smith marketplaces of people exchanging goods and services largely on a local or regional basis.

You know where price signaling was a principal coordinating function but also you had a lot of visibility into who you were buying from, you knew them perhaps, there was a lot of trust signals and so on and then you look at this modern global marketplaces where there are vast information asymmetries. They can be exploited by players who have much more information. So the financial price signaling aspect is actually much less effective because those signals can be gained and controlled.

By players with a lot of financial power and meanwhile, you start to see this evolution of these new market places and this is one of the things I think a lot of people haven't recognized about Google and Facebook because they make so much money. They go, "Oh well that's the market right?" They go, "No." Actually the actual content exchange market of both Facebook and Google of people producing content and consuming content is kind of independent of the price signaling.

The price signaling in the market, the advertising market is a sidebar market that gets attached on. It is a side car that is attached to this market, that is coordinated by non-price signals, by non-economic signals. Google says, what we can take hundreds of fractures into account to figure out what people are really looking for when they say the Engineering Today podcast or Software Engineering Daily. Sorry.

**[0:38:28.2] JM:** It's all right.

**[0:38:28.6] TO:** Presumably the AI probably would recognize though, "Actually he really meant Software Engineering Daily," right? So here is this centrally managed and created and curated set of algorithms that are matching up people with what they're looking for. The same thing with

Amazon, it's like when you have 600 million products, we are not all looking at the same store. You know Amazon's algorithm should be deciding, "What are you really looking for? What are you most likely to buy?"

And it is dynamic and it is unique for everyone and so, I think there are some fundamental changes in the nature of the economy that we haven't fully understood and I am really enamored of this idea that this phrasing that came from Paul Cohen. He is the dean of the Information Science School at Pitt. We were both at a meeting on AI at the National Academy in Washington, DC and he says something beautiful. He said, "The opportunity for AI is to help humans model and manage complex interacting systems."

And I think that is kind of a beautiful summation. You think effectively, the job of the opportunity of AI is to help us build better markets. You know Google is a marketplace that is designed and managed by people. Facebook is a market place designed and managed by people. Amazon is a marketplace designed and managed by people. The Apple App Store. And they have created a space where there can be a market with most of contributors but it is in fact centrally managed and coordinated by these algorithmic systems.

And so I say, let's take those lessons to government and say, "Okay, government has to get better at managing the systems that it is effectively creating the infrastructure for them.

**[0:40:18.6] JM:** I want to shift the topic completely to something more micro cosmic. So your company, O'Reilly is a private company and that stands in stark contrast to the public companies that we are discussing. Nonetheless, your company has been super successful. What are the pros and cons of a private company in contrast to a public company?

**[0:40:41.9] TO:** Well I guess there's two or three different axes that you have to look at and the first one is – let me actually just talk about a financialized company rather than a public or private. That is a different distinction. Because you can have a startup for example that from day one is financialized even though it is not –

**[0:41:03.8] JM:** Right, cash flow positive meaning?

**[0:41:05.3] TO:** Yeah, what I mean by financialized is its fundamental product is the price of the company. That is a financialized company. When you have a startup and your goal is to increase the evaluation all the way out to IPO, the product you are fundamentally making is the price of the company, right?

**[0:41:24.6] JM:** I see what you are saying.

**[0:41:25.4] TO:** Whereas [inaudible] have an old fashioned Adam Smith company. I make stuff or we make stuff, we sell it to people who say, "Oh I want that," and they pay us for it whether it is a book, whether it an event, whether it is our online subscription service on Safari, people pay us for the stuff we create and we make our money on the spread between what it cost us to make it and that is the way the whole economy used to work.

Now if you look at the startup economy, it's a microcosm of the broader public market economy which is just a betting economy and in some sense, you know I don't really go this far in the book and maybe I should have, it is a sign that we are actually, we've commoditized so much of the Adam Smith economy. You know that is most of what we make can be made really cheaply and it is a commodity. So humans are always looking for a way to make something new valuable.

This is a thread that runs through the book. You know I talk about it in four or five different contexts. You know Clay Christensen called it the law of conservation of attractive profits. It is where one thing becomes a commodity, something else usually something adjacent becomes valuable and so in some sense, as we stop, as we meet more of the day to day needs of people in the economy, we build things that people don't really need but maybe they just want.

Actually Samuel Johnson, the famous 19th century author, you know once wrote about this wonderful passage in his little the novel Rasselas, he said, his character says, "I consider the pyramids to be a monument to the insufficiency of all human enjoyments. He who has built for use until use is supplied must begin to build for vanity." And so you think about how much of our economy is now stuff that you don't need but that you want.

Whether it is fashion, where it is entertainment or whether it's my startup is worth more than yours. And in some sense, way too many startups I think are being built. I mean there is sort of a good part of all of that where it is like if you really see it as startups are kind of like movies and VCs are like movie studios and entrepreneurs are like movie stars and then you go, "Okay I get what it is. It is an entertainment economy and we are creating products and Snap is like mission impossible".

You go, "Oh great okay I know what it is I know what I am getting into." But you know we haven't really figured out which and those things is like just being popular gets you a valuation. You know either Twitter nor Snap has ever made a dollar of real profit where their actual revenues were greater than their cost. Then there were other companies like Google -

**[0:44:25.9] JM:** They are super money that right?

**[0:44:27.4] TO:** Yeah, they do. I call them in the book super money you know? So they get this huge –

**[0:44:33.1] JM:** And do you ever wonder what could O'Reilly be if we had super money?

**[0:44:38.0] TO:** Well I thought about it many times and part of it is first of all, it's a winner takes all game and you know it is sort of a betting market game and I have been around a lot of companies and watch them come and go and everybody kind of focuses on the winners without thinking about the losers. And I think that for every company that is a big winner in this gamble to be of perception you know for people to be betting on you for the future there are a lot of losers.

And so I guess I said, "Well look I think it is a slow and steady way to win. And then there is this high return high risk way to win." The problem with the high risk high return way is I think a lot of times it is kind of a fraud you know? I hate to use that word and a lot of people will hate me in Silicon Valley for it but it is not that dissimilar from if you don't actually have a real business in mind that will actually produce revenue and profits in the end, you're preying on people just like the people on Wall Street who were selling these packaged up mortgages in 2006-2007 leading this big crash.

Because in the end, a Google for example which is a real company, you know, people are betting on its future and the bet pays off, right? People are betting on Amazon and the bet pays off. You know, Amazon is a little different.

Sort of interesting, one of the things that I have been doing is an exercise since I wrote the book is actually looking at how far along are we to the bet paying off by looking at the market cap of the company or the wealth of the founders versus the what they would have if they were a private company.

So for me, you know I look - effectively my net worth is a product of well what are the retained earnings of my company over 40 years, you know what I mean? How much did we make and I don't necessarily I will have it personally but if I sold the company, that could realize the difference between what's in the company and maybe I could sell it in some other way but there is sort of a set of dollars that have accumulated.

**[0:46:57.8] JM:** Yeah.

**[0:46:58.1] TO:** And you know you really see it vividly, you know I have been looking at a contrast in Google and Amazon. You know Jeff Bezos is currently worth $144 billion in the stock market. He now owns something like, I don't remember whether he is down to 19% of the company ownership but anyway, I just stood track over the years since they went public. If he just simply got his share of the companies, retained earnings that its share of his profits he would be worth more than a half billion.

So he has a 100 times much wealth as he would have just as a share of the actual dollars that his company made and so you kind of go, "Will that ever equalize that?" I think it will but it will equalize out because Amazon will come down from a couple of hundred times earnings down to a more reasonable number. Like Facebook and Google are not that far ahead of the S&P 500 now. I mean Google is 26 times and Facebook is 29 times its earnings.

And because of that you kind of go, “Okay so what that means is over a period of 20 years, you know if you bought the stock and the stock is a claim on the earnings effective the stock will earn out, you know?

As oppose to all you places bet and you managed to cash it out before the greater fool didn’t realized that it was going to crash. You know so Google I mean Larry and Sergei probably are already halfway there to having really earned their wealth through the actual profits of the company. You know Jeff has achieved 1% of his actual wealth.

**[0:48:38.4] JM:** Sure.

**[0:48:39.3] TO:** Now again it is not to say these companies also demonstrate, particularly Amazon, Google didn’t need that much capital to get to profitability, whereas Amazon needed a great deal of capital to get to profitability. And that is how financial markets should work. They should be when you need capital to build a future that’s what they should be good for but instead we are spending a lot of that capital just making a lot of people rich for companies that fail.

They get acquired, they don’t go anywhere and you know, I trace in my book a little bit how that happened with AOL. You know AOL went all the way up to 240 billion in market cap. You know partly based on a set of fake news in some sense about we are an internet company and they weren’t. They were a dial up company and they weren’t actually an internet company but they rode the internet wave and then they crashed back down to 20 billion.

So they’ve created some value but they are able to sell on this hype wave of the internet, able to sell themselves as way bigger than they were and I look at that with Uber for example and self-driving cars. I make reference to this in the book. Uber’s investments in self-driving cars were kind of fake news. “Hey, we’ll be a way stronger business in the future because we’ll get rid of those pesky expensive drivers so value us more highly now,” right? And the fact is, that’s the kind of perception engineering that we see in an overly financialized market.

[SPONSOR MESSAGE]

**[0:50:18.4] JM:** You listen to this podcast to raise your skills? You are getting exposure to new technologies and becoming a better engineering because of it. Your job should reward you for being a constant learner and Hired helps you find you dream job. Hired makes finding a new job easy. On Hired, companies request interviews from software engineers with the upfront offers of salary and equity so that you don't waste your time with the company that is not going to value your time.

Hired makes finding a job efficient and they work with more than 6,000 companies from startups to large public companies. Go to hired.com/sedaily and get $600 free if you find a job through Hired. Normally you get $300 for finding a job through Hired but if you use our link, hired.com/sedaily, you get $600, plus you're supporting SE Daily. To get that $600 signing bonus upon finding a job, go to hired.com/sedaily.

Hired saves you time and it helps you find the job of your dreams. It's completely free and also, if you are not looking for a job but you know someone who is, you can refer them to Hired and get a $1,337.00 bonus. You can go to hired.com/sedaily and click "refer a friend". Thanks to Hired for sponsoring Software Engineering Daily.

[INTERVIEW CONTINUED]

**[0:52:01.3] JM:** So your company, O'Reilly, established a durable competitive advantage overtime and along that path, you also did do some speculative things that worked out. So you had at Skunk Works, you actually started a company called or spun off a company called the Global Network Navigator which was out of the Skunk Works project, you sold it to AOL for I think $11 million.

**[0:52:29.7] TO:** It is actually 15 by the time, yeah but anyway, whatever there's plus in stocks. Yeah, anyway.

**[0:52:33.8] JM:** Yeah, so that is great outcome, Skunk Works project. O'Reilly has –

**[0:52:39.0] TO:** But $15 million in '95 was a lot more money than it is today, yeah.

**[0:52:43.1] JM:** Of , absolutely. What I wonder is had you continued to do Skunk Works things and how have you felt overtime over the last 40 years about the durable cash flow positive business and just focusing in and sticking to your knitting as oppose to trying to do Skunk Works things, speculative things, moon shot projects that might be more native to a company like a Google or an Amazon that have super money and they can sort of throw money - well anyway, yeah you understand what I mean.

**[0:53:19.1] TO:** Yeah, I guess what I would say is you pick the hat to fit the head you know? And there are some things that you know this has a business model just keep turning in the crank. There's other things you don't know if you have a business model and so with GNN, there are a couple of things. We were very early in the web. It was the very first commercial website launched in 1993. It was the first advertising on the web and we had a lot to prove and we got a few years into it and we saw the web taking off and I said, "Oh I'm going to have to take in a lot more money."

Because I read a book called the Marketing High Technology by Ron David and he basically had an appendix. We talked about the math market domination and it was what convinced me to sell. I said, "Look in order to dominate a market, you have to be at least half the marketing growing faster than the marketer as a whole." And I looked at the web and I said, "There is no way I can do that without taking in a lot of money," and I don't want to do that because in my consulting days I've been around a lot of startups.

And I watched them go from being a really interesting places to places that I didn't want to be anymore and I wanted to keep O'Reilly independent so I spun it out and we sold it to AOL and watch them promptly take it because they didn't really believe in the internet even though they said they did, you know? And over the years we have spun out a number of other technology projects and sold them. We started an early venture firm and have done some great useful investments and we'd had some wins.

You know we were the first investor in Blogger which we sold to Google. I have this first company, for example and again it was one of those things where very nearly went out of business but managed to get rescued and blogging went on to become quite important although

Google didn't do that much with Blogger and I guess I just say I have a mix like we were the first investor in Planet Labs for example, Planet now it's called, which is micro satellites.

And you know, here is a company that requires capital. It launches satellites which cost money and it's been years to build this global network to image the surface of the earth every day. That's what financial markets are good for. We could never have done that without speculative capital but on other things you kind of go – but also some it is just inclination. I think the main thing is to be focused on the value that you are creating because if you are creating value then you say, "Oh is this a better way?"

And when I say value I mean real customer value not, "Oh I can get some greater fool to give me money for this thing and I can sell it." And I have watched companies, the companies I am looking at today, you know some of them are competitors and you go, "Yeah you know you manage to go public losing a couple hundred million dollars."

**[0:56:18.5] JM:** Competitors to O'Reilly, you are saying?

**[0:56:20.1] TO:** Yeah where they are spending money for customer acquisition. Now you really look at the business and you go, "That's a crappy business. It is not sustainable." But they are managing to get through to a financialized exit. Now maybe they can now turn it into a real business but we are in bubble times when you can have businesses that are getting 50 cents on the dollar that they spend go public because hey, that's not real business. That's just appearances.

And again, you know part of the thing is that people don't understand that there are some businesses where scale sticks and there's other businesses where scale doesn't stick.

**[0:57:07.1] JM:** There are a lot of head winds in the industry that you are in. The developed marketing, there's tons of developers, that the market size obviously growing, you've got developing markets, what are the biggest changes that you foresee for the O'Reilly Media business in the near future?

**[0:57:25.6] TO:** Yeah well I mean the biggest change is that we're really betting on is we have shifted a lot of emphasis - you know if you have this, you're like three legs to the stool today. This is our original business which was book publishing. It's now the smallest part of our business. Then there is events which the next largest and then there's our online platform which is the largest and so, we're placing a big bet on the online learning platform.

It is in fact a marketplace play because we are not the only provider. We are both a provider of content from our book publishing and our events business you know feed content and we have hundreds of other publishers and other types of content providers. You know, we see that on demand learning market place being an incredibly important part of the future of how developers learn and just in general how companies do continuous training and up scaling of their employees.

So you know, we have already placed a huge bet on that as the future of our business and I think we have some real advantages there. I mean there is a lot of people who are doing video training for example because we have - books are really good for I need some really in depth answer that's been vetted but we also have a lot more, we also go all the way through because of our experience with events and the live training, we do online live training.

And so, we have a comprehensive set of offerings. The other thing I would say and this is one that we have not fully grokked and that is this idea of up scaling that we have talked about with regards to Uber or Amazon warehouse workers and that is where the intelligence really resides in the machine itself. And humans in partnership with the machine and quite frankly, it is something I had thought about for 20, 30 years, you know? How does that apply to our business?

And it is going to one day somebody is going to do it and I am going to slap myself on the forehead and why couldn't we see that. But that augmentation. You know again we know some, if you look at modern developer tools and how much they assist you in coding correctly. You look at all the tools for sort of version control and sharing and that is all developer augmentation. We spend a lot of time thinking about things like Jupiter Notebooks as a way of delivering learning and content more effectively.

And those are also examples of how you can augment people and augment the kinds of ways that we share information with each other.

**[1:00:07.2] JM:** You are talking about up scaling non-developers right?

**[1:00:09.7] TO:** Well you know both, in some sense if you think about like an up scaling technology, desktop publishing, it meant that anybody could publish a good looking document and Jupiter notebook is an up scaling technology because it means you can publish a document with the data that goes with it in a way that – or a model that goes with it. And so it is a real advance in publishing and knowledge transmission and I think that's important.

But we still haven't really seen the kind of knowledge on demand. When I think of the metaphor of where we all need to be converging on, it's a little bit like the scene in the Matrix where Neo asks Trinity about the helicopter, "Do you know how to fly that?" And she says, "Not yet." And of course, that's what we all want. You go, "Do you know how to do Tensor Flow?" Yeah you know do Tensor Flow and you go not yet and you download the information and you know in some ways of course, we are there.

Because the ability to package up and containerize, those are all elements of this super power that we are building around development where you can be more powerful and you can quickly get access to new skills, new capabilities. You know, the fact that you no longer have to build your AI models from scratch that there is a pretty powerful tools available from the cloud platforms. These are all ways of developer up scaling and I think for us part of it is understanding which of those things are most appropriate for people.

An interesting new book I am reading right now is called *Prediction Machines* and it is actually one of the best books I've read on the application of AI to business and it makes the point that look, stop talking about AI. Just talk about these things or machines that are good at prediction. You give them some data and they say, "Well this is what this data predicts," and you say, "Well what becomes valuable in a world where this prediction is cheaper and they kind go, "Well it's judgment."

What do you ask, what are the questions that you're going to ask. When you get a bunch of predictions, are they good predictions or not? And again, you look at that ability effectively debugging in some sense becomes senior to programming in that world. I love this phrase. It is one of these things that I have regretted. I didn't use t in my book it was because after my book went to press, I remembered a conversation I've had.

I don't know, maybe 30 years ago with Andrew Singer. It was early in the company's history, we were working on documentation and it was probably 1987 or '88. I was writing the manual for a product called Light Speed C which was the first C compiler for the Mac. Andrew had a comical think technologies, it later became and called Think C due to a trademark problem. Andrew said something that stuck with me and it came back recently.

It was like, "The skill of debugging is figuring out what you really told your program to do instead of what you thought you told it to do," and if you think about it that is what Facebook is doing right now, they've got this vast prediction machine that says if I show you more of this, you are going to look at it, you know? And now they are going, "Oh well is it doing what we really thought it was doing?" You know they are realizing there were all of these consequences.

And that's really what this book, *Prediction Machines* is talking about. It's like oh, in a world with increased prediction, the key skill is actually understanding whether the predictions did what we thought they were going to do and that is something that I think is something we all really have gotten to grips with, you know? We are in some sense, you probably remember in the early days in the web where everybody went nuts over so you can make things blink.

And then there was color and all of this kind of crap, you know and then we had this sort of design renaissance and we're approaching that moment with AI because we are realizing that we can do all of this stuff and we are doing it wrong in some way. You know we are making bad predictions and just accepting them. You know it is everything from the bad predictions based on sentencing algorithms and criminal justice to Facebook's algorithms to whatever.

And it is exactly what this book points out, you know what is really becomes valuable again is our human judgment to evaluate, you know and again, I love Andrew's phrasing, "You know, is the system we're building is it doing what we actually want it to do?"

**[1:04:45.3] JM:** Tim O'Reilly thanks for coming on Software Engineering Daily. It's been really great talking to you.

**[1:04:48.9] TO:** Fantastic to talk with you too. Thanks.

**[1:04:50.4] JM:** Okay, great.

[END OF INTERVIEW]

**[1:04:55.0] JM:** In today's fast paced world, you have to be able to build the skills that you need when you need them. With Pluralsight Learning Platform, you can level up your skills in cutting edge technology like machine learning, cloud infrastructure, mobile development, dev ops and blockchain. Find out where your skills stand with Pluralsight IQ and then jump into expert led courses organized into curated learning paths.

Pluralsight is a personalized learning experience that helps you keep pace. So get ahead by visiting pluralsight.com/sedaily for a free 10 day trial and if you are leading a team, discover how your organization can move faster with plans for enterprises. Pluralsight has helped thousands of organizations innovate including Adobe, AT&T, VMware and Tableau. Go to Pluralsight.com/sedaily to get a free 10 day trial and dive into the platform.

When you sign up you also get 50% off of your first month. If you want to commit you can get $50 off an annual subscription. Get access to all three. The 10 day free trial, 50% off your first month and $50 off a yearly subscription at pluralsight.com/sedaily.

Thank you to Pluralsight for being a new sponsor of Software Engineering Daily and to check it out while supporting Software Engineering Daily, go to pluralsight.com/sedaily.

[END]