

The Economic Club of New York

453<sup>rd</sup> Meeting  
109<sup>th</sup> Year

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Eric Schmidt  
Executive Chairman, Alphabet, Inc.

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Interviewer: Charlie Rose  
Anchor, Executive Editor of Charlie Rose  
and Charlie Rose: The Week  
Co-Anchor, CBS This Morning



## Introduction

Chairman William C. Dudley

Good afternoon everybody. Welcome to the 453<sup>rd</sup> meeting of the Economic Club of New York in our 109<sup>th</sup> year. I'm Bill Dudley, Chairman of the Economic Club of New York and President of the Federal Reserve Bank of New York. As you all know, the Economic Club of New York is the nation's leading nonpartisan forum for speeches on economic, social, and political issues. More than 1,000 prominent speakers have appeared before this Club over the last century and we've established a strong tradition of excellence.

I want to personally recognize the 232 members of the Centennial Society. These Club members continue to make an extraordinary contribution to ensure the financial stability of the Club as we go into its second century. Their names are in your programs. I'd also like to welcome students that are here today from Columbia University, Hunter College, NYU Stern Business, University of Pennsylvania, and Southern Methodist University.

This afternoon we're honored to be able to have as our guest speaker, Eric Schmidt, the Executive Chairman of Alphabet, Inc. In this role he acts as the firm's global ambassador with responsibility for the external matters pertaining to all its businesses, including Google. These responsibilities have taken him to all corners of the world including visits to Cuba, North Korea, and Saudi Arabia to promote open internet access. In his role he also advises the senior

leadership of Alphabet on business and policy issues. Joining Google in 2001, Eric helped grow the company from a Silicon Valley startup to a global leader in technology. He served as Google's Chief Executive Officer from 2001 to 2011 and as Chairman from 2011 to 2015.

Prior to Google, he had leadership roles at Novell and Sun Microsystems and he holds a bachelor's degree in electrical engineering from Princeton University as well as a master's degree and PhD in computer science from the University of California, Berkeley. He's a member of the President's Council of Advisors on Science and Technology. He's also a writer, the co-author of *The New Digital Age* and *How Google Works*. And he serves on the boards of the Mayo Clinic and the Broad Institute. He's also a pilot, a Gulfstream pilot, and his philanthropic efforts through the Schmidt Family Foundation focus on climate change. So welcome.

We are also quite fortunate today to have as our interviewer, Charlie Rose, anchor and Executive Editor of Charlie Rose, the nightly one-hour program, and the newly launched, Charlie Rose: The Week. As many of you know, he also co-anchors CBS This Morning and is a contributing correspondent to 60 Minutes. So let the conversation begin. Charlie and Eric, the floor is yours. (Applause)

CHARLIE ROSE: Thank you very much, Bill. Thank you. Do you care what side? Thank you very much, it's an honor to be here and to be with my friend, Eric Schmidt, who I've known for a long, long time back when he was a chief technologist at Sun Microsystems trying to explain to

me what Java really was about. Remember those days?

ERIC SCHMIDT: I do.

CHARLIE ROSE: And Bill has said it well about what Eric represents, and I just looked at the paper today, there's a story about Google and others in Europe. There's a story about the Saudi's investment in Uber. I mean you can look at any paper today and there are three or four stories about how technology is affecting our lives. We did a program this morning about artificial intelligence and virtual assistance. I mean everywhere we go great companies are becoming technology companies. And Eric has been central to that revolution. I don't know, I mean what Google has become, now the second richest company in the world, what he has done and what his partners have done is to help us understand the power of technology and he feels strongly, and so do I, about how essential it is for this country to make sure it treats with urgency and with a sense of commitment to all that technology can do for us. And I know that's a central concern of his. But let me just begin with a couple of questions. When you went to Google, they said to you we need an adult in the room? Because it was a good day for you. (Laughter)

ERIC SCHMIDT: It was a good day for me. It's an honor to be here, and thank you guys very much for inviting me, and Charlie, thank you for doing this as well. Larry and Sergey had decided that they needed someone to sort of run things. And they had spent 16 months interviewing people and they made them do things. So to become CEO you had to go skiing with

them or you had to go to Burning Man with them. And very, very few people met the test apparently but I was fortunate enough. I told them I wasn't going to spend the weekend with them, but we made a long list of things to do and from then on it worked.

CHARLIE ROSE: And ten years at CEO.

ERIC SCHMIDT: Yes, and we built the company.

CHARLIE ROSE: What was the most important thing that happened in those ten years for you, for the company as you see it?

ERIC SCHMIDT: Well, my world is full of brilliant ideas that are not monetizable in the sense that people have amazing ideas. In order to build a company of the sort of success of a Google or a Facebook or an Uber, you have to have both a technological idea but you also have to have a significant change in the way the revenue will come in. In our case, we invented targeted advertising which is really much better than untargeted advertising, and that's what happened. And we rode that really, really hard. And that gave us this engine, right, in the same sense that Microsoft had the engine from DOS and Windows and you go back, you know, in the 80s, we've had this engine that has allowed us to build these systems, not necessarily with a particular revenue plan. We've been able to fail at big projects without too much of an issue with respect to our shareholders and so forth.

CHARLIE ROSE: So you can risk much.

ERIC SCHMIDT: So because of the underlying engine we can take risks, invest in ideas, and do crazy ideas, right, things which I don't think will work but they work or they don't, we cancel things. That's part of the culture. And I've learned that that's not normal, right, that most companies, most companies are locked in these quarterly cycles, debt structures, and so forth which give them very few degrees of operating freedom and it's very tough for them.

CHARLIE ROSE: And today, what is the role that you have?

ERIC SCHMIDT: I'm mostly working on science. I spend a lot of time, as you know, because you've spent a lot of time on this, on public policy trying to understand how the world really works and trying to make sure that frankly the governments wouldn't screw this sort of amazing thing that's happening up in the form of the internet.

CHARLIE ROSE: Is there risk of that?

ERIC SCHMIDT: Of course. Whenever you're affecting communications and information, governments have a role to play. We've had this sort of significant battle, if you will, with China. The democracies are generally okay. As long as you're on the side of informing people and you're reasonably fair and so forth, you can get through that.

CHARLIE ROSE: Will Google be back in China?

ERIC SCHMIDT: I hope so. We left in 2010 because they have these very, very strict rules about censorship and we just were unable to operate morally from our perspective under their censorship rules. So we keep trying. I spend a fair amount of my time trying to get it reopened, but it's really up to the Chinese government at this point.

CHARLIE ROSE: I want to talk about the issue that I touched on which is very strong for you because we want to talk a lot about the future here, the notion of the moonshot. We're looking at it in cancer, as an example, which Joe Biden is heading up, by appointment of the President. But what are the possibilities that a moonshot could do for us?

ERIC SCHMIDT: Well, maybe I should say that I've come to a sort of obnoxious view that we're operating under this sort of zero sum set of assumptions in our society and I'm including the Western World, not just the US, and that we're not asking enough of our people and enough about what we can do and we're not trying to build things that are transformative. Go back to the interstate highway system, right, which was originally justified, by the way, so they could move missiles around. So the lack of the interstate highway system would cause America not to grow at all. And economic growth, this is an Economic Club, is largely from interconnectedness and innovation. The interconnectedness comes from making the world closer, and I mean that intellectually and informationally and physically and distribution that works and all the kinds of

things that companies represented in this room do. And it also, and new inventions come along. And every once in while there are things which we have a consensus, right, and if we would just get behind it. We call these moonshots. As you know, the vice president did a cancer moonshot. Sean Parker has just donated \$250 million to a set of doctors who have figured out a way to promote white blood cells against red cells in a complicated new way that might be a very major cancer breakthrough. These things come along, but we don't talk about them. We spend all of our time arguing about political issues which are largely not that important compared to how do we solve these massive problems. And they can be solved. So the two biggest things that are going on, I think, in the world that I see are this incredible revolution in medicine and this incredible revolution that's going on in knowledge. And the two of them become the basis, I think, for many of the things that we can do. The cancer moonshot is powered because we've had these cancer breakthroughs and they are occurring because we're being able to essentially marry the analog world of cancer and biology and the digital world that I live in.

CHARLIE ROSE: Do you think there's a consensus in the country to do that? Is there a consensus in the leadership and the problem is politics in Washington?

ERIC SCHMIDT: The criticism, I will say the criticism as precisely as I can, is that we've gone from an era where we thought about solving problems that were very, very big and we've now become, we've now defined them as problems of special interests of one kind or another. And everyone's guilty, I'm not making a particular political point here, everyone has their own issue.

But let's dream bigger. So I'll give you an example, 3D printing of buildings, right, we now think we can start to build whole buildings with 3D printers dramatically lowering the cost of housing. Does that matter? Well, we all have houses, right? It doesn't really matter, huh? Of course it matters. It matters enormously. It matters enormously to all of the people. Another example, synthetic food. Well, we have lots of food here. We don't need to work on that. Well, of course not. In fact, 10% of the global warming contributions come essentially out of cows. I call this sort of nerds over cows. Cattle are, they're wonderful animals but they're a significant source of pollution. Right? So even if you don't care about the cost of food which many people do, it looks like we can do synthetic food, food generation out of plants, with quite a positive, it tastes good, it works and so forth, and I can go on.

CHARLIE ROSE: Okay, but let me say in terms of the essential philosophy, for government to provide an investment in the future by investing in the research and science or somehow to unleash the private sector to be able to do this, or are these problems too big?

ERIC SCHMIDT: It's more of a consensus. Right? The country is full of smart people, right, shocking, right. And furthermore, when you compare it to Europe and Asia which I've spent lots of time in, I want to be here. So let's start with that. And why I want to be here is we have 18 of the top research, out of the top 20 research universities in the world. Our demographics are such that we're growing, we're relatively open to immigration – politics aside. The diversity matters, right, the kind of thing, the American model that got us through the last 30 or 40 years, is

stronger now than ever. We don't want to admit it. But compared to the other models, I'll take ours. But we need to focus on it, right; we need to agree roughly what these projects are. They need to build a consensus. I don't think it takes a lot more money. There's lots of money, right. It's how do you apply it?

CHARLIE ROSE: Let me talk about revolutions. There was the industrial revolution, then there was the information revolution. Where are we now and what's the next revolution?

ERIC SCHMIDT: I mentioned there are two phenomena that I think are going to be transformative in the next decade. The first is in health, biology, and I'll talk about that, and the second is in knowledge. In health and biology there's been a breakthrough of something called Cas/CRISPR9 which is a way of sort of, essentially gene editing. At the moment it's a very, very tough hammer. They use a piece of genes that they didn't think were useful that turned out to be very useful to sort of reassemble components. It's gene editing in its basic form. The combination of that, and then doing databases of genes and sequencing and so forth, allows us to really probe into the molecular and biological structure of life. It's certainly true within the next ten or twenty years that you'll be able to get a body part generated out of stem cells that come out of your blood which is an extraordinary achievement, right, one, I think, was made in Japan by the way.

CHARLIE ROSE: And removes it from the political controversy.

ERIC SCHMIDT: Yes, and the politics were just, it was a stupid argument anyway. So the core issue here is you need a new body part, we can actually regenerate it from your own cells. That's lifesaving for people who need transplants. So let's go through, this is the real combat. Your friend is dying; this stuff fixes it, why are we not doing more of it? I'll give you another, well; I'll get on cars in a sec. But the core point here is the combination of all of that is occurring. Now why is it occurring? Well, partly because technologists and scientists see this, but also because there's a great deal of money at stake, because the healthcare industry sees new treatments as new sources of revenue and new billion dollar drugs. So you've got a good alignment now of economic interests, venture money. The stuff is risky, right? So venture capitalists, some of whom are in the room, are really going to, some will make a fortune, some will lose money. That's how it works. Great! In information, Google is working very, very hard on the concept of an assistant. And the way the assistant works is the assistant is, and this is all opted in with your permission and so forth, it uses all of the knowledge that Google has generated. We have something called a knowledge graph. We understand how language is spoken. We have, you know, 17 years of queries and those sorts of things, to sort of try to help you out. So one of the first versions is we built an instant messaging app which can reply for you. And it sort of learns what your patois and it knows what to say. Our first foray on this last year was an email product which would automatically reply to your email. Now I assume everyone here wants this product, right? So we launched this thing and its most common reply is I love you which turned out not to be the correct answer in a corporate setting. (Laughter) So, you know, we're, we have bugs and so on and so on.

CHARLIE ROSE: Let me stop you there one second. I mean the idea of a virtual assistant coming out of artificial intelligence is, everybody's trying to do that. I mean we have Amazon already on the market with Echo and how many people get up and say, Alexa, what time is it? Alexa, what's the news? You have, all of the major companies are there. I assume that competition will be good for the end product, but is Google behind the curve on that?

ERIC SCHMIDT: No, I mean...

CHARLIE ROSE: Because you don't have a product on the market.

ERIC SCHMIDT: Well, I mean we have, we just announced a product which uses different technology and we'll see how well it does. This is how our industry works. But we're far more collaborative than competitive. Everyone wants to focus on Apple versus Google or whatever, but the fact of the matter is the whole ecosystem moves forward, right? And it is building those platforms and building that knowledge. I think it's reasonable to expect that again in a decade the vast majority of your computer interaction will be by voice. It's sort of shocking. By the way, ten years ago I predicted this would never happen – it shows you how right I am – but you look at the technology and the gains in voice recognition and Alexa which is now common in everyone's lives, you see it. Now I'm not particularly interested in the voice recognition part. I'm very interested in the voice recognition with knowledge understanding.

CHARLIE ROSE: And to tap into the data that already Google has for example.

ERIC SCHMIDT: Or the underlying algorithms. Another example is you can use Google; we have a product now that you can get on your phone. You can speak in your language; it comes out in another phone in another language. Like, Oh my God, right? Does this really work? Yes. Is it as good as a human translator? Not yet. Is it good enough to have a casual conversation? Yes. How does it work? Well, the translator takes your voice. It digitizes it. It puts it into text. That's done using a neural network which is an AI concept. It then uses a different translation neural network which has learned how to translate by looking at good language pairs. It translates it. And then it translates it back into voice. So you have three different translations to go from voice to voice.

CHARLIE ROSE: Back to my question, is there a name for what the, from industrial to information to the age that we are looking at now, the transformative age of all of the technology and what it's doing for us? Is there a consensus name for this?

ERIC SCHMIDT: There is not a consensus name for it, but I can define it a little better. So another example, there's a game called Go which Americans typically don't know anything about, and it's infinitely harder than chess. And a group in the subsidiary of Google or Alphabet I guess I should say, called DeepMind, have been working for a long time to try to develop the concept of intuition. And they developed an ability to take a game in the form of bits, literally

they can watch the bits of a screen and with enough work they can, and playing enough games, they can figure out what the objects of the game are, how to win it, and then beat all the humans. Well, that's pretty interesting. Now, what's interesting technologically is that you don't have to tell it what the game is. So how does it do this? Well, you know, it sort of watches for a while and it sees common patterns and it begins to develop a base of knowledge and then it learns against that base of knowledge. You know this is not human intelligence yet, so it's not, we're not making that argument.

CHARLIE ROSE: But carefully you said yet.

ERIC SCHMIDT: Yet. Right. And we don't know how hard it will be to get there. But what we do know is this is something which has never been done before. So then we applied this to the game of Go which is thought to be incomputable, and what it did is it learned how to only look at certain positions by the same rough training mechanism. And we decided to have a game against the best player in the world in Korea. He was a perfectly nice human being. And we beat him 4 to 1 which was historic, maybe the most important...

CHARLIE ROSE: It was historic and huge. I mean everybody looked at this. Help us understand. We're now talking about artificial intelligence. All of these things you just talked about is artificial intelligence. And some, a friend of yours said to me recently Eric is thinking a lot about artificial intelligence. On the one hand, you have DeepMind which is able to beat Go.

That's a huge thing. On the other hand, you have Watson which began with chess and then won Jeopardy and they're working on...explain artificial intelligence to most of us here, because in this audience and elsewhere everybody hears about it, some people are making deep investments in it, hedge funds and others.

ERIC SCHMIDT: But remember what I said about the biological world, it's happening because there's a confluence of a platform, a set of ideas, and a large amount of money and a lot of investing, a lot of people coming out of school that are working on it, and a sense that it's transformative to everyone's lives. The same thing is going, the two are symmetric. So with respect to AI, the current AI uses, I'll give you a couple that are simple. If you are familiar with a disease called diabetic retinopathy because the diabetes revolution, not revolution, tragedy, if you will, is taking over the world, it causes your eyes to go bad. You become blind. It can be detected by a good ophthalmologist but we did a test where we take pictures of your retina and we can do it better than an ophthalmologist. Wow! How is that? Well, it turns out we see more eyes. We saw a million eyes. It's very hard for the ophthalmologist, as hard as they work, to see a million eyes. So in situations, there's a large number of cases where if you just let the computer with its new technology see more examples, they can come up with better decisions. I'll give you another example. We believe that you can apply this to oil and gas distribution networks. There's a great deal of leakage and sort of decisions that are made about flow and storage and so forth and so on and by using that data we think we can reduce the emissions from that. So again, it's a good, and by the way the emissions also are costly to the industry. So the real question is how far

does this go? We think we can develop enough intuition – I’m going to use that term carefully – that a physicist or a chemist could say, you know how they work, right, they wake up in the morning and they say, oh, I want to combine the I-3 chemical with the Z-2 chemical and I’m going to have the following crazy reaction. It’s not going to blow up and instead I’m going to produce a new substance which will get me a Nobel Prize and get me a promotion at work. So they do that, right, that’s at 9:00 in the morning. At 11:00, they do it. They have their subsidiary chemist do it. And at 3:00 in the afternoon it fails. So then they go home and have dinner. And then the next morning they come up with another one. Okay, that’s how it really works, right, and these are incredibly intelligent people. But that process can be automated. We can ask the computer to go through all the combinations and give you a probability. Does that matter? These are trillion dollar industries globally, around chemicals, synthetics, drugs of one kind or another.

CHARLIE ROSE: With respect to artificial intelligence, on the hand DeepMind has a different operating idea than what IBM’s Watson; explain how they are different and what they’re trying to accomplish each on their own.

ERIC SCHMIDT: Each, Watson and Facebook and DeepMind are doing, have completely different sort of providences. So in the case of Watson, they use a particular kind of inference model – that’s the technical term – which worked particularly well for Jeopardy and for complicated problem solving. And they’re having a lot of success applying this to complex systems and explaining them. So think of them as there’s a complicated system, they can read it

literally and tell you what's in it. So this is sort of, sort of lawyers add complexity, you take it away or whatever model you have, how the world works. So you can take all the contracts and read all of them and give an answer. And that's a generalizable result and a powerful one for them. Facebook just announced this week that they have a breakthrough in language understanding around communications, sort of what they do, and they have said that they have made significant progress in detecting hate speech. So that's clearly a good thing. In our case we took the position that we wanted to build an underlying platform that allowed you to do all this stuff so we built a network. I'm sorry to describe it technically but it's called TensorFlow. A tensor is a multidimensional matrix and the underlying systems that I'm describing are essentially multidimensional matrix algorithms of one kind or another and we've given this framework to all of our competitors. It's so strategic for us to build the community and all the players and so forth that we literally took this amazing intellectual property and have given it away and they're in fact using it.

CHARLIE ROSE: You bought DeepMind. I mean some will say to you that DeepMind, what they're trying to do at DeepMind is they're trying to understand how humans think and build from there. The IBM and Watson people will say it's man plus machine.

ERIC SCHMIDT: That's right. It's a different; the DeepMind people are interesting because the founders came out of neuroscience. So they imagined that you would build computer systems that use the same way we do learning. And I'll give you, I won't do a good job of this because

I'm not a neuro-scientist, but think about it, when you came into this room. How much cognitive time did you spend figuring out that the floor was where your feet went, the lights were up there, the table was there, and you had a knife and a fork and your friends and there are roughly eight people and everyone is, you know, dressed properly? Zero time. You had already learned that. You had chunked that, if you will. And so what, there's evidence the way our brains work is we study a scene and then we subset it to the things that are really important. And the things that are really important, we then put into the brain. This is called reinforcement learning in the vernacular. And we believe that reinforcement learning is going to be a core part of this next set of AI algorithms.

CHARLIE ROSE: Okay, we've talked about the future. I know there's interest here in business and in terms of how the economics and the global economy. Take these five companies – Apple, Amazon, Google, Facebook, Microsoft – is there a race to do any one thing? Are they all in the same business? We know that Apple has made a fortune on a smart phone. Google has made a fortune on search. Microsoft made a fortune on software. Amazon made a fortune on a whole range of different things. But in these companies, are they in pursuit of a Holy Grail?

ERIC SCHMIDT: The tech companies as a group are highly competitive, seeking new – I want to say it right – think of each of these as a platform company driven by innovation that solves a problem that's global, in some cases it's a problem you didn't know you had, but you discovered they solved it very well. So if you go back, Microsoft being the eldest of them, solved the

problem of inter-operable work station platform and we all know the history there. Amazon started off as essentially a virtual bookstore. I didn't realize that I'd want a bookstore bigger than a current bookstore. But now that I have one, I think it's fantastic. Right? It's so useful. So each of these has had that. Apple's transformation, of course, is legendary with Steve's, the sort of resuscitation of the company. And when Steve took over the second time, he clearly wanted to do phones and led the category. Each of these companies, we've never in our industry had four, and I would argue that the first four without Microsoft are leading the platform fights, we've never had that many companies fighting so brutally against each other and yet also collaborating. In our industry we always had IBM and then we had Microsoft and a few others.

CHARLIE ROSE: Where is the collaboration because you're also suing each other? (Laughter)

ERIC SCHMIDT: Well, but that's okay. That's normal. There's lots of collaboration. A typical example is our apps all run on Microsoft products. Our apps all run on Apple.

CHARLIE ROSE: When Apple had their announcement last year, they announced a partnership with Microsoft.

ERIC SCHMIDT: And, you know, a traditional model would say, well, we won't put anything on that platform. It turns out that Apple is a customer. In our case, we're also a customer of Apple for things, and on and on and on. And in fact, everyone sort of argues with each other. But

we benefit, we as an industry, have benefitted from open markets globalization, a sense that technology is transformative, and the kind of financing market...

CHARLIE ROSE: Should we insist on open sources in terms of the future, in terms of all that's being discovered? Or are we looking at a world in which each organization is going to be jealously guarding not only what it knows and learning, but also trying to hire away and protect itself from losing their most talented human beings.

ERIC SCHMIDT: But this is, by the way this is the genius of competition, this is evidence of real competition. And we fight brutally to hire the top people, to get our products down. Think about the Android phone or the I-Phone that you use today. Think about how powerful it is. I figured out it's 100 million times more powerful than the computer I used when I was in college. And by the way, it costs a lot less because there was only one of them in college and I stayed up all night to use it because it's the only time I could get access to it. So it's real consumer benefits. So I think that the competitive structure, the architecture you described of the four or five companies, will continue for a while until another one joins us and one leaves.

CHARLIE ROSE: One we don't know now.

ERIC SCHMIDT: Of course. And I can tell you that, you know, the current next one is Uber, right, which has done remarkably well. And as disclosure, Google is a large investor in Uber.

CHARLIE ROSE: And so is Saudi Arabia's Sovereign Wealth Fund.

ERIC SCHMIDT: Yes, I didn't do that deal. But so anyway, Uber has done incredibly well and again, I wish I'd invented Uber. What a great idea, right? At the same time that Travis and his partner were standing – it was actually invented in Paris at the base of the Eiffel Tower according to Travis – so at the exact time he was there inventing Uber, I was giving a speech about how there will be amazing companies founded based on smartphones, Google Maps, and GPS. Right? But I didn't figure out what the app was. So I can tell you that the next, the next Uber, the one that's a new one, the one that we'll be talking about again in five or ten years, will be built on a machine intelligence platform of the kind I've defined, very fast networks. It'll use a Smartphone, Android, an I-Phone most likely, and it'll use very rapid iteration. I just don't know what the app is because I don't know what problem we could solve.

CHARLIE ROSE: Which raises, I mean all of you have read this, which raises in terms of artificial intelligence, and how smart machines are becoming, the often-expressed fears of people like Elon Musk and Larry in some cases but not as strong, Bill Gates, the idea of is there some danger from machines becoming so smart, so human, but uncontrollable that they provide a threat to the planet.

ERIC SCHMIDT: These people have been watching a lot of movies. (Laughter)

CHARLIE ROSE: These are your colleagues and smart people.

ERIC SCHMIDT: My colleagues, and perhaps competitors in Elon's case, so Elon backed up his concern by...

CHARLIE ROSE: And Stephen Hawking too.

ERIC SCHMIDT: Elon backed up his concern by creating...but he's not a scientist, he's a physicist...he backed up his concern over this very important issue by investing a billion dollars in a competitor to DeepMind. So, you know, we'll see how that plays out. You never say never, but let's go through what is needed to make that scenario happen. So the first thing is we're still learning how to do basic intuition and those kinds of things. There will be breakthroughs and we'll get excited about it and we'll be able to answer questions and answer your email and make suggestions for how you should, you know, what movie theater you should go to tonight and so forth and so on. That's not intelligence. We may be able, and we hope to be able to assist humans in their daily jobs. And who doesn't want help? Think about all the professionals and so forth and so on. We think we can do that. It's real speculation to get to the kind of human level of intelligence that everyone here has in the room, let alone going past. My own intuition, right, which is just a guess, is that there's another discovery needed. The human level of intelligence is a very hard problem. It's hard to define what it actually is. But my own intuition is we have probably another discovery which might occur. And then the concerns over, oh, my God, the

robot has, you know, let loose in the lab and has basically decided to kill its owners and so forth, well, I saw that movie, it was really good. (Laughter)

CHARLIE ROSE: There are also questions of disruptive technologies. Does Google fear that there may be some disruption so that search engines will be obsolete?

ERIC SCHMIDT: In my industry you always worry about the next idea. And inevitably, there's always a new team, you know, the canonical garage, right, sort of the young professor and the two graduate students. Hey, by the way, that's how we started. You always worry about that. And there are many, many ways in which what we currently do could be disrupted over time. This is why we invest so much. This is why we're so focused on this assistant model, right; because there we have significant advantages in terms of the engineers we have...

CHARLIE ROSE: Because, in fact, that's what technology has done. I mean Uber is a disruptive technology. Amazon was a disruptive technology. That really has then the power of technology to disrupt the way things have been.

ERIC SCHMIDT: But if you look at Uber, Uber is both a disruptive business model as well as technology. It's a two-sided market. And so there an infinite number of PhDs being written over two-sided markets and the fact that you have to have a pricing model which they don't set for their drivers as well as the pricing model to get enough customers. This is how it works.

CHARLIE ROSE: Okay, big picture. Some people worry that there may be somehow, go back to the 2000, 2001, you know, you lived through that in terms of some kind of collapse of technology companies, a bubble burst.

ERIC SCHMIDT: We lived through the bubble. The bubble, you know we were so much more handsome and beautiful during the bubble I must say. You know the bubble sort of makes you feel like you're God. And I remember being at this dinner in Davos where you were, and I looked around, I said, these are the leaders of the Free World? So, there was some, we sort of got ahead of ourselves, and thank goodness that it crashed and we rebuilt it properly. The markets and investors are much savvier now. So for the companies that don't have strong profits, they have a strong potential revenue scale solution.

CHARLIE ROSE: There is this fact too. I did a conversation the other night where John Malone was being honored, a very successful entrepreneur. And, you know, he just bought Time-Warner through one of his companies. And he obviously is intent in terms of his vision; his access to the internet, that's what he, broadband and access to the internet is what these companies will do for him. But he raised a question with me. People like Google and Apple have so much money that he worries about the possibilities that they have. In addition, they have so much money, can they scoop up all of the best talent, the five companies that we were talking about.

ERIC SCHMIDT: We're trying to hire the best people, each of us globally, because we

understand the economic return of these people. But this is a narrative; it's not just unique to the five companies. For each of the companies represented here in the room, if you had five or ten of the kind of engineers I'm talking about, we could materially improve the effectiveness of your business. This is sort of the software, big data stuff. And there's a great many, many examples now where you take what your business is like, you put it in a big data thing, and you analyze it for a while and you come up with customer insights that really do drive your bottom line. So that's where the race is. And the value, the economic value of these people to the labor markets is very, very high. They're very, very highly paid.

CHARLIE ROSE: People worry about, they know that technology will bring productivity; will it also create problems in terms of people being displaced from the job market?

ERIC SCHMIDT: We've had this concern for a long time. If you go back to the 1980s, automation concerns, and 1990s, there was a great deal of concern that there would be a loss of jobs. But, in fact, the American economy has generated throughout all of the travails and all the ups and downs a very large number of jobs during the supposed time when all these jobs would go away. So I think the evidence is that the American model does create jobs but the jobs are different. And everyone has a right to fear for their own future and fear that their jobs will be disrupted, but the fact of the matter is we're running, the US today is running at near what economists call full employment. And that's a testament to the recovery since 2008 and 2009. Everybody here was in New York, I would assume, in 2008 and 2009. Try to remember how you

felt. It was only seven years ago. Think about how strong this city and what you all have done is. I think that's a testament. I'm not as worried about this. I want to be clear that I think that there is a problem with the loss of high-paying, middle-class manufacturing jobs. That's on the new data. This is called the hollowing out of the middle. And we need to find ways to address the job dislocation, the lifestyle issues with service workers and so forth. And there are many economic solutions for that. But the ultimate answer to this stuff is more education, more education, more education, more competitiveness, and more entrepreneurs. What's interesting is you named the five companies; every one of them was started by incredibly brilliant entrepreneurs. Maybe we should thank them occasionally. Think about the number of jobs that all these people, I'm not the founder, think about all the jobs these guys created. Think about all the taxes they paid to the state, in our case in California, to bail the state out. I mean you get the idea.

CHARLIE ROSE: Well, speaking of taxes, should there be a change in the tax structure so that they can bring all that money they make overseas home?

ERIC SCHMIDT: We have argued for two decades that the offshore cash should be brought into America.

CHARLIE ROSE: And create job development...

ERIC SCHMIDT: Of course. And in Google's case, we generate a lot of cash from our own

operations, thank goodness, but it seems crazy to not let that cash come into the country and be used for capital investment. Here's another sore point. We're under-investing in our infrastructure. The country's population is growing and the inter-connectivity is increasing, right, so you have greater demand on fixed services. We need to spend the money on roads, bridges, you know, airports, you name it, and we're not doing it, and interest rates are low.

CHARLIE ROSE: And so therefore investment in infrastructure will create demand.

ERIC SCHMIDT: Right, and there's a set of things that businesses can't do, and one of them is they're not allowed, in most cases, to build roads and bridges across the local river. There is a proper function for government and the government needs to get organized around doing this. That stuff drives economic activity which drives wealth creation, which drives happiness, better healthcare, happy families, and more voters. Right? It seems very straightforward.

CHARLIE ROSE: How much time do I have, Bill? I may be at the time. Five more minutes, okay. When you look at globally, where is the most competition going to come to the American technological, economic engine? Is it China? Is it South Korea? Is it somewhere else?

ERIC SCHMIDT: The history in this was that America would invent it, Korea would perfect it, and China would make it in huge volumes. That's sort of the pattern. Many people believe that China is now going to jump one level higher and they're following our playbook. They're

incredibly intelligent. They have lots of money and they're very, very focused on emphasizing their universities and so forth. There are critics who believe that their educational model and the lack of political speech and a whole bunch of other things will not allow them to get to our level. So that's sort of the great debate. And there's other arguments that China's economy is slowing down, that the numbers are overstated and so on and so on. I can't really tell. So China is clearly going to be a player. The most interesting country to spend any time in is Israel. On a pound for pound or person per person or whatever metaphor you want, their productivity and innovation is the highest, I think, in the world, just literally because of the small size. And partly it's because they all have forced military service. They are very aggressive in their culture with respect to innovation and they tolerate risk. So that's a repeatable model in other countries.

CHARLIE ROSE: Interesting, one of the last times I saw you was at Technion which is a partner with Cornell?

ERIC SCHMIDT: Technion, that's right.

CHARLIE ROSE: And they're trying to create a Silicon Valley essentially in New York.

ERIC SCHMIDT: Mayor Bloomberg, of the many great things Mayor Bloomberg did, Roosevelt Island, they're building this huge campus with a combination of Cornell and Technion in Israel. And it's an attempt to create a competitor to Silicon Valley, and Silicon Valley needs a

competitor. This is a great thing. I'm on the board of it and I love this project. But I think if you go through where the innovation will occur, Beijing comes to mind, Tel Aviv comes to mind, London is having a huge renaissance and it's largely because King's Cross has a train line that goes to Cambridge, and that train line is about an hour and a half. I'm serious.

CHARLIE ROSE: Is it more important to go to Cambridge say than Oxford?

ERIC SCHMIDT: Well, all I can tell you is that the people in Cambridge had a lot of free land around the university and they allowed the construction of business parks. And this is relatively rare in Europe which doesn't like to build anything – excuse the comment but I think it's roughly true – and so they were clever enough, they owned a lot of land that was unoccupied and the university was able to entitle it. And so they had on the order of 1,000 startups, most of which didn't work and they were small and so forth. But those startups at some point have to move to a city and of course they moved to London at King's Cross. So that's a pretty good model, right?

CHARLIE ROSE: But what about the model that Stanford has with Silicon Valley? I mean take the two founders of Google, they both were in graduate school and the relationship between the university allowing them to do whatever they wanted to do, does it create opportunities?

ERIC SCHMIDT: Well, you can argue that Cornell-Technion is doing the same thing here. Stanford is the best example of this, but this is a copyable model. There's no secret here. It's not

like it's some intellectual property that's in some vault somewhere. Stanford is, it's organized around graduate students. They have a lot of funding. They're encouraged to write interesting things. The moment they have something interesting they have lunch with the venture capitalists. They get funded a couple of million dollars which to them seems like an enormous amount of money, right, and for me too at the time. And they move into some dumpy, you know, little house in Palo Alto that costs too much and off they go. And it's, the cycle has happened now six or seven cycles so it's highly repeatable and copyable.

CHARLIE ROSE: If you were starting over today, would you more likely go into biology rather than computer science and engineering?

ERIC SCHMIDT: Both are having a renaissance and I don't know, it's interesting you ask that question. I've spent a fair amount of time with the computer scientists that are working in biology because they're right at that intersection and all of the interesting computer science problems at scale are true in biology – the number of proteins and protein folding. I figured that genetics was kind of a solved problem. In fact, there's this whole area called epigenetics which is around the behavior and the modifications. I didn't know this, but in fact your genes change as a result of environmental factors and so forth and so on in very complicated ways involving proteins. This is just, you know, a gold mine for the kind of problems that people like myself were interested in, in their 20s. That work today will become the foundation of Nobel prizes ten years from now, twenty years from now, 30 years from now.

CHARLIE ROSE: I think one of the most exciting things happening today is really the marriage between biology and computer science and technology because they both help each other. I mean with the power of computing and the velocity it adds, we just see in terms of mapping the human genome, how much it cost then and how much it costs now, how much it adds to personal medicine now. The kinds of ways, I did a thing down at a university where they are matching what they understand about genetic causes of cancer with a global understanding of all the trials that are going on everywhere and they can compute this so that a doctor who is treating a patient has an incredible amount of information in front of him that might not otherwise have been available.

ERIC SCHMIDT: So the way this is ultimately going to work is you're going to have a healthcare record that's more than just a medical bill and it'll be able to digitally describe and say what's going on. It'll calculate the probable outcome as you enter the hospital. We have a project at DeepMind which has been announced using the National Health Service from the UK and they have a large number of blood samples and so forth. We're trying to predict the prevalence of acute kidney injury which is a very deadly problem and something that was a very common source, a common source of death in hospitals in the UK and probably here too. And we have early results that we've materially saved lives and it's a large percent improvement. How did we do it? We just study, right, the outcomes and then we give the doctor a heads up and we say this patient, this combination, which is impossibly complicated, is far more likely to need intervention in the next hour.

CHARLIE ROSE: And there is this, tomorrow night I've been asked by James Comey to come down to Washington – he's getting honored – to interview him. He's been at the forefront of about a log ahead between the FBI on the one hand and national security issues and at the same time, encryption. Where do you come down in terms of somehow in the national interest, on both sides, finding a solution to this?

ERIC SCHMIDT: We need a solution to it. The industry is united in saying that the government forcing us to weaken encryption is a bad idea. If we are forced by law to weaken encryption, and there are people who are proposing that, it won't be just the government that has access to your information on your phone, it'll also be the bad guys because the computer can't tell the difference between the good guys and the bad guys. And it's even more important in countries like China where the laws are not so favorable to human rights. So we've taken a position that there need to be other solutions rather than forcing a weakening or a back door, if you will, and this is a hard issue because encryption is getting stronger. And in fairness to our industry, it's important to understand what happened. When Snowden revealed all of the activities that he did which is an illegal act on his part, we read of the things that the government was doing that we didn't know about, to survey, among other things, United States citizens. And we have fully, fully encrypted data at Google that's at rest and in transit. So I can tell you that if you have something that is, that you want to be private, the best place to keep it is in Gmail. Seriously, it's fully encrypted, very strong, very, very difficult to break in, and we know this because everyone is complaining.

CHARLIE ROSE: So what would happen then, what would happen then if the FBI Director came and said we know this person is suspected of something serious and we think that there is an exchange of information through Gmail, please give us access?

ERIC SCHMIDT: Well, you know America has a great law in that regard. It's called the FISA Court.

CHARLIE ROSE: Right. So it's a legal proceeding.

ERIC SCHMIDT: It's called a legal proceeding. That's called the front door. All of the, terrorism is a horrific thing obviously, and at least democracies have legal processes to follow. So the FBI Director would not call us. They would go to this three-judge panel and the three-judge panel would order us to give that information and we would give it just like that.

CHARLIE ROSE: And most of the time they have.

ERIC SCHMIDT: Well, in fact, something like, it's a public number, less than 50,000 times, maybe 40,000 times per year we're asked this and we have billions of users. So it's a relatively rare event, and that's for all national security matters.

CHARLIE ROSE: Final two quick questions. Ten years from now, the world will be

dramatically different because of what we're doing?

ERIC SCHMIDT: Think about the information that you have now that you didn't have a decade ago. Think about the companies that you, that we talked about today, that didn't exist ten years ago. Think about the, find a 10-year old, you know borrow one, get one loaned to you, and watch this 10-year old manipulate his or her iPad or iPhone. You will see the future and it is a good future. All the evidence is that people are getting smarter, by the way, not dumber. The evidence is that educational achievement is going up. And a lot of this is due to the interconnectedness, right, and the integration of all of us. It's going to be a very good world.

CHARLIE ROSE: It reminds me of the old joke which many of you may have heard is why is your 13-year old working on that? Because my 10-year old was at play. Thank you Eric.

(Applause)

ERIC SCHMIDT: Thank you Charlie. Thank you all. (Applause)

CHAIRMAN WILLIAM C. DUDLEY: Thank you so much, Eric and Charlie. The next meeting of the Club will be a Member-Guest Breakfast next week, Tuesday, June 7. We'll be hosting Jeb Hensarling, Chairman of the House Financial Services Committee. I understand that he plans to make a major announcement at that breakfast and there are still a few seats remaining, I think, if you'd like to join us. So enjoy your lunch and thank you again.