

Eric: The Governor of Virginia is the clearest thinking politician I have met. With well-thought words, he articulates a vision of a great state. And he does it with the energy, which we worked with him for a while on, say for example, he decides that all of the information that's publicly available in Virginia needs to be available to its citizens. So he invents with us something called site maps. And all of the sudden all of that information that could not be available before is now available to everyone worldwide. We have now replicated that in ten other states. An example where the governor, his vision, our teams make something happen, and now everyone else is scrambling. This is also a governor, one more plug for this governor, this is the only governor I've ever met who actually cares about outcomes. Right? I mean I think most of you would agree with me that outcomes are actually what you should be judged against, but apparently not in normal government. But in Virginia, we've got the leadership, and that's why the state is doing so very, very well. To me, Virginia is an upcoming leader globally. I was sort of studying this and I was looking at UVA and College of William and Mary are now ranked among the top public universities. UVA, William and Mary, Virginia Tech, Mary Washington, and James Madison are among the top 25 best values for education. I used to play football against Thomas Jefferson High School, and I'm quite concerned that they were ranked number one among public high schools in the nation. I mean isn't that phenomenal? And we used to beat them, by the way. My point here is there's something afoot here with the consensus that has been built in this state.

And I think to some degree the success also marries the success of the internet. The internet of course is this phenomenal thing that's going on. There are somewhere around 1.3 billion users on the order of 200 million users being added on a yearly basis. The internet is this phenomena that will define essentially the rest of our lives and our children's lives and our grandchildren's lives, and so forth and so on. And a lot of it in our case is occurring because of things called Moore's Law. Moore's Law means that everything doubles every 18 months. There's a lesser known law called Kryder's Law, which says that data storage doubles every 12 months, which is why you have this enormous amount of crap on your computer. The drives just get bigger and bigger and bigger. And so if you think about it, if you just sort of do the math a little bit, let me give you an example of a problem. By the year 2019, it's going to be possible to have an iPod like device that will have 85 years of video on it. So you will be dead before you watch the whole – I mean does this cause any stress here? I mean I'm really quite upset about this. I intend to be alive in 2019, and I've already consumed a whole bunch of those 85 years. It's a very serious issue. And this rate of connectivity, the rate of innovation is not slowing. People tend to underestimate what can be done with these things because it compounds and it compounds, and it compounds, just as the success of the investment in education that's going on here in Virginia. It's a compounding. The investments that were made 70 years ago to create VPI, right, as a land grant university where I was fortunate to grow up, and we have the president of the university here, it compounds now. Now all of the

sudden they're busy looking at this interesting new biotech maneuver, right, which nobody ever thought about when it was going to be in agricultural school. But the quality of the faculty is so good now that they can actually expand, and the governor and his programs are consistent with the funding that they need. So that's how these things work .

Now by the way, it's only going to get worse because the rate at which people are for example blogging, there are like 70 million blogs. It's frightening. Every day, eight hours of video, actually every minute eight hours of video is uploaded into YouTube. By the way, most of it is kind of iffy. So don't worry. But some of it is extraordinary. Pictures of peoples' families, but there are amazing things going on there as well. So it is this new phenomena. There are more than 10,000 applications that have been built on top of Facebook, there are more than 20,000 iGoogle applications, which are part of the way Google works. This phenomena is now extending, and is extending globally.

So Google started with 25,000 webpages, we now have tens of billions. So again, the growing continues. You'll never read it all, you'll never get it all, and it's only going to continue. And we're undergoing this interesting shift from the shift where you have your computer and you have everything on it, to keeping everything on the net. So one of my literally people that I grew up with was running admissions for Virginia Tech. And one of the main things that she was very proud of is that they put an online form so you would apply online without any hard copy. Simple thing. Huge improvement in terms of outcomes and so forth and so on, a simple idea. There are many, many examples of how in this new model the services that universities and governments provide can be provided on any device for any particular reason. So this shift is just beginning.

It's always hard to put yourself in the mind of a college student, partly because it's a little frightening. I want you all to think about the world of a college student today and how they perceive things. I was quite alarmed, we hire lots of people right out of college, and I ask people how many of you have a landline telephone? I bet you if I asked this group it's 99%, there's one person here who doesn't have one. 95% did not. I said how can you possible operate without a landline? They say why would we want to have an extra phone? I mean again, it's a simple example of the gap. And for all of you who manage, lead, teach, getting inside their minds and understanding such a simple observation is fundamental. It's a completely different way of living. In fact, the statistics are that 42% of users 18 to 29 are going to use the internet as their primary news source for the '08 presidential election. That's a little frightening. I mean, and by the way, those people are going to vote, too.

So all of the sudden this online shift changes the world view. There are lots and lots of interesting statistics. 45% of college students who watch series television, the sort of series of episodes, watch them online. You can imagine what that does

to the advertisers on the traditional mechanisms. 30% of the users, same age group, share a video sharing site every day. Again, watch them, you'll see it's very, very different.

Now, when you think about it as an educator, the world is very, very different now. So, when I was in the seventh grade in Montgomery County, one of the things, and I assume that you still have a requirement to do Virginia, study Virginia in the seventh grade, we had to memorize the names of all the counties of Virginia, and I succeeded. And I tell you that story to think why did I need to know that now that I have Google? Which one of you made me do this? I mean, can't I just look it up now? A more serious point is you remember the whole thing with the SATs and how they weren't going to let you use calculators at the SATs? That's a huge crisis because of course people have to be able to do math and use pencils and so forth and so on. Now you're required to use a calculator. Interesting.

So we have evidence that education shifts based on the world view of the student and the things which are accessible to them. And my central thesis here is that we, all of us, have not shifted sufficiently at the rate of change that is going on, which I think is sort of the fundamental message for education. All of us have to anticipate that.

So another example is that we hire lots of young people. They're more collaborative than my generation was. They're used to working in teams. So if your model as a professor is a single student doing his or her research, working in the lab lonely late at night, you've got the wrong model. The new model is teams. And by the way, not just teams in the lab, teams across the world. People who have research relationships with people they haven't even met. That's normal now. And we need to teach it that way.

So this notion of collaborative and collaborative learning is in fact how people will get to the next level. Going back to the governor's initiative around getting Virginia to be number one, sort of my goal, too, it's going to take this shift. We're going to have to think it through and figure out a way to get there. Now, when you make the information that you have available, you're going to have to make it available to the students. What do the students do? They're on video games, they're on iPhones, they're on iPods, they're on so forth. You're going to have to find a way to get it to them because that's how they want to consume information and they're ultimately the customer. An example is Old Dominion University, which is a really, really sharp group, launched their own YouTube channel with putting course content on it. And the resolution is okay and so forth and so on, but given the complexity of students' lives, it really has served them very, very well. There's something called iTunes U, which I think is fascinating, where basically people are now putting lectures and campus speeches from famous people all around the United States, another example. Berkeley and YouTube are doing

something similar with their core work. Google Book Search, and you all have heard about this, we're busy indexing and making sort of useful copies of all the books that are in people's libraries around the world so you can look them up. And you sit there and say well, who really cares about the manuscript in 1880. But what happens is it's 3:00 in the morning, it's snowing, the library is closed because students aren't real good with their time management, right. Not news to you guys. And all of the sudden the key insight is right in front of them. You want to talk about having an impact on somebody? That's when you have the impact, when they're stuck, when they needed that thing and all of the sudden it's there and it has huge implications for what they learn and how they operate. In the 16<sup>th</sup> Century, Henry VIII dissolved the monastic libraries and there are only 538 manuscripts of this time. So we have another group that's busy basically digitizing and putting them all online because they have the majority of the English history from the sixth to the 15<sup>th</sup> Century. And people can just touch it, they can look at it right now. Again, think about it, the difference between when we grew up, having to go to the library and it wasn't there and you have to wait and so forth and so on. And now it's all right there. It changes the way you think, it changes the immediacy of decision making, and it changes the depth of ones learning. I want the students to do that because the challenges they're going to face 20 and 30 years from now are going to require that level of knowledge, require that level of sophistication as the world gets even more interesting.

So when I think about all of this, let me give you another example. Here's another professor. This guy named Jerome Berg has created a website called Google Lit Trips. And what he does is he uses Google Earth and Google Maps, and if you haven't played with them, they are phenomenal. And he actually goes through Homer's Odyssey on the map with pictures and music. So here you've got somebody that says oh crap, I can't deal with Homer's Odyssey, the guys been dead for 2,000 years, or is it three? All of the sudden you now have a way to reach that student. By the way, that student was me, right, and maybe some of you to be honest. Voltaire's Candide, Steinbeck's Grapes of Wrath, all of these things. In fact, we have projects in the company where we're trying to actually do things like we'll look at a whole document and then produce a map of the book, all the places in the book, all of the documents, everything that's referred to, and building a global map of where you are. So okay, fine, you don't really want to read the book, at least you can navigate through where the book takes you so you can get a sense of what it's about and get excited about it and maybe learn something that way. It's all about learning however you can, whatever it takes. If it's a traditional mechanism or a YouTube video or a book, any of those are fine as long as we ultimately win and the outcome we want is knowledge and insight. That's what we're going for, that's what we care a lot about.

So the principle here is that we as a group have to do four things. We have to adapt. We have to adapt to the fact that this internet phenomena that I'm talking about is getting bigger. And I told you the math, do it in your head, remember,

doubling every 18 months is a factor of ten and five, and a factor of 100 in ten years, 100 times faster, 100 times more information, 100 times more complexity in ten years. Ten years happens pretty fast when you're an adult. Now all of the sudden it's going to happen now. We need to get organized about that. The second thing is that we have to learn from the students. Everybody here knows that you have the sharpest students and you have the okay students. The sharpest students will show how they learn, they can teach us. And every one of them that I've talked with uses every device I just described. They literally take it all in, they all put it together. They have a map in their head of how they learn, and they just do it. We have to grow the knowledge base about how to do this. Here in this room we have the leaders of higher education in Virginia. You guys are in charge. But you also manage a very large set of people who are not in this audience, right. How are they going to get this message? How are they going to learn? How are they going to grow? How are they going to develop all of these new ideas unless you go and you tell them, and you tell them you've got to get organized around this new phenomena of learning, this internet centric version of learning. And then the final thing is that we have to invest. The governor has laid out his plan, which I obviously think is brilliant. You have to invest in capital, you have to invest in faculty, you have to invest in research collaborations. I mean Google, by the way, remember, came out of a collaboration at Stanford. The fact of the matter is, I don't know what it is, but universities produce these extraordinarily talented, creative people every year. And every one of them has an opportunity to go create another Google here in Richmond, in Newport News, in Roanoke, in Northern Virginia. Every single one of them. It's producing entrepreneurs. The only problem we have is we don't know who they are. We don't know their names yet. Out of all those people, we don't know the winners. But we want to make sure that the system will make that happen.

The human genome project started as a partnership between Merck and George Washington University, sort of nearby, in Virginia and near Virginia, and of course it has changed the world because we now understand a lot about the human genome. So if you look at the progress of history, you look at the progress of science, you look at the progress of accomplishment, it all starts here with what we do, the way we work, and by the way, it's because the students are the ones who will make the change with our help, with our leadership. That's what it's all about. Ultimately the student is what matters.

So if I think about this, I think about this and just finish up with one thought. I believe this next generation expects and deserves the absolute best. I think that Virginians expect it, and I think that they deserve it, it's a great state. What I like about what you all are doing is I believe that Virginia, with Google helping, will really deliver on that. And that's why I'm so excited to be here. So thank you very much.

Tim: Eric, thank you very much. And now what we want to do is open it up and have questions. You'll see me a lot and have many chances to ask me questions, so I would hope that most of the questions would be for Eric, I'm glad to answer some, too. But with that, we'll open it up, and I'll kind of play MC and watch for hands around the room. Yeah, please, Jim, and we'll repeat the question so that all in the room can hear.

Q: Eric, Google has the reputation of hiring the most brilliant students. Could you describe how you screen for that and how the decision \_\_\_\_\_?

Tim: How does Google hire the most brilliant students, how do you screen for it and how do you find talent that can help an organization like this go?

Eric: We copy the way universities do it. Universities have hiring committees and they do searches, and they have teams, and they look at accomplishments. Every person we hire is graded on a score. We look at their GPAs, which turn out to matter, we look at the nature and the quality of the school and the program that they were in, and then we give them a test. By the way, programmers have to do a programming test, seems kind of obvious if you think about it. Marketing people have to write a marketing document. Sales people have to do a sales call on a sales person. You can imagine how intimidating this is. With managers what we do is we ask them to write what are they going to do in the first six months in the job, and by the way, we don't tell them that after they write that, we throw it out, because we want to see what their thinking is. So it is possible to put a science around recruiting. We don't allow friends to hire friends. Often the hiring manager is not part of the hiring committee, as an example, which is again a university thing. Very, very few companies do this, and as far as I know, we are the only one that does it with our rigor. The other thing that we do is we look at outcomes and we measure predictive scores from the interview scores from the predicted outcomes, and then we adjust based on bias. So if you, for example, are an easy grader and we look at the quality and the predicted outcome of the people who you convinced us to hire, a year from now we'll actually mathematically adjust your grade down, sorry, Joe. It is possible to bring science and data to something as heuristic as recruiting.

Tim: Please, over here. Alan.

Q: What should the presidential candidates be talking about in terms of increasing the science of technology \_\_\_\_\_.

Tim: For the whole room, what should the presidential candidates be talking about in terms of increasing science and technology capacity of our population that they are not talking about now?

Eric: The first thing I would do is give them Governor Kaine's speech and have them just repeat it word by word. That's the first thing. The second thing is that there is this bizarre rule called H1B visas, people here may be aware of this. These are people who are very, very educated in science and math and there's a quota, which is filled within a few days of the window opening on a yearly basis. So we and other technology companies have employees who want to come to the United States who are brilliant scientists who are parked in another country. And when they get permission they come in. They work for us anyway, when they come to the U.S. they pay taxes and they change the world. This anti-immigration phenomena in the country is a real issue I think for creating the world's best place. We want in the United States the smartest people, we don't want them in other countries, sorry, right. And by the way, because of the quality of U.S. higher education, they want to be here, just to your credit. Sort of phenomenal, right. You have a situation where the higher education system, typical example is in China, everyone is obsessed with China. Our higher education system is 100 times better than the Chinese one, and yet nobody wants to talk about it. Let's talk about what our strength is. So that's the second point. The third is that both parties have been bizarrely restrictive on the funding required for a lot of key research programs. Computer Science, which is what I'm part of, has had essentially flat to slightly declining budgets for five years. And by the way, guess what? The percentage of graduates in computer science has also been flat to declining in the United States, no surprise. The money matters. I went to Berkeley and was funded because I didn't have any money, was funded by a national science foundation fellowship. I needed the money, it was only \$3,000, but I didn't have it. The concept of leverage is really fundamental, and in government, a small investment now creates entrepreneurs and scientists who create billions of dollars of businesses that create enormous amounts of taxes, and create huge jobs. The problem is that that lifespan is ten years, and the average politician is in office for two, three, four, or five. So we have to have the conversation which is multi-generational. It has to be a part of both parties that we want the United States to be, and otherwise what's going to happen is we're going to have a Sputnik moment. I mean all of the science and math that I was part of occurred because we were terrified of the Russians. So now what's going to happen is somebody else is going to do this and finally we're going to say oh well, we should certainly invest in science. Why don't we do it now? So I think that's a simple list, there's a lot of others.

Tim: Please, Russ.

Q: Is there still a digital divide, and is that still affecting the low income families?

Tim: Digital divide question, how deep is that divide and maybe some thoughts on eliminating it.

Eric: Governor, you have a view on this. Why don't you talk about this state, rural and \_\_\_\_\_?

Tim: Sure. I'll be glad to. And then maybe I'll say it and then Eric, you can weigh in from Google's standpoint. We have, and Aneesh Chopra, my secretary of technology I know is here, and he and others in the state work hard on these digital divide issues. We have viewed the digital divide somewhat as geographic with limited access to high quality telecom, high digital telecom in rural parts of Virginia. With funds from the tobacco commission, but also some other funds, funds from the federal government, we've built out a very extensive, are building out a very extensive digital network throughout rural Virginia, southwest and south side of significant spine there, eastern shore, so that we can really put the best capacity in all of the communities of the Commonwealth. And so that, trying to build that infrastructure and build it in parts of the Commonwealth that have not been served has been a key initiative that we've been promoting. We have an advisory committee that Governor Warner actually has agreed to come back and he's the chair of it right now. So as we continue to build out that network we think we'll solve some of the geographic digital divide. But I think, Ross, probably it's also getting at okay, so now it's available everywhere, what about families of different income levels or different education levels and how they access these opportunities for their youngsters. That's an additional serious issue that we have to tackle.

Eric: In the early '90s, Blacksburg did something remarkable. Blacksburg when I was growing up was really quite remote. It became the most wired city in America. Those of you who were in Blacksburg or part of VTI know this because they had the foresight, and I suspect you have a fair amount to do with this, to actually go and take all those apartment complexes that the students live in and wire them with fiber. Somebody just had the idea and they did it. It was a small enough town they could just do it. So I learned something. And the thing I learned was that this digital divide internet thing is the same thing as rural electrification in the 1940s. We're too young, thank goodness, to remember the fights in the '30s and '40s around the infrastructure required to get electricity all throughout the rural areas of America. And many governors, including this one, have recognized that it's very, very important that access to information be independent of where you are physically. And the technology helps because the technology is getting cheaper. So the problem you have now is you have the other problems. And the fact of the matter is, and you all as educators know this, if you put a computer in a classroom, the quality of teaching does not a priori go up. People like me say well, put a computer in and let them have a good time. It's a system. We can get it connected, and I think that the current digital divide is the values, expectations, parental involvement, and school involvement, and getting people to use these things. And I'll tell you that I encounter all sorts of people who say I was in this rural area, my family was poor, and I learned from Google. And I go this is like terrifying, right. But if they're sitting there in some terrible remote place, that is



their source of information. So I know it's having an impact, but it has to be supplemented by many other things.

Tim: I saw a hand, yes, in the red shirt right there.

Q: [Inaudible]

Tim: Yeah. The glut of information question, with more and more information and more and more storage, how does Google try to make sure that search results retain relevance and don't just haul in all the dreck that's out there? So yeah, how do we do this?

Eric: Yeah, we do haul in all the dreck, we just put it lower than the high quality stuff. The good news about your question is search is what Google does. So every problem that we see, we see as a search problem. So when I go through the math about the number of videos and the amount of blogs and so forth, you're never going to organize those anything other than a search process. We use very, very sophisticated algorithms that are proprietary to the company that I don't really, they're so complicated I don't even understand them now as a computer scientist to actually rank and relate all of that information to produce the results that you see. A typical situation is that our computers are looking all the time for new information, and they're being ranked in parallel. So the tenth of a second or less that you see as a result, there are 100 computers that collaborated to rank and rate and give you that information. We have a lot of ideas of how to make it better. A lot of them have to do with personalization. So the more that we know, the classic example is hot dog, right. The query is hot dog, am I hungry or do I have a dog that's hot, right? Like cool them off or something, put them in a bath of water, I mean how do you disambiguate those sorts of things? So the ambiguity of language is something that artificial intelligence techniques are very, very good at and we have a lot of new things coming there. The other interesting thing we're doing that I didn't talk about, but it's probably relevant here is that we're working on translating every language to every other language. And computers can do this, humans can't. We have something called statistical machine translation where we look at a text and we look at the other language text, which has been translated by a good translator, and then our algorithms can sort of figure out how to do that repetitively for any text. It's magic. I don't really understand it. It's been explained to me twice and I don't think I'll ever understand it. But basically what happens is you take all of this stuff and you translate it. And so we do Chinese, Arabic, and English. One of the terrible things in the world is that there's a very, very large body of Arabic work that's never been translated into any other language. So here we are, we're all obsessed about all these problems in the Arab world and we don't even understand their culture. So now all of the sudden, and it works both ways, by the way, they benefit from seeing all our stuff, too.

Tim: Question here in the back.

Q: [Inaudible]

Eric: I didn't want to do too much of a plug for Google. We're doing one thing that everybody should know about, which is that we're offering people the ability to essentially have university branded Gmail accounts free for students. And you say well, why would we do that? And the answer is of course they then get used to our products and then they use them when they graduate, so it's a good business deal for us. It's a great business deal for universities because the management of that corpus of computers and activity is pretty low value added and it's a huge pain. So this is an example where our computers can do it better than a university can. And that's the test that we applied. In the case of book search, we've signed up on the order of 20 libraries now and we're adding more, who are giving us mostly works that are pre-1923, so it's pre-copyright law. And we're trying to have the largest database of that. We give that information back to the library so they have a copy, but the reality is it's easier for the library to just let us do the hosting, and again, they can have the rights, too, and then their students can use it in the normal course of business. So far everybody seems to be pretty happy with that. We depend critically upon an educated citizenry. We depend it in every country, not just in the United States. So it's in our interest to get every university up to speed, every bit of information available to the smart students who really want to pursue it. It's good business for Google as well.

Tim: Please.

Q: [Inaudible].

Tim: The question is conversations between Google and textbook purchasers, particularly for students or school systems that might have financial challenges to have these textbooks available.

Eric: Actually we have, and we've had such great conversations that they're busy suing us. So we worked hard, and we actually like them, and we're trying to sort of work it out, so don't take that too seriously. But the offer that we've made is that for things which are in print, so these textbooks, which is what you're referring to, we're perfectly happy to get a snippet, that is a small piece of information, and then refer to the student to the book and to a website where the book can be purchased. We don't want to just take the book and make a copy of it, one, because that would be a violation of copyright, and two, the publishers actually have to get paid for their work. So we want to distinguish between the cost and the consumption. My view is that people will consume media on any format, and that book publishers should be willing, for the same amount of money, by the way, to make it available in a book as well as online. The trick is how to make all that work. And that's our goal.

Tim: Questions? Yes, please.

Q: Eric, I'd just like to know your view on the Wiki phenomena \_\_\_\_\_.

Tim: The question is about Eric's view on the Wiki phenomenon as a way of putting knowledge together.

Eric: I have been struck by how good Wikipedia is. There are so many sites that we deal with, which are, it's Gresham's law, the bad content drives out the good content, and you see them all and all when you spend time online. But Wikipedia has somehow managed to avoid that. And if you study what they did, they have a charismatic founder who does this out of love for the world and is a hero in my view, they have volunteer editors who make sure that defamation and sort of scatological and sort of all the wacky stuff that happens online is quickly eliminated. People who do evil things to the information are shut out for a while as punishment for their evil behavior. And it is produced, a remarkably accurate user generated content. It is the poster child. The question I have is how reproducible is that? So here you are and you're in your university and you want to build your own Wiki, do you have to do all the same things that Wikipedia has done. We at Google use the Wikipedia technology, and Wikis for those of you who don't know are collaborative bulletin boards essentially. What you do is people are just constantly adding information and so forth. It's a knowledge network, if you will of information. But within a corporation, we have control over who has access to it and again, we can control it for quality. The fundamental question about user generated content is the Gresham's Law issue. If you have everybody producing user generated content, you get people who are literally mad, who have nothing to do but generate spam hate mails, right. And they just want to pollute everything. I don't think they're in Virginia, I think they're in some weird country. What do we do about those people? And I think that's the problem that the industry as a whole is addressing.

Tim: Yes, please.

Q: [Inaudible].

Tim: What does Google do to foster continuous innovation, always ranked as one of the most innovative companies within its employees?

Eric: The company is very bottoms up run. I seldom make any decisions. It's sort of hard to imagine. It's all percolating all the time. And the key incendiary thing is something called 20% time. And basically if you're a technical person, a product person in the company, we encourage you to spend 20% of your work time on something of your own interest. It doesn't even have to be about Google, it doesn't have to be about the internet, and as far as I know, we're the only place in the world that does that. And all of the interesting ideas have come out of that

because what will happen is that some employee will spend the weekend or Friday or whatever working on it, and then all of the sudden they'll begin to recruit their friends. And then a wave starts going, and then all of the sudden I'll show up and there's ten people working on it, and each one of them is 20%. So it's like two people, right, 20% here, 20%, and I say well, maybe you should like combine forces, and off we go. So the other aspect of what we do that is actually useful is we have a ship and iterate philosophy where what we try to do is we try to make changes constantly. We don't wait for product cycle. Education, if I may, and I don't mean to offend anyone, is the slowest moving organization I ever deal with. Let's say you want to bring out a new textbook, okay. Well, how long does it take to produce a textbook? A year. Then you have to get three years of approvals, right. So now we're up to four years, I'm sorry, that was a low number. So how are you ever going to use a textbook model and get it to match this Wikipedia model? So I think that you all should think about how can you use these ideas like 20% time. And then, of course, the culture is tolerant of failure, tolerant of fast iteration, and encourages individuals to spend, and I do want to be clear that there are groups that we do not encourage to do 20% time. So for example, finance people, we don't want them, we want them sort of working on keeping the money in the bank.

Tim: How about, yes, sir.

Q: [Inaudible]

Tim: How does Google deal with the identity theft issue, making sure that sensitive information is not uploaded and then utilized by people who intend to do others harm?

Eric: It does happen to some degree, and it's obviously not a good thing. We do not allow, we detect credit card numbers for example, we detect social security numbers, we throw them out. In other countries there are equivalent numbers to the social security number, so ID numbers and so forth. And when we detect them we throw them out. And we try our hardest to let people have choices. So for example, here's a, since all of you have landlines, type your phone number into Google and you'll see if we have it, because we may have gotten it through some database that you happened to have signed up with a long time ago. We give you the ability to delete it. And you can leave it there if you want.

Tim: Please, Hank.

Q: How important is it to Google that engineering and science \_\_\_\_\_?

Tim: How important is it for Google that the employees that they are hiring for technical positions also have a good liberal arts founding in their education?

Eric: I think the blunt answer is it depends on where they are in our protocol stack. We have some people who live in our engine room, and as best I can tell, they only come out at night. And I think their lives are probably much better enhanced by having a liberal arts education. But their communication skills are not so high anyway, okay. And I think anything you can do with them is appreciated. The more serious answer is that we have a cohort of people who build our consumer products where the liberal arts education that you all have provided them has been phenomenal because they have judgment, taste, sense, color, style, all the things that our engine room fellow lacks.

Tim: Let me see, maybe take one or two more. Please, yeah, President \_\_\_\_\_.

Q: [Inaudible].

Tim: Let me summarize this question. Simple and powerful point. The earlier discussion was about liberal arts and the value of liberal arts, even in hiring for technical capacity, and President Runta(?) sort of extended it by saying in a world of more and more content, so now a glut of content, isn't liberal arts really important to be able to determine what is the content that is really valuable. So really promoting liberal arts as building capacities of judgment to be able to take the massive amount of information and boil it down to the essentials, so.

Eric: Again, I actually agree with the thesis of your question that we're very good at organizing information, but we still don't have insight. Insight comes from a student and a faculty member and a conversation and the kinds of things that you all do so well, that is the benefit of a liberal arts education. With this explosion of information, it gets worse, right. How do you sort out this idea, this idea, and this idea? So you have to build in your student a thesis, an approach, a model of how good decisions are made or good insights or so forth, and then let them run with it. The only thing I can suggest is that universities will have to help students search better, right. That literally they'll have to ultimately be some kind of assistance, well, maybe this is how you should think about this problem, this is how you should look up this information, this is how you should view it. And that's I think an emergent phenomenon.

Tim: I'm going to take one more question, but just before I do, just to encapsulate a little bit of this, it's been an interesting presentation for Business Higher Ed Council. It hasn't been a speech just on why higher education is important, but I think two themes really emerged from, at least two from Eric's speech. First, he's shared with us the way learning is changing, and the way learning is changing among the young, which will then, it's driven by technology, but it's even bigger than that, and so how that's going to change the mission of all of our organizations, and certainly require our universities to really be at the forefront in this because they're at the forefront of learning. But the second aspect of the speech that really bears on the Business Higher Ed Council's lesson is just the

phenomenal success story of Google, it would not have been without higher education. The beginning points of Google in a higher education environment and then this continuous innovation that is brought about by bringing in people who've had access to the best highest education in the world. And our system is still, other nations may have passed us in X, Y, or Z, even in the percent of people that have higher ed degrees. But in the quality of the higher ed programs we have, we are still not even, it's not a close race. We are head and shoulders above the rest of the world in terms of the quality of the educational programs we have. The phenomenal success of Google and then its ability to transform the world wouldn't have happened without a strong higher education system. And so those are two very powerful messages, the changes in the way we learn and the critical nature of higher ed to this success story and so many others that really bear on your mission. Let me take one more question and then we'll move to lunch, just straight back here please.

Q: I'm just curious with Google becoming universal \_\_\_\_\_, what has happened to previous search engines \_\_\_\_\_?

Tim: Question was sort of there used to be a number of search engines that were competitive with Google, now Google is ubiquitous and we all use the word Google as a verb now. So that really is the test for how ubiquitous it's become. So are there other competitors or if not, how do you define, I guess in some ways, do you have some additional responsibilities as sort of a monopolist in the search for information?

Eric: Very well said, Governor. I'll carefully not answer the last part of that sentence, by the way.

Tim: I can see why.

Eric: The sites that you named are still around. What they do is they become more specialized and they offer specialized value if you're looking in some specific areas. Our primary two competitors are Yahoo! search engine and Microsoft search engine. Yahoo! bought a bunch of them and aggregated them into a competitor, and they do a good job. With respect to our market share and our role in the world, we take it very seriously. We understand that people are making decisions based on Google search results. A typical story is we get this letter, this fellow saying I typed in my symptoms and the answer came back, the first result was you are having a heart attack, dial 911. So the person dials 911, the paramedics show up in three minutes, and they say if you had not done that, you'd be dead. That's a life changing experience. So we tell that story, we say imagine if you'd had the wrong result. This person would be dead. So we take it very seriously. One thing that's alarming is that a significant proportion of our queries are health related. And yet we're not doctors. We're just trying to organize medical information in the normal course of business. Indeed, we have some

initiatives around that around Google Health. So we take it seriously. Ultimately, there are always going to be choices in this space. We hope to be a common denominator, a basic choice that you can start with, and then if you have specialized interests you can go to some of these specialized engines.

Tim: Please thank Eric again.

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