

University of Washington  
Computer Science & Engineering Distinguished Lecturer Series

***The Opportunity Ahead: A Conversation with Bill Gates***

Thursday, October 27, 2011

**Transcript of Q & A Session with Students**

**ED LAZOWSKA:**

Bill thanks for a wonderful talk. We've got 20 minutes for your questions. What I'd like to do is, I'll take the privilege of asking the first one. But I'd like this to be student dominated, please. There are a set of microphones. So please if you've got questions for Bill, think of them, line up at the microphones, and please begin by letting us know your name, and what your major is. And that'll be a way of introduction.

I'm obviously inspired by the notion that computing has a role to play in so many of these things. And you mentioned the 7 billion threshold. I read that we're actually going to cross that threshold on Halloween, sometime on October 31st. And I wonder what you think the particular implications of population growth are on the problems that you describe?

**BILL GATES:**

If you go back to the 1960's and 1970's, the prediction was that world population would get up to about 20 billion. And that, from a global perspective, was very scary. And the people, the sort of liberal group at that time, Club of Rome, wrote about the need for forced sterilization and that nothing was going to work.

Well in fact, two factors avoided that. One was that it turned out that as people got healthier, as they got better nutrition, they decided to have smaller families. And so today, the majority of countries in the world are actually below replacement level. Now the peak population in the UFA-- UFK model is about 9.3 billion. I think because they underestimate what we're doing with various health things; it'll be more like 8.8. But that's not a key difference, about 500 million.

But the problem we have with population today is that it's in some locations that can't afford the population increase. It's exactly where we can't afford the increase. So for example, Africa which is 800 million today will be over 2 billion by 2040. That is, it will be bigger than China or India. And if you treat it like a country, it'll be by far the biggest in the world. And yet, in terms of stability, education, agricultural resources, that's very troublesome.

So it's still very important to very quickly give women who want reproductive health those tools, and to improve health, because we have about a ten-year leg. When you get rid of malaria, just getting rid of malaria in Africa say within ten years, which is optimistic, it would take the peak population of Africa from 2 billion down to 1.6 billion. Just that one act alone. And so we do have levers that we can pull on this.

Another lever you could pull but people aren't very open minded is immigration. That is, all those shrinking countries, you know, right across the Mediterranean, you've got all shrinking countries that should welcome those people in. But that we can't count on it.

**ED LAZOWSKA:**

Question for you. Let's start right up front please.

**STUDENT:**

Hello. I'm Andrew and I'm a computer science major. I'd like to thank you for coming. It's a certainly privilege to hear you talk. I'm interested in your work in education, particularly in your investments in the Kahn Academy, which I'd personally like thank you it saved me last year in linear algebra. What is being done currently to bring this technology to the mainstream education where you have, like you were saying, an ability to quantitatively evaluate students and if there really isn't even a need for a teacher role anymore with games and stuff for the internet for education.

**BILL GATES:**

As you go from kindergarten up to college, certainly the need for adult supervision hopefully goes down somewhat. But, remember, education to some degree is about motivation. I mean if you want to learn physics and you're highly motivated, Feynman wrote a book. It's called *The Feynman Lectures on Physics*. Read it. You don't need a university. And if you're that motivated to even sit and read that thing, wow. That or theory of algorithms. Just read Knuth. And by the way, do the problem sets while you're at it. So education is not about the unique availability of information.

It's about some pure reign of the information into a form that the student chooses to ingest it. And so how do you create that framework. Well I think there'll always be a teacher to some degree. But the place that that's most replaceable is in the case of the lecture. And so I think the answer to your question is you can take slight advantage of Khan at all just as a supplement. "Mom, I was confused about this." You know, mom doesn't know. Mom points you to Khan. You watch the thing, tried some things out, and it helps. It's a supplement.

But the big impact of Khan so far is where the teacher's been willing to flip the classroom. And what's meant by that is that there are no lectures done in the classroom. You assign the lectures which are watching the Khan videos, maybe two or three a night, and then you do the basic problem sets associated with those lectures.

When you come in that next day, the teacher sees who watched those lectures and who didn't, and sees how well people did on those problems. And so that teacher can then divide the class up into groups and do problems that develop that knowledge. Put that knowledge in context. Make the knowledge interesting. You know, why you would want to know about that, which is not the part that Khan is focused on.

Actually we have other people on the web looking at if I want to do nursing, why should I learn math. If I want to do construction, why should I learn math, and complimenting that with the Khan stuff. So we have about 20 schools now that have redesigned the entire classroom experience around those Khan lectures. There's a charter school called Rocket Ship that's completely redesigned around using online curriculum.

And so within a year we'll have the results from that. Only one school did that last year. Los Altos fifth grade. And the numbers appear to be very, very strong. Now the acid test for education is inner-city schools, where the environment, the motivation is the weakest. And that's why half the schools we're trying out right now are inner city schools.

**STUDENT:**

Alex Darling, biochemistry major. One of our professors, my math professor is big into education in third world countries, and he's written a couple articles, including stuff about computer science and whether or not it's

necessary. I was wondering, what are your opinions on computer science in education starting even in elementary school, and whether that's a good idea?

**BILL GATES:**

Well, I think the computer is a great tool and you should be using it as much as you can. If by computer science, we mean understanding queuing theory, and hashing, how you do database indexes, I'm not sure where in the curriculum that should come in. I do think being able to write a program, if you think you understand, say, prime numbers, the idea that you can express that by writing, say an SIB algorithm, I think that's a very interesting test of whether I know prime numbers or not.

But it's hard to say anything is necessary in the curriculum. I mean, can we say that geometry is necessary in the curriculum. No, it's probably not. People don't get to use arc signs that much once they graduate. There's certainly a level of complex symbolic thinking that is valuable to be exposed to. You know, personally I might put statistics in instead of geometry. I'd put statistics certainly before calculus. I'd have more people take statistics than calculus. Where computer science belongs in that hierarchy, I don't know.

**ED LAZOWSKA:**

So here's what I think our pitch would be for computer science. And that is there's this notion originally from Jeanette Wing of computational thinking. And computational thinking is a lot of things you described. It's algorithmic expression, it's problem decomposition, it's step-wise fault isolation, what we call debugging. It's modeling. There are a set of things like this that need to be part of everyone's bag of tricks.

And writing a program is perhaps a way to learn and exercise a set of those skills. But the critical thing to me is that this computational thinking is something that every student needs which is, again, different than understanding hash functions.

**BILL GATES:**

No I think that's right. I do find that people who have computer science backgrounds, when given a problem from another domain, the idea that they take the system and they look at the size of various elements, they look at the rate limiting steps for various elements, and they can say, okay, we need to optimize here. That type of thinking is like, yeah. And what other domain gives you that type of systems thinking. Maybe some parts of science and engineering. But the basic notion of what's an algorithm and the many systems and societies are basically poorly designed algorithms, I think that's very worthwhile.

**STUDENT:**

Hi my name is Ashat or Ashat, whichever one you want to go for. I'm a computer science major and also an economics major. So I guess over the last couple decades, we've seen at least in the United States, a growing disparity of wealth and income. And we've seen money concentrated in the hands of just a couple people. At least you know, you among them. I'd say you're doing pretty good. But in addition to this, we've also seen a growing power of money to influence politics, especially with the Citizens United court case.

So we have kind of a cycle, where the money is in a lot of cases who has the money influences what kind of information gets out. So I'm wondering, do you think that making voters more informed, increasing people's ability to make rational decisions in regards to politics is something that we should be focusing on as a nation?

**BILL GATES:**

First of all, the world at large is less inequitable today than in any time in history. That is, the poorer countries

are getting richer faster than the richer countries are getting richer. The number of people in abject poverty, percentage of people is at an all-time low today, and that continues to go down. And innovation will continue to drive that down. My favorite metric is the global under five children deaths which are now somewhat under 8 million a year. Fifty years ago that was over 20 million a year.

So I do think that in most problems, time is on our side. You're absolutely right, there are some big fortunes. And it's not good to have a society where you don't have mobility in between different income levels. That is, if you're born in the bottom quartile, education ought to be good enough that you have a reasonable chance of getting into the first or second quartile.

And so if you really look at where we're letting people down in terms of the American dream, I wouldn't say, and you could say this is self-serving, I wouldn't say it's because a few people are very rich. I'd say it's because we aren't doing a good job in education to give them an opportunity to move up into the top few percent. In terms of the very rich Warren Buffet and I, we're the two wealthiest Americans, are certainly believing that the rich should be taxed a lot more than should and the rich should give away more of their wealth than they currently do. And we've certainly have been willing to speak out about that. Warren is the only person who has ever had a tax named after him, the Buffet tax, which is sort of about he should pay more than his secretary should.

So you can be very frustrated with the political system. I certainly am myself right now. I was in Washington D.C. on Monday and Tuesday meeting with members of the House and talking about things like cutting science budgets is not the way to keep the country strong. I don't know exactly why politics feels so frustrating right now. It's certainly worked very well up to now. And so maybe, the system will realize the problems that it has there.

But I don't think, just by getting rid of the wealthiest in the country that would automatically solve these other problems. I really think you do need to fix the education system. I do think you need to get the cost of education and health care to go down. Then I think our society will feel far more equitable just for those reasons alone.

**ED LAZOWSKA:**

Let me ask a question about civic discourse for a second. I was worried ten years ago that the web and our ability to get information targeted just to us, and to communicate with people who are just like us was going to sort of increase the hostility of civic discourse. The fact that I don't have to listen to people who disagree with me because I can find a cluster of friends. It seems to me that that's happened, but it's not obvious to me that technology has played a role.

**BILL GATES:**

Well we have a variety of things that may have led to the current polarized situation. We have money politics which is bad. We have districts where the voters, they are designed so they're safe districts so the primary allows somebody who is fairly extreme to the left or right to be the one who ends up holding that seat. California actually recently went and fixed that. Could that be fixed more broadly, could you fix money politics?

And certainly the media. People do wonder if this polarization partly comes from the Fox News phenomena that you're kind of listening just to those people who agree with you. I don't really know. I do think that underestimating people's ability to go and find things that represent broad viewpoints; I wouldn't want to be too pessimistic about that. Because the web gives you so many choices.

I do think it's far better than broadcast TV. If you're curious about a topic, in fact, your ability to dig in about that topic and learn about the topic. One thing I worry about and I don't know of the solution for this, is complexity. The U.S. tax code is so complex that you don't know where to be outraged. And you don't have time to read it. There's this bill called the Volcker Rule. Its 430 pages long. And a law firm's summary is 41 pages long. Well I'm going to read it. But what percentage of the voters will read it. I don't know. The health care reform bill, 2,300 pages. I'm not going to read it. I care a lot about it but it's too arcane. If it was readable, maybe. So this complexity, the fact that we really can't talk directly about the issues means that we talk about personalities and things. And so I think complexity is hurting us.

The internet is one of the few things that might help us have explainers who are out there, who can talk through, hey, here's why you ought to be pissed off about the tax code. And here's why medical costs are going up. And what you ought to do to help those things go down. So I tend still to be optimistic, but some of the current data points are scary.

**STUDENT:**

Thank you for the talk. Bill Gates and Ed, thank you very much. My name is Tony Weagream. I'm a computer science student. I graduated back here back in '98. I'm back here as a student again. So my question for you is about the health care reform that was passed. The question was, so a couple years ago I was in an accident. I was put in a medically-induced coma in Harborview Hospital for four months. I remained an employee of my company as a computer science company. I remained an employee, my health care insurance dropped me like seven days after it happened because it was going to be too expensive. They did not want to take care of me, cover me anymore.

So what do you think about I cannot get insurance for the rest of my life no matter what. Even on my way back to work. I've been an internship three times, still cannot get insurance no matter what. What do you think about the health care insurance reform that was passed? What do you think about it? Do you like it, do you not like it?

**BILL GATES:**

Well health care's a very complex topic, and I know a lot more about malaria and hash tables than I do, and I like hash tables and I dislike malaria. But in terms of health care reform, I do think it's super important because the cost trends are such that we are going to be denying people care.

And that's horrific. And yet the tradeoffs to society, the resource costs involved there, it was in the news today that the governor's budget proposal will cut the amount of the money to the UW, again. Why is that happening? Well I think there are many steps in the causation. But rising medical costs, if you go all the way back that is a core piece of what's going on there.

And so, in order to make health care always available to somebody like you and not have to cut education budgets forever, I mean, you get to zero at some point, you really have to take innovation and make it your friend. You have to make it come up with lower cost ways of doing things. Now that requires measurement, it may require a framework for competition. We're really not there. The best single book on this is one by Michael Porter called, *Redefining Health Care*. Again, it's not simple. Its 400 pages. But if you're interested in the topic, I think it's well worth looking at.

**STUDENT:**

Hi. I'm Fabrian Walker and I'm an electrical engineer major, and you talked about robotics being something that will be happening in the next couple years hopefully. And I wanted to know how it'll affect the issues that are facing the world right now? Like overpopulation or diseases or just some of the kind of catastrophes that we're facing?

**BILL GATES:**

Well robots, they clean the rug today. And they disarm bombs today. The term robot is an unusual term because we tend to apply it for something that can move on its own. If something paints an automobile in a stationary position, or if it helps do surgery, is that a robot or is it not.

But when it comes to things like doing physical security, or doing transport, having cheap robots really can improve the world. It can do fantastic things. There's one of the people I brainstorm with over in Nathan Myhrvold's company, talks about how whenever a mother's delivering, there ought to be a robot that comes in that can do a C-section, because it's very difficult to get a doctor in there.

And this is less farfetched than it sounds. It sounds very farfetched. But if you want to cut maternal mortality dramatically, you have to find a way to get out into rural areas and give very sterile C-sections. It just there's a level of mortality you can't get below unless that intervention is available. And it should be absolutely possible to do.

When you talk about making things less expensive the robot can perform a lot of functions that are now fairly expensive. When you talk about manufacturing being done in the United States it happens to be one of the things that might allow a resurgence in a fairly dramatic way. I think it's pretty hard to predict just like if any of us had been asked to say, okay, the Internet's going to be cheap and available. Which parts of the world of business will move to the internet most rapidly I think we would've missed, now it seems obvious. But we would've missed that somewhat. So I don't know what the breakthrough applications are. But I know when you get to the right price points, they're extremely broad.

**ED LAZOWSKA:**

I think your position in agriculture is another example, where there's a lot of robotics in it. Sort of GPS-controlled combines and things like that's clearly had a big impact on productivity.

**BILL GATES:**

Yeah, and at the expensive end. And now can we make cheap robots that for African agriculture, small holders actually would help out.

**STUDENT:**

Hi. So my name's Jasmine. I'm from Beijing, China. I'm a freshman. My major's undecided. I want to start this by telling a little story when I was young. So when I was young, it will be short. My parents and my friends and my teachers would always ask me what would you want to be when you grow up. And my answer was always I want to be one of the richest person in the world.

So here I am, here you are. So if A is equal to B, and B is equal to C, that means A is equal to C. So I want to be you I guess. And so what is one word of advice that you would give to someone like me to become someone like you?

**BILL GATES:**

Okay, well I didn't start out with the dream of being super rich. And even after we started Microsoft and the guys who ran Intel, Gordon Moore and those guys were billionaires, I was like, wow, that must be strange. And so it is. It's quite strange. But I think most people who've done well have sort of found something that they just are kind of nuts about doing.

And then they figure out a system to hire their friends to do it with them. And if it's an area of great impact, then sometimes you get sort of financial independence. But wealth above a certain level really is just a responsibility that then you're going to have to either A, leave it to your children, which may or may not be good for them. Or B, try to be smart about giving it away.

So I can understand wanting to have millions of dollars. There's certain freedom, meaningful freedom that comes with that. But once you get much beyond that, I have to tell you, it's the same hamburger. Dick's has not raised their prices enough. But being ambitious is good. You just have to pick what you enjoy doing.

**STUDENT:**

Hi. My name's Pauline Ross. I'm a computer science and industrial engineering student. To kind of play devil's advocate for a minute, there's been a lot of information coming out (microphone cut out) impacted kids these days. They can't read body language as well, relate to each other as well, speak as well. And so I was kind of wondering how you felt about that and what you feel like some of the responsibilities of computer scientists and other people who generate this technology are to society?

**BILL GATES:**

Well we should always measure the good impacts and the bad impacts in the stuff we have. Certainly whenever a new technology comes along, there's a lot of fear about what it's going to do. When the printing press came along, there was a great fear that people would just read books and not go out and seek real experiences and I tried that when I was that kid. Just reading books. And maybe I'd be more rounded if there hadn't been books around.

So I think it's hard. I haven't seen any evidence of any significance that socialization has really broken down in some bad way. I know that with Skype now, I meet my daughter's boyfriend's parents when I walk into her bedroom and there they are on Skype.

So socialization is changing. I'm not sure you can really say that there's a negative vector there. And there are so many positive vectors about if you're curious and you want to learn something. When I was young, and I'd ask a question about hey, what's fertilizer. If the World Book didn't have it, I wasn't going to get the answer.

Now, of course, you go online, watch videos, and my children are always asking questions where if I don't know the answer, we just go and it's actually kind of fun to learn it together. So I'd say on balance I think we're quite, quite far ahead. There are some things about privacy. Maybe misuse of, overuse of pornography.

Letting your kids play too many videogames so you have to set a quota. Just like I had to have a quota for how much I was allowed to read. But I think overwhelmingly, we've got mostly positive things, including the opportunity ahead of us of how the tool gets used in mainstream education.

**STUDENT:**

My name is Shing. And I'm an electro engineering major. I'm not going to ask you anything about politics or how to be a rich man or something. Just wondering a really quick question. So from personal computer to

internet, and now is smart phones will mobile internet. What will be the next generation of the technology? And what will be the future of the technology?

**BILL GATES:**

Well in a sense, the only difference between a phone and a PC is sort of the screen size. You have the size of the screen and the input technique. And so in a classroom, you have a big, big, big wall. And in your pocket, you have this little device.

The next generation is either a screen that you can fold out to any size that you want, kind of going back to the papyrus scroll, or more likely it's simply projecting onto your retina. Because if you want to get a very high projection experience, if I have a projection ability, I can have a camera that's watching my gestures, I can just say okay, I want a newspaper this size, and I can get perfect HD resolution right in front of me. And the cost and weight of having that capability is almost zero. So eventually, we'll laugh that there were these big flat glass screens that were expensive and if you drop them they broke. All you're trying to do is put stuff on your eye. That's all. So what a weird contraption, all these LCD chemicals and chips and things.

You're just trying to project into my eye. Why don't you just go ahead and paint there. So I do think that's the display technology. Now then you get into the pervasive sensors and the robots and things that mean that the dividing line between this is a computer A this is computer B sort of gets lost in that picture. So the pervasiveness in perhaps the projection along with the new interaction techniques are where it takes on a different form.