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JULY 15, 2009, 11:52 AM

Gates Puts Feynman Lectures Online

By *JOHN MARKOFF*

Microsoft The new [Tuva Web site](#) features annotated videos of Richard Feynman's physics lectures.

Microsoft Chairman [Bill Gates](#) believes that if he had been able to watch physicist [Richard Feynman](#) lecture on physics in 1964 his life might have played out differently.

Mr. Gates, of course, is legendary as a Harvard University dropout who went on to create the world's most successful software firm. He has told associates that if had watched the lectures earlier in his life he might have become a physicist instead of a software entrepreneur.

However, Mr. Gates, who is also well known for his sharp and varied intellectual interests and his philanthropic commitment to education, said this week that he had purchased the rights to videos of seven lectures that Dr. Feynman gave at Cornell University called "The Character of Physical Law," in an effort to make them broadly available via the Internet.

[Microsoft Research](#) announced on Wednesday that Mr. Gates, who purchased the rights to the videos privately from the Feynman estate, BBC and from Cornell University, in cooperation with Curtis Wong, a Microsoft researcher, has created [a Web site that is intended to enhance the videos by annotating them with related digital content](#).

The name "Tuva" was chosen in reference to Dr. Feynman's decade long — and ultimately unsuccessful — effort to reach the tiny Russian republic of Tuva, which is located in Asia, toward the end of his life.

Mr. Gates said that he had stumbled upon the film version of the lectures a number of years ago, watched them with a friend using a traditional film projector, and "fell in love" with them. The lectures are not the first acquisition of this kind that the software billionaire, has made. In 1994 he acquired the Codex Leicester, a collection of the written work of Leonardo da Vinci, for \$30.8 million in an auction. He did not disclose the amount he spent to gain clear title to the Feynman lectures.

"I do think that making science cool to people when they're young and therefore getting more people to go into it in an in-depth way, I think that's very important right now," Mr. Gates said.

The Tuva Web site will be expanded with additional Feynman lectures in the future, Mr. Gates said. When it is completed it will offer searchable transcripts from the lectures as well as commentary from well-known physicists. The site also offers individual viewers the ability to annotate and take notes. Currently, the first lecture has an "extras" features on the right side of the Web page which includes interactive animations and other components.

Mr. Gates said that he remained fascinated with the lectures, which are intended for a freshman college audience, but which he said were within the grasp of his ten-year-old son. He noted that he had recently watched them again while he was helping Mr. Wong put up the Tuva Web site.

"I couldn't help myself, I watched them one more time," he said.

This post originally described Gates as a "freshman" dropout, that's incorrect. He did make it to his sophomore year.

Richard Feynman on reality

Richard Feynman was the ideal physics professor. Utterly brilliant and engaging with a wide streak of anti-authoritarian feeling he was an inspiration.

His books are excellent but I've never seen him speak, until now. Microsoft, god bless their well-funded enthusiasm, have digitised some of his lectures and published them online on their Project Tuva website, which collects bits of video and puts them online to try to get you to download Silverlight, their Flash competitor. Just one of these lectures alone would be worth the install, but there are seven of them, more than eight hours on a variety of subjects from gravity to the nature of the present.

I can't embed them here - Microsoft won't let me - but I do urge you to set aside a little time and watch this great series. Apart from the enormous pleasure of seeing how a college campus looked in the fifties, they're a very good introduction to topics that are still current in physics.

He's funny, clear, knowledgeable and entertaining. This is the best science video I've seen in a long time. Some choice quotes:

'I find it odd then when an introduction mentions that I play the bongo drums it rarely finds it necessary to mention that I also do theoretical physics. It shows that we have more respect for the arts than for science.'

'Our main concentration will not be how clever we are to have found it all out, but on how clever [nature] is to pay attention to it.'

'There was a time when the newspapers said that only twelve men understand the theory of relativity. I don't believe there ever was such a time. Maybe once there was only one man who had caught on, before he finished his paper, then after other people read it there were a lot of people who understood relativity in one way or another. More than twelve. On the other hand I can safely say that no one understands quantum mechanics.'

'I'm going to tell you what nature behaves like, and if you'll just simply admit that maybe she does behave like this you will find her a delightful, entrancing thing.'

CNET News

[Beyond Binary](#)

July 14, 2009 9:00 PM PDT

Bill Gates offers the world a physics lesson

by [Ina Fried](#)

It's been a year since Bill Gates [left full-time work at Microsoft](#), but he's found plenty to keep him busy.

In between trying to eradicate polio, tame malaria, and fix the broken U.S. education system, Gates has managed to fulfill a dream of taking some classic physics lectures and making them available free over the Web. The lectures, done in 1964 by noted scientist (and Manhattan Project collaborator) Richard Feynman, take notions such as gravity and explains how they work and the broad implications they have in understanding the ways of the universe.

Gates first saw the series of lectures 20 years ago on vacation and dreamed of being able to make them broadly available. After spending years tracking down the rights--and spending some of his personal fortune--Gates has done just that. Tapping his colleagues in Redmond to create interactive software to accompany the videos, Gates is making the collection [available free from the Microsoft Research Web site](#).

Gates said that he hoped his action would serve as a model for taking great educational content and making it broadly available for free.

"When a lecture is presented as well as this, it draws more people in to understanding science." Gates told CNET News. "And over time I hope there's more like this."

In a wide-ranging interview, Gates also reflected on the changes at Microsoft, spill the beans on the [expansive vision for Product Natal](#) and [shared his thoughts on Google's just-introduced Chrome OS](#). Here's an edited transcript of that interview.

You first saw these videos on a vacation 20 years ago. Do you want to talk a little bit about how that happened, and what your reaction was to seeing those lectures?

Gates: Yes. I was in a period where, in order to learn new science, thought it would be a fun thing to see what films there were, and we went to some university catalogs, including University of California system had a catalog of films, and got a lot of health, biology, physics type films--those are those metal cans with big reels--and then we had a projector in a room that we made dark. So even (during) the day, you could thread these films. And there were a lot of interesting ones, but these Feynman lectures that he gave at Cornell...those were just unbelievably good.

After that, I got them put onto videotape, and I got rights to make a small number of videotapes. It was VHS tape at the time, and send it around to some friends who might be interested. But I always had in the back of my mind that it was kind of a crime that there wasn't broad availability of those things, particularly for young people thinking about science.

And so I sort of had this project in mind, and (have been) making some progress in understanding who had the rights, and eventually doing deals for the rights, and then getting these things scanned, and then getting Microsoft Research agreed to host the stuff and create some innovative software around it, which Curtis (Wong) has run. It's taken a long time, but with lots of PCs and the Internet, and my willingness to spend some money, now these things are just going to be out there.

What do you hope people get out of these videos? Who is your ideal audience for them?

Gates: Well, I didn't get to see these until I was about 30, and so I would love it if lots of young people saw them, and got a sense of the fun, and how science works, and what's complicated, and what's not. I hope some people who teach science are inspired by the way that Feynman managed to make it interesting without giving up the depth of how it works.

With super-high-quality material like this up there for free, I hope people see the potential, and that they'd benefit from this one in

particular, and then it starts to push forward the idea if someone is great lecturer, then their work should be out there and available.

I've heard you talk about the way community college really should change, and really what we should be doing for some of these subjects that are somewhat universal is taking really the best explanations, the best lectures out there, and making those broadly available, and then focusing sort of the local learning around discussion and different sorts of things.

Gates: That's right. Education, particularly if you've got motivated students, the idea of specializing in the brilliant lecture and text being done in a very high-quality way, and shared by everyone, and then the sort of lab and discussion piece that's a different thing that you pick people who are very good at that.

Technology brings more to the lecture availability, in terms of sharing best practices and letting somebody have more resources to do amazing lectures. So, you'd hope that some schools would be open minded to this fitting in, and making them more effective.

But, you've also got this huge set of people who like to teach themselves and like to learn things, and yet find science kind of daunting. And when a lecture is presented as well as this, it draws more people in to understanding science. And over time I hope there's more like this, including some about science stuff that's changed since the time these were done.

How big an impact do you think these types of things can have in terms of the overall problem of getting people interested in math and science? Is this type of thing enough, or do we really need to fundamentally do more, younger?

Gates: Well, certainly in fifth grade through senior year, most students aren't yet motivated to want to learn a lot in general, and particularly about science and math. The big impact is anything that can help teachers do a better job, where teachers can either see other teachers doing it super-well, or they might incorporate some online things into the classroom experience. As you get older, and you've got people who are motivated more clearly, then it shifts where these online lectures can be a huge part of learning.

That's where Feynman with his clarity of explanation and simplicity of explanation, and love of the subject, and humor around it is such an exemplar.

You mentioned that you didn't get to see these until you were in your 30s. If you had seen them earlier in your career, maybe before you decided to start Microsoft, do you think you might have headed in a different direction?

Gates: I'm not sure. I've always liked physics, but I also want the equivalent lectures to be out there for biology, and computer science, and chemistry. Everybody has a level where you can bring in their interest. I mean, people care about animals, and disease, and food, but many of the sciences are so abstract, and the amount of things you have to learn before you start connecting to those practical issues can be very daunting. And yet with a teacher like Feynman they're out there in different fields, it's just that we haven't had a way to magnify their excellence, and make it broadly available.

One of the points that's made in the lectures is this idea that from the discovery of gravity there's basically been since then 400 years of just an avalanche of discoveries, and he sort of puts forth this notion of continuous progress. And I'm curious, do you see that having continued, or have we seen limits to sort of some of the full understanding that the basic sciences can give us? Are there things that are beyond sort of what basic science can teach us?

Gates: We're learning more about basic science today by a huge amount than ever before. You just take understanding materials, why they break, why they're strong, how you engineer them to have various properties, and a lot of that was black magic. And it's only now that we're able to say, okay, when we want to make batteries that charge really fast, okay, how do you make something with a lot of surface area that doesn't degrade.

Anyway, in material science, or basic medical things, or basic things about physics that are going to be important for cheap energy as just one example, this is the most interesting time. That's why it's partly an irony that you're not getting the best and the brightest particularly native born to go into science and math. And so you've got to look back and say, what is it we're doing about making it daunting, or abstract that holds that back so much.

There's an American physicist, [Fritjof Capra](#), (who) wrote a lot of books in the '70s on ecology, and the limits of Cartesian thinking. Basically his thing was that by focusing on sort of the Cartesian reductionist approach to things that prioritizes sort of looking at the small parts--that type of thinking has contributed to not getting as deep an understanding of things like ecology, and really complex systems. Is that what's caused us to get into some of the problems we have, or do you think

People care about animals, and disease, and food, but many of the sciences are so abstract, and the amount of things you have to learn before you start connecting to those practical issues can be very daunting.

it's more just these are tough choices and require conserving, and things that are kind of hard for us as humans to do?

Gates: Well, the tough situation that we're in is that we have electricity, we have medicines, we have vaccines, those were all due to scientific understanding. And as we get new materials, new batteries, solar, nuclear energy that don't cause environmental things, it will be because of these scientific understandings. So, I think the incredible improvement in living standards, and life expectancy, and literacy, and all those things really do come back to the advanced scientific understanding. And when people look at history, that's the one thing that they always undervalue is how scientific progress has allowed us to do those big things.

It's true that as you go forward, you tackle more complex problems, but the tools of modeling and simulation and getting a lot of people who are mainly in politics, but know enough about science to be in the discussion, that's important. You know, there was a book written called [Physics for Future Presidents](#), which took some of the basic notions of energy density and costs and dangers about radiation or nuclear weapons, and put that into a fairly straightforward thing.

We do have a problem if we don't draw a large part of society into at least some understanding of science and the tools of science.

We do have a problem if we don't draw a large part of society into at least some understanding of science and the tools of science. And so, having great lectures online, I have several goals--improve education, get more people into the sciences in a deep way, but also get a broader set of people into sciences in even a modest way.

When we talked a year ago, I asked kind of what you anticipated your life would be like once you stopped being at Microsoft full time. Now a year later what are some of your observations on how your time is different, and maybe what are some things that you hadn't expected about where you are today?

Gates: Well, the foundation work is very rewarding, and there's a lot of interesting complexity that comes with it. I'm pretty much doing what I expected to be doing, which is very different than what I was doing before my job changed. I do have about 20 percent involvement with Microsoft, where topics like their future of Office, of search, or various things that Steve (Ballmer) asked me to look into and help out with come along. So that's developed pretty much like I would expect.

It will be interesting as I get a year or two more out, and I know the activities and the people (at Microsoft) a little bit less, you know, how Steve and I make sure I stay fresh and connected and things like that. So, maybe the first year was always going to be the easiest. And it's at the level that we planned it for, which is giving me a massive amount of additional time to meet with scientists and go to the developing world and meet with various government partners.

For the last three months, up until two weeks ago, I was entirely in Europe, and actually based out of there. Our family had moved over there. So, I was up at Cambridge and Oxford. For that period I was particularly focused on the science and partners, both governments and companies, and things that happen to be based in Europe. That's done, but the kind of things I was doing there are exactly what my schedule looks like over the next six months, where I'm in India, I'm in Africa, going to meet with companies, doing things, meeting with scientists. So, you know, I'm thrilled by the foundation work, and fortunately I have Jeff Raikes running the foundation as CEO, and so my role at the foundation is a lot like it was in the period where Steve had already taken over as CEO, where I got to be more on the research side, the breakthroughs, the new ideas.

And you've been [doing some stuff with Intellectual Ventures](#). I know every time you show up on a patent application that, folks get interested in what you're looking at, whether it's stopping hurricanes, or [beer kegs](#), or what-have-you.

Gates: That's right. We're going to make the cows that don't fart. You name it, we've got it under control.

That's been really exciting to take this idea of gathering top scientists from a broad set of areas and think about problems that can be solved. And in the case of the foundation, you know, Nathan (Myhrvold) has used that ability to convene great scientists to look at things like how do you deliver vaccines without having to use as many refrigerators, or how do you pasteurize milk in a better way, some very interesting things. And then I also sit down with that group when they're looking at their rich world applications, including things around energy, and one of those has actually led to creating a company called [TerraPower](#), which is focused on a new, very radically improved nuclear power plant design, which is a hard thing to get done, but extremely valuable if it comes through.

I'm curious of your thoughts of how Microsoft is doing as a company since you left. I'd also be remiss if I didn't ask you what you thought of Google's efforts to get in the OS arena.

Gates: Well, just to do the second part very succinctly, there's many, many forms of Linux operating systems out there, and packaged in different ways, and booted in different ways. So I don't know anything in particular about what Google is doing. But, in some ways I'm surprised people are acting like there's something new. I mean, you've got Android running on Netbooks; it's got a

browser in it. In any case, you should make them be concrete about what they're doing. It is kind of a typical thing. When Google is doing anything it gets this--the more vague they are, the more interesting it is.

I guess there is the notion, though, and I know Microsoft Research had been looking at it, too, of whether the browser, because it's become so central to so much of our work, needs to take on more operating system-like characteristics.

Gates: It just shows the word browser has become a truly meaningless word. Anyway, what's a browser, what's not a browser? If you're playing a movie, is that a browser or not a browser? If you're doing annotations is that a browser or not a browser? If you're editing text, is that a browser or not a browser? In large part it's more an abuse of terminology than a real change.

What about on the question of how Microsoft is doing?

Gates: I'm always the one who thinks, gosh, why isn't Microsoft doing even more, because that's been my mindset, let's move fast, do new things very quickly. But, you have to say, whether it's Windows 7 that is a really excellent piece of work. I'd go so far as to say both compared to other operating systems, and compared to other generations of Windows, it's an extremely nice piece of work.

What they're doing in new versions of Office--I guess they showed a little bit of how the Web piece fits into it recently, but there's a lot about the new version that will get talked about in the next nine months or so. The work on search, where people see Bing as a nice piece of work, really see us in the game, hiring really top people, and willing to try to do things some different ways.

The part of Microsoft I stay up to date the most on is probably the research group. I was over at the Cambridge lab a few weeks ago, over at the India lab as part of a trip I take this month, and that's really the sort of crown jewel in terms of always feeding neat new things into Microsoft. I'd say a cool example of that, that you'll see is kind of stunning, in a little over a year, is this (depth-sensing) camera thing... Not just for games, but for media consumption as a whole... If they connect it up to Windows PCs for interacting in terms of meetings, and collaboration, and communication, you put the camera in now it's a cool thing, and it's just an example where Microsoft research did the original stuff to show, with the depth information, something great could be done. Then both the [Xbox](#) guys and the Windows guys latched onto that and now even since they latched onto it the idea of how it can be used in the office is getting much more concrete, and is pretty exciting.

So Microsoft is a very innovative company, but obviously in a hyper-competitive field, which is what makes it such a great field.

I'm not sure I understood that last point. You're talking about cameras, you were talking about like the depth sensing cameras that are in Natal?

Gates: Yes, exactly, Natal. The software libraries and applications we're doing around Natal.

And we'll basically see that in more than gaming? We'll see it in other scenarios, too?

Gates: Well, I think the value is as great for if you're in the home, as you want to manage your movies, music, home system type stuff, it's very cool there. And I think there's incredible value as we use that in the office connected to a Windows PC. So Microsoft research and the product groups have a lot going on there, because you can use the cost reduction that will take place over the years to say, "Why shouldn't that be in most office environments?"



During her years at CNET News, Ina Fried has changed beats several times, changed genders once, and covered both of the Pirates of Silicon Valley. These days, most of her attention is focused on Microsoft. [E-mail Ina.](#)

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News Press Release

Microsoft Research and Bill Gates Bring Historic Physics Lectures to Web

Lecture series by celebrated physics professor Richard Feynman is now available to all.

REDMOND, Wash. — July 14, 2009 — Microsoft Research, in collaboration with Microsoft Corp. Chairman Bill Gates, today launched a Web site that makes an acclaimed lecture series by the iconic physicist Richard Feynman freely available to the general public for the first time. The lectures, which Feynman originally delivered at Cornell University in 1964, have been hugely influential for many people, including Gates. Gates privately purchased the rights to the seven lectures in the series, called "The Character of Physical Law," to make them widely available to the public for free with the hope that they will help get kids excited about physics and science.

The historic lectures and related content can be seen at <http://research.microsoft.com/tuva>. The name "Tuva" was chosen because of Feynman's lifelong fascination with the small Russian republic of Tuva, located in the heart of Asia.

Feynman was one of the most popular scientists of the 20th century, equally regarded for his scientific insights as well as his ability to convey his enthusiasm for science through his lectures and writings. He shared the Nobel Prize in Physics in 1965 and was also known for his quirky sense of humor and eccentric and wide-ranging interests.

"No one was more adept at making science fun and interesting than Richard Feynman," said Gates. "More than 20 years after first seeing them, these are still some of the best science lectures I've heard. Feynman worked hard during his life to popularize science, so I'm sure he'd be thrilled that now anyone, anywhere in the world, can just click a button and experience his lectures."

Curtis Wong, a principal researcher with Microsoft Research, enhanced the experience of viewing the lectures by integrating the historic video with a Microsoft Silverlight-based video player that allows viewers to search the lectures for references to particular subjects, take notes that are synchronized to the video, and click on hyperlinks to related Web content, among other customized operations.

"There is a lot of public interest in building innovative educational resources online," Wong said. "This is an opportunity to take some existing educational content and utilize software and the wealth of resources available on the Web to create a richer learning experience. And because people can annotate the lectures with their own comments and links to related resources, I expect this experience to become richer and richer over time."

Microsoft Research has been exploring video annotation for many years and chose to publish the Feynman "Messenger" lectures with a new enhanced video player. Neither Microsoft nor the Bill and Melinda Gates Foundation were involved in the acquisition of the rights to the lectures.

About Microsoft Research

Founded in 1991, Microsoft Research is dedicated to conducting both basic and applied research in computer science and software engineering. Its goals are to enhance the user experience on computing devices, reduce the cost of writing and maintaining software, and invent novel computing technologies. Researchers focus on more than 55 areas of computing and collaborate with leading academic, government and industry researchers to advance the state of the art in such areas as graphics, speech recognition, user-interface research, natural language processing, programming tools and methodologies, operating systems and networking, and the mathematical sciences. Microsoft Research currently employs more than 850 people in six labs located in Redmond, Wash.; Cambridge, Mass.; Silicon Valley, Calif.; Cambridge, England; Beijing, China; and Bangalore, India. Microsoft Research collaborates openly with colleges and universities worldwide to enhance the teaching and learning experience, inspire technological innovation, and broadly advance the field of computer science. More information can be found at <http://www.research.microsoft.com>.

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