

Transcript of talk delivered by Sergey Brin at UC Berkley in 2007.

Watch the video at <http://www.youtube.com/watch?v=Ka9IwHNvkfU>

Interesting quotes bolded.

0:13 MARTI HEARST: We have a fantastic guest speaker  
0:15 today, Sergey Brin, who is a co-founder of Google.  
0:19 You might have heard of this company.  
0:20 [LAUGHTER]  
0:23 I actually got the Wikipedia article on you, Sergey, in  
0:26 order to give your history. So I could sit here and  
0:27 read things for a couple of minutes but I don't think  
0:31 I'm going to do that.  
0:32 SERGEY BRIN: I should sit down and do that.  
0:33 MARTI HEARST: Sorry?  
0:33 SERGEY BRIN: I should sit down that.  
0:36 MARTI HEARST: Yeah, why don't you do that?  
0:38 That'd be great. I'm not going to sit here  
0:39 and take up the time. We don't have that much time  
0:43 with you so I'm just going to let you take over.  
0:45 SERGEY BRIN: OK.  
0:46 MARTI HEARST: So, Sergey Brin.  
0:47 [APPLAUSE]  
0:55 SERGEY BRIN: So I mostly want to do some Q&A here today,  
0:58 but I wanted to start with a few opening thoughts.  
1:02 And actually you reminded me of one of them which  
1:06 is the Wikipedia -- Wikipedia in general.  
1:10 There are things out there that are very simple and  
1:17 you never think would work.  
1:19 And that's why you just don't do things that you assume  
1:23 they basically won't work.  
1:25 Wikipedia is one of those that it would never occurred to me  
1:29 that something like that would work.  
1:30 And I assume many of you-- has everyone here seen  
1:33 Wikipedia articles? All right.  
1:36 Yeah and it's amazing to think that you can build  
1:39 an encyclopedia and anyone can edit anytime.  
1:42 I've gone to Wikipedia pages at first when I said, look I don't  
1:46 believe they're getting this content this way.  
1:48 Here, I'll hit the edit button and see what happens.  
1:51 I go on a random web page.  
1:53 I don't know, it was some artist, 18th century.  
1:55 And I made some stuff up.  
1:58 He really liked the colors brown and orange,  
1:59 something like that. And I punched it in there.  
2:02 And I said, come on, there's no way this is going to work.  
2:04 And of course, I click submit and then I view and  
2:06 there's the change there.

**EXHIBIT 2032**

*Facebook, Inc. et al.*

v.

2:08 And then I quickly undid it.  
2:11 I didn't want to pollute it.  
2:13  
2:14 But it does work.  
2:16 And it works for several reasons, many that I  
2:21 don't understand for sure.  
2:23 But one of them is scale.  
2:26 And by virtue of the fact that there are so many people out  
2:30 there that are reading these Wikipedia entries, that are  
2:35 editing-- well, there are a smaller number editing them.  
2:38 And then a still smaller number that really actively  
2:42 monitors all of them. But still, it's a small  
2:44 fraction of a huge number of people.  
2:47 They're able to keep it to be a pretty-- a very comprehensive,  
2:53 reasonably high quality site.  
2:54 Occasionally like some of the stuff I think above  
2:57 me is a little bit wrong.  
2:58  
3:00 But I don't know how it would compare to like normal  
3:03 encyclopedia entries.  
3:05 I know it not. So I think that they  
3:07 do very, very well and I'm very impressed.  
3:14  
3:16 With internet search as a whole, forget about  
3:21 Google for a second.  
3:23 That too, which today we take for granted in a sense.  
3:27 But it was a fairly simple idea that you take all the  
3:30 information out there which let's say 12 years ago when the  
3:35 first search engine start being developed wasn't that much.  
3:38 But the computers were a lot less hefty then too.  
3:43 And you just create an index.  
3:46 Even a fairly basic inverted index.  
3:49 **In fact, in the earliest days, people didn't really**  
3:51 **worry about ranking even. It wasn't that big a deal.**  
3:54 There weren't that many matches for most searches.  
3:57 And AltaVista probably made the biggest leap in terms  
4:01 of comprehensiveness and speed and what not.  
4:07 And you just index it and you let everybody query it.  
4:09 And today it's just it's very-- we all take it for granted.  
4:14 But this was just a short time ago.  
4:17 **And it wasn't at all obvious that it would work, that**  
4:19 **it would be useful or anything like that.**  
4:23 And I would extend the same idea to the web as a whole.  
4:29 They were a number of hypertext experiments and systems  
4:33 that people put up. What was the one with  
4:35 a funny guy, Xanadu?  
4:37 Did you cover that?  
4:40 Yes, Ted Nelson.  
4:41

4:43 Who's a very interesting guy. But anyway, so he had created  
4:46 this thing and it wasn't the quite the same as the web  
4:48 but it was-- people have tried that.  
4:52 And yet, with a few simple ideas-- and I won't pretend  
4:56 to know to identify the key features that really allowed  
4:59 the web to grow-- but it's really became a repository  
5:04 of the world's knowledge.  
5:07 So anyway, I guess I want to finish that intro just with the  
5:15 point that people who have taken fairly simple ideas, ones  
5:19 which you might not think would work at all really, at a  
5:22 certain scale and after they gain a certain amount of  
5:27 momentum, they can really take off and work.  
5:29 And that's really an amazing thing.  
5:32  
5:34 Let's see, maybe I should try to relate that to  
5:37 Google a little bit. I want to leave time to--  
5:45 **At Google we had one simple idea which now seems obvious.**  
5:50 **But the idea that the ranking does matter.**  
5:54 **And in fact that was not a high priority in a lot of**  
5:58 **information retrieval web search research at the time.**  
6:03 **That the ranking is-- I mean some people worked**  
6:06 **on it, but it wasn't that important of a thing.**  
6:10 And we decided that for queries that really return a lot of  
6:12 results that we could do something more reasonable.  
6:15 And we sort of stumbled upon a way to do that  
6:19 by studying links.  
6:20 And I don't know if any of you have-- what have we presented  
6:23 here in this class to date?  
6:25 MARTI HEARST: [INAUDIBLE]  
6:29 SERGEY BRIN: OK. So you've covered  
6:30 a lot of stuff. And page rank?  
6:32 Have you?  
6:33  
6:34 OK. I'll go through in a high level.  
6:37  
6:39 We originally developed page rank-- well, I was kind of  
6:41 playing around with studying all the links on the web.  
6:45 **And that too was a pretty revolutionary idea though it**  
6:51 **seems very simple that you could even just collect them**  
6:54 **and then do anything meaningful.**  
6:57 Because as a graph in the computer science sense it was  
7:03 a very large graph compared to computers of the time.  
7:05 Or at least compared to our budget of  
7:07 computers at the time.  
7:09 **And anyhow, I really credit Larry pursuing that idea**  
7:13 **that it's even worth collecting the graph.**  
7:17 And then that you could run any kind of processing on it.  
7:21 But soon after we had it, and we had a crawler that went out,  
7:25 and we have to kind of develop our own RAID to be able

7:28 to write to the data to the disk fast enough.  
7:30 And it's kind of things that are trivial today, even  
7:34 probably on your laptops, but were hard back then.  
7:38 **And then they started to play with it and came up to the**  
7:43 **notion that not all web pages are created equal.**  
7:46 People are but not web pages and some web pages are  
7:51 inherently not worse than others but at least less  
7:54 important than others.  
7:56 And we developed this analysis of a graph of link structure  
8:02 of the web that imputed an importance for every web page.  
8:06 And we use a similar algorithm today.  
8:09 There are many other algorithms that we have to run.  
8:11 And it's evolved a bit over the years.  
8:14  
8:15 But it is one of the things that we continue to use.  
8:19 **And the general concept that not all web pages are created**  
8:23 **equal is very important.**  
8:25  
8:27 The other thing I want to highlight is that when we were  
8:31 studying this, and we actually weren't sure that we wanted to  
8:34 have search as the big application, at some point we  
8:39 realized that this actually worked really well for a search.  
8:43 That if you type Berkeley-- there are a lot of pages that  
8:46 mention Berkeley-- but some like the Berkeley homepage  
8:49 are probably somewhat more important than others.  
8:52 And I guess there's a UC Berkeley homepage and a  
8:55 Berkeley city homepage.  
8:57 Anyway, all the Berkeley pages.  
8:58  
9:00 **And we decided that was actually very useful to search.**  
9:05 **When you had a lot of results and that if you wanted**  
9:07 **ranking to matter, that was a good way to do it.**  
9:10  
9:11 But the other thing we were kind of thinking about at the  
9:13 time is how would you-- we weren't kind of thinking of  
9:17 this as how would we let millions or hundreds of  
9:19 millions of people use this.  
9:21  
9:22 But how would you even make something anyone, a single  
9:25 person, could use or how could you make a search  
9:27 that would work well.  
9:29 We had a phrase for it: search for kings.  
9:32  
9:34 No, you're not searching for kings but a search that a  
9:38 king would use or queen.  
9:41  
9:42 But the point was, is given the resources that we had, how  
9:48 would we create really good search engine, not worry about  
9:50 how many searches it could handle or how large a user base

9:53 it could support, but to make something really, really good  
9:57 for a small number of people.  
10:00 It wasn't that we wanted to make something good for a small  
10:02 number of people particularly. But we wanted to get rid of  
10:05 that constraint that you had to scale it up to a large  
10:08 number of searches.  
10:10  
10:11 But ultimately what we developed we  
10:13 were able to scale. And in fact in subsequent years  
10:17 as a company at Google when we've had sort of projects  
10:21 which say, well throw as much compute power at it as you want.  
10:25 Let's say we just want this to work well for a  
10:26 small number of people.  
10:28  
10:29 We've ultimately always found ways to scale it up  
10:32 and deliver it to everyone.  
10:34  
10:35 Which is kind of interesting. It's kind of like technology  
10:38 as an inherent democratizer.  
10:40  
10:41 Because based on the evolution of hardware, probably more  
10:48 importantly the evolution of algorithms and the system  
10:51 software that supports these, you're able to scale sort of  
10:56 almost anything you can think of up.  
10:58  
10:59 Now it takes-- it's not trivial.  
11:03 It takes some hard work and effort.  
11:05 But I think that's an interesting observation that  
11:08 it's-- we'll have to see if in our lifetime if that means  
11:15 everybody has more or less tools that are equal power.  
11:22 And there's not much way that you can really spend a lot more  
11:27 for the search and get much better results because in  
11:30 a short period of time technologists are able to make  
11:33 it work better for everyone.  
11:35  
11:36 So anyhow, that said, I just wanted to quickly go over a  
11:40 little background and open it up to some questions.  
11:42 MARTI HEARST: [INAUDIBLE]  
11:46 SERGEY BRIN: Yeah.  
11:47  
11:49 Oh, thank you.  
11:54 AUDIENCE: Hi. I'm curious what keeps you  
11:56 up most at night from a competitive standpoint?  
12:01  
12:03 SERGEY BRIN: Well I found over the years-- if I may say that  
12:05 though we've only had a company for seven years or so now--  
12:11 it's important that those sorts of things not keep  
12:13 you up at night.  
12:15 I mean, we obviously have big competitors.

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