Science AMA Series: I'm Tony Hey, chief data scientist at the UK STFC. I worked with Richard Feynman and edited a book about Feynman and computing. Let's talk about Feynman on what would have been his 100th birthday. AMA!

Tony$_{H}ey^{1}andr/ScienceAMAs^{1}$

[1]Affiliation not available

April 17, 2023

Abstract

Hi! I'm Tony Hey, the chief data scientist at the Science and Technology Facilities Council in the UK and a former vice president at Microsoft. I received a doctorate in particle physics from the University of Oxford before moving into computer science, where I studied parallel computing and Big Data for science. The folks at Physics Today magazine asked me to come chat about Richard Feynman, who would have turned 100 years old today. Feynman earned a share of the 1965 Nobel Prize in Physics for his work in quantum electrodynamics and was famous for his accessible lectures and insatiable curiosity. I first met Feynman in 1970 when I began a postdoctoral research job in theoretical particle physics at Caltech. Years later I edited a book about Feynman's lectures on computation; check out my TEDx talk on Feynman's contributions to computing. I'm excited to talk about Feynman's many accomplishments in particle physics and computing and to share stories about Feynman and the exciting atmosphere at Caltech in the early 1970s. Also feel free to ask me about my career path and computer science work! I'll be online today at 1pm EDT to answer your questions. Edit: Thanks for all the great questions! I enjoyed answering them.

the WINNOWER

REDDIT

Science AMA Series: I'm Tony Hey, chief data scientist at the UK STFC. I worked with Richard Feynman and edited a book about Feynman and computing. Let's talk about Feynman on what would have been his 100th birthday. AMA!

TONY_HEY R/SCIENCE

Hi! I'm Tony Hey, the chief data scientist at the Science and Technology Facilities Council in the UK and a former vice president at Microsoft. I received a doctorate in particle physics from the University of Oxford before moving into computer science, where I studied parallel computing and Big Data for science. The folks at Physics Today magazine asked me to come chat about Richard Feynman, who would have turned 100 years old today. Feynman earned a share of the 1965 Nobel Prize in Physics for his work in quantum electrodynamics and was famous for his accessible lectures and insatiable curiosity. I first met Feynman in 1970 when I began a postdoctoral research job in theoretical particle physics at Caltech. Years later I edited a book about Feynman's lectures on computation; check out my TEDx talk on Feynman's contributions to computing.
I'm excited to talk about Feynman's many accomplishments in particle physics and computing and to share stories about Feynman and the exciting atmosphere at Caltech in the early 1970s. Also feel free to ask me about my career path and computer science work! I'll be online today at 1pm EDT to answer your questions.
Edit: Thanks for all the great questions! I enjoyed answering them.

CORRESPONDENCE:

DATE RECEIVED:
May 12, 2018

DOI:
10.15200/winn.152604.46695

ARCHIVED:
May 11, 2018

CITATION:
Tony_Hey , r/Science , Science AMA Series: I'm Tony Hey, chief data scientist at the UK STFC. I worked with Richard Feynman and edited a book about Feynman and computing. Let's talk about Feynman on what would have been his 100th birthday. AMA!, *The Winnower* 5:e152604.46695 , 2018 , DOI:

Hi Tony,

Thanks for taking the time to talk to us about the fascinating figure of Feynman which captured the attention and imagination of the general public beyond the physics community. One of the reasons that Feynman is such an interesting figure is because if you read the general sources about his life, he almost seems like a character from a movie or a novel. He was undoubtedly a genius in physics and mathematics and also seemed incredibly talented in many other area's besides physics. However at the same time he isn't portrayed as your typical genius like Dirac that spends all his time on physics. From what one reads he was very charismatic, had this "playboy" side about him, and had no trouble fitting in any social situation. In his own biography you can read about him visiting strip clubs and getting into fights, going on gamble trips with some casino owner, etc... all already as a professor.

To summarize, all the stories about him make him look like a "rock-star genius" in some way. I am very interested in how far this is actually really true. Is this description of him accurate? Did he have his own demons that many people don't know about?

Invariant_apple

Thanks for the question – it is certainly an interesting one! In many ways Feynman does appear like a

10.15200/winn.152604.46695

'rock star genius' but I think that is a bit misleading as a description. I was once invited to join Feynman and his family at their house in Mexico that he bought with his Nobel Prize money. We walked on the beach together and he talked about all sorts of physics questions that caught his interest. He was passionately curious about Nature and very serious in his approach to understanding things. Because of his wife Gweneth coming from Yorkshire in England he made some wonderful TV programs in the UK that illustrate this perfectly. I particularly recommend 'The Pleasure of Finding Things Out' if you have not seen it (https://www.bbc.co.uk/programmes/p018dvyg)

To get back to your question two things I remember from our walk on the beach – one was his advice to me 'Hey, you read too many books!' and the other was about the breadth of his interests outside of physics. He said that he started out very narrowly focused on all thing physics and only later in life after he had achieved success did his interest broaden. When I called 'Surely you're joking' a biography, he corrected me and said that it was merely a collection of stories of episodes and events in his life and not a biography. His colleague, friend and rival, Murray Gell-Mann always disliked what he called 'Feynman's myth making' and I think that Feynman's stories certainly became more 'polished' over time! So yes, he did visit strip clubs – I saw him in the now defunct HiLife Club in Pasadena where Caltech students and faculty got a discount – but underneath it all I think Feynman remained deeply serious about science and understanding Nature's secrets.

You've got a fantastic set of achievements under your belt, amazing work!

My question would be, if you were working in a bank as a data scientist and had access to millions of transactions across millions of customers. What insights would you want to gain from such a dataset? Maybe you could list your top 5 questions you'd want to ask the data. How would you best create behavioural segmentation's of the customer base?

Thanks in advance!

pp8435

Thanks for the compliment! However, I am sure that I am not the best person to ask about data mining in a bank. However, what your question reminded me of was the approach that my old Microsoft Research colleague, Jim Gray, took when he started working with scientists. Jim had realized early on that the scientific research community were likely to have larger datasets than most companies and he wanted to stress test the Microsoft SQL Server relational database. So he started working with a number of scientific research communities - in astronomy, in bioinformatics and in environmental science. Since he was not a professional research scientist with a Ph.D. in these fields, he used to start his engagement by asking them to specify '20 questions' they wanted answered from the data they were generating. With astronomer Alex Szalay from Johns Hopkins University, Jim pioneered this approach with the famous Sloan Digital Sky Survey, the first large-scale high resolution survey of a large fraction of the night sky.

Thanks for the ama!

How stupid(or smart) do you think it is to go into total seclusion to self study physics outside of academia? Do you think Feynman would have made it if he were not within the academic circles? And do you think that if I want to make any significant difference I should aim for higher education in physics given that I consider the universities of my country well... incompetent and any amount of time that I spend in mine I consider to be a total waste. I'm a second year undergrad studying computer engineering by the way.

Also, please suggest any books that totally changed your perception of the world.

Thanks again!

eatmylongs

Thanks for the question which is certainly a complicated one to answer! First of all I think it is very difficult to self study physics all on your own outside of conventional academia. The only person I know of who really succeeded in such an endeavor was Albert Einstein. He had completed his undergraduate degree at ETH in Zurich and had been so irritating and disruptive to his professors that he could not do a research degree there. Instead, working in the Swiss Patent Office in Bern, he pursued his own research with only a few friends that he called 'The Olympia Academy' to discuss his ideas with. This led of course to his marvelous year in 1905 in which he published four great papers that changed physics for ever (https://en.wikipedia.org/wiki/Annus_Mirabilis_papers)

So I am in favor of going to a university and undoubtedly you will find some parts of your course boring and/or incompetently taught. Of course,now you can supplement what your professors tell you by going to online resources (http://www.changinghighereducation.com/2012/08/coursera-.html) So long as you have a good internet connection you can now see the best scientists at work.

When I was at Microsoft, Bill Gates had been so impressed by Feynman's lectures he gave in the 1960's at Cornell that he arranged to make them available via the Microsoft Research website. I recommend anyone to take a look at these marvelous lectures on physics (https://www.microsoft.com/en-us/research/project/tuva-richard-feynman/)

I am wondering what your impression of Mr. Feynman's level of political interests. I know he dealt with the government a great deal.

To be clear I am not asking about "leanings" I am asking about what degree of political involvement he had or thought was appropriate.

BryantheMad

BryantheMad2 points·1 hour ago

I am wondering what your impression of Mr. Feynman's level of political interests. I know he dealt with the government a great deal.To be clear I am not asking about "leanings" I am asking about what degree of political involvement he had or thought was appropriate.

Bryan, interesting question again. Actually although many of Feynman's colleagues at Caltech were involved with Government in things like the JASON committee, Feynman was adamant that he did not want to do that. He felt that other people could do these things as well as him and that he should focus on his science. It was the same in terms of departmental administration at Caltech and applying to agencies for grants. He was happy that Gell-Mann and other colleagues did these chores. Feynman did not write much about his political views although his Wikipedia entry quotes an FBI file on him that suggests that he might have communist leanings. However, more likely this was just a product of the McCarthy paranoia of the time. What I would recommend are three lectures he gave under the title 'Thoughts of a Citizen Scientist'. These were lectures he gave at the University of Washington in the John Danz Lecture series and contain musings from Feynman about uncertainty in science and values and comments about what he called 'This unscientific age'.

Did he practice his lectures a lot before delivering them? If so, how?

ardor4go

I think he certainly put a lot of effort and thought into his lectures. He also understood that he needed

to put a lot of different 'hooks' into the lecture for the different types of people in his likely audience. With his lectures on computation I had access to his hand-written lecture notes which showed the amount of detail he prepared for each lecture. So although Feynman made his lectures sound spontaneous and relaxed I think he had given a lot of thought as to precisely how he would explain each point. The 'Feynman Lectures in Physics' are a case in point - however it took a lot of effort by several other Caltech physics faculty members to get the lectures into their final form.

Hi Tony,

Welcome to /r/science! I used to work for STFC in Business and Innovations, so it's nice to see the organisation engaging with these AMAs!

Data science is a crucial area of scientific research that ties in with real world applications; what are STFC's plans to continue to deliver world leading data science services with the upcoming challenge and uncertainty with Brexit? It is a big area of concern for the many companies and organisations at Harwell.

OldBoltonian

Hi, good to hear you remember STFC fondly! And yes, I am concerned about Brexit and maintaining our global links. What I am personally trying to create is a 'Scientific Machine Learning' group in the Scientific Computing Department that can help researchers make sense of the ever increasing amounts of data now generated by their experiments at the Harwell site's large-scale facilities. These are the Diamond Synchrotron, the ISIS neutron and muon facility, and the Central Laser Facility. Detector improvements now mean that the data rates are now increasing much faster than Moore's Law ever did. The 'SciML' group is now gaining practical experience about applying state-of-the-art AI and Machine Learning technologies to 'Big Scientific Datasets' and I believe that this expertise will benefit the Harwell 'clusters' of companies and organisations in Space, Health and Energy.

I also work with the US Department of Energy Laboratories such as Berkeley, Oak Ridge, Argonne and Brookhaven who also host facilities like those at Harwell. These labs have also set up data analytic centres to explore the application of AI and Machine Learning technologies to their experimental data to help scientists make new discoveries. I am concerned that we make sure that UK scientists are not disadvantaged with respect to their US colleagues!

Asking on behalf of /u/phealthy:

Hi and thanks for joining us today! With government agencies ramping up public availability of large datasets via APIs, e.g. (https://www.data.gov/developers/apis), what would be your major focus points if you were to develop an API for a large agency?

OldBoltonian

Hi, a good and difficult question! In my work at one of the UK's national Labs I am trying to make AI and Machine Learning technologies available to scientists trying to make sense of their data. However, most scientists - except of course the particle physicists and astronomers - do not want to have to deal with low-lying systems issues relating to flavors of Linux or whether to use a Docker or Singularity container. In kits like SciKit Learn and Google's TensorFlow, popular Machine Learning methods such as the current favorite Deep Neural Networks have been packaged up to make things relatively easy for reasonably technical users. What I think is need for the majority of less technically inclined users is an API that hides low-lying system features of the tools and helps them use the tools without making elementary mistakes. This is one area that I am focused on and I think would probably hold true for large government agencies.

I know there was a lot he was proud of, but did Feynman have any regrets?

bradrconrad

Actually I never heard Feynman express any regrets but there clearly were some regrets about his participation in not making the atom bomb but in actually dropping it. At the end of his story 'Los Alamos from Below' he recounts how working hard to accomplish something becomes pleasure and excitement at completing the task and 'you just stop thinking'. He then recounts how, when he was back in New York and no longer working at Los Alamos, he thought that all the building and activity he saw around him was crazy. Didn't they understand how useless it was to be making new things now that the atomic bomb existed with its immense destructive power?

The last topic that Feynman was working on was nonlinear hydrodynamics. Some recent interesting work on this tying together topological quantum physics and ocean and atmosphere dynamics.

webhubtel

I would be surprised by a connection between topological quantum physics and ocean and atmosphere dynamics. But what do I know - I will ask my colleagues here in the Centre for Environmental Data Analysis and maybe some of my physicist friends!

What is perhaps not so well known about Feynman is that he spent the last five years of his life lecturing on computing. His son Carl was working for Danny Hillis's 'Thinking Machines' company and Feynman was engaged as a consultant with Danny in Boston. Back at Caltech, Feynman had gotten together with John Hopfield and his old friend Carver Mead to create an interdisciplinary course called 'The Physics of Computation'. For various reasons, they never managed for all three of them to give the course together. Feynman was hospitalized with cancer for the first year of the course and Hopfield remembered the course that year as himself and Mead wandering 'over an immense continent of intellectual terrain without a map'. In the third year of the course, in 1983/84, Feynman gave the course by himself assisted by MIT Computer Science professor, Gerry Sussman, who was at Caltech on sabbattical that year. The deal was that Sussman would help Feynman with the course in return for Feynman having lunch with him after the lectures. As Sussman later said 'that was one of the best deals I ever made in my life'. In 1987, I got a call in England from Feynman's faithful PA, Helen Tuck. Feynman wanted me to help him in writing up his lectures. Unfortunately Feynman died before we had finished but from his detailed notes and audio recordings of the lectures I did finally manage to complete this 'labor of love'. You can see the result in 'The Feynman Lectures on Computation' that were finally published in 1996. The lectures are still relevant today and many researchers and companies are actively working to realize Feynman's vision of a quantum computer.

I am curious what was Feynman's sense of humor like. Do you happen to remember any particular jokes or movies that made him laugh? Was he curious about humor and what makes things funny?

kermit_the_moose

Feynman defintely had a sense of humor and liked jokes. One story he told was about the V-A theory of weak interactions and the experimentalist Valentine Telegdi. There had been controversy about whether the weak interaction used 'S and T' couplings or 'V and A' couplings. Telegdi's experiment had shown that the answer was S and T so he was not impressed when Feynman and Gell-Mann published a paper that said the weak interactions were Vand A and that his experiment must be wrong. He was angry and sent Feynman a letter that ended by saying 'The F-G theory is no F-G'!

In fact Telegdi was a very good experimentalist who Feynman respected. Telegdi went back and re-analyzed his experiment and found that he had forgotten to take proton recoil properly into account. When this was included his experiment agreed with the F-G theory. I do remember hearing Feynman speaking about his discovery of the V-A theory and I commented to him that he had not mentioned the name of his collaborator, Murray Gell-Mann. He replied that was because it was usual for your collaborator to have done something on the paper! I think that this was largely meant as a joke ...