

# Melissa Pierce

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Wednesday, November 5, 14



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Hi, I came here in a bus. A 1963 GM PD 4106. For those of you unfamiliar with classic busses it's an old greyhound that was converted to an RV sometime in the 80's. You can tell when it was converted by the wood paneling, floral patterns on the couch, and carpeted walls, but I love it. This bus is what my film production crew tools around in when we go on shoots.



# BORN WITH CURIOSITY

## The Grace Hopper Story

Wednesday, November 5, 14

Right now we're shooting a film about the life of Grace Hopper and the birth of the computing industry. What's great about Grace's career is that it spanned over 60yrs, so I get to do a lot of research on the computing industry as well as the social climate of Grace's lifetime, which is pretty cool. By the way, this illustration was made by a friend of mine, Lana. Some elements of the drawing include the mythical moth or "first computer bug" as well as clock gears and the counter clockwise running clock Grace used to keep in her office to bother visitors. You can also see Grace as both a young aspiring mathematician and an older accomplished one.

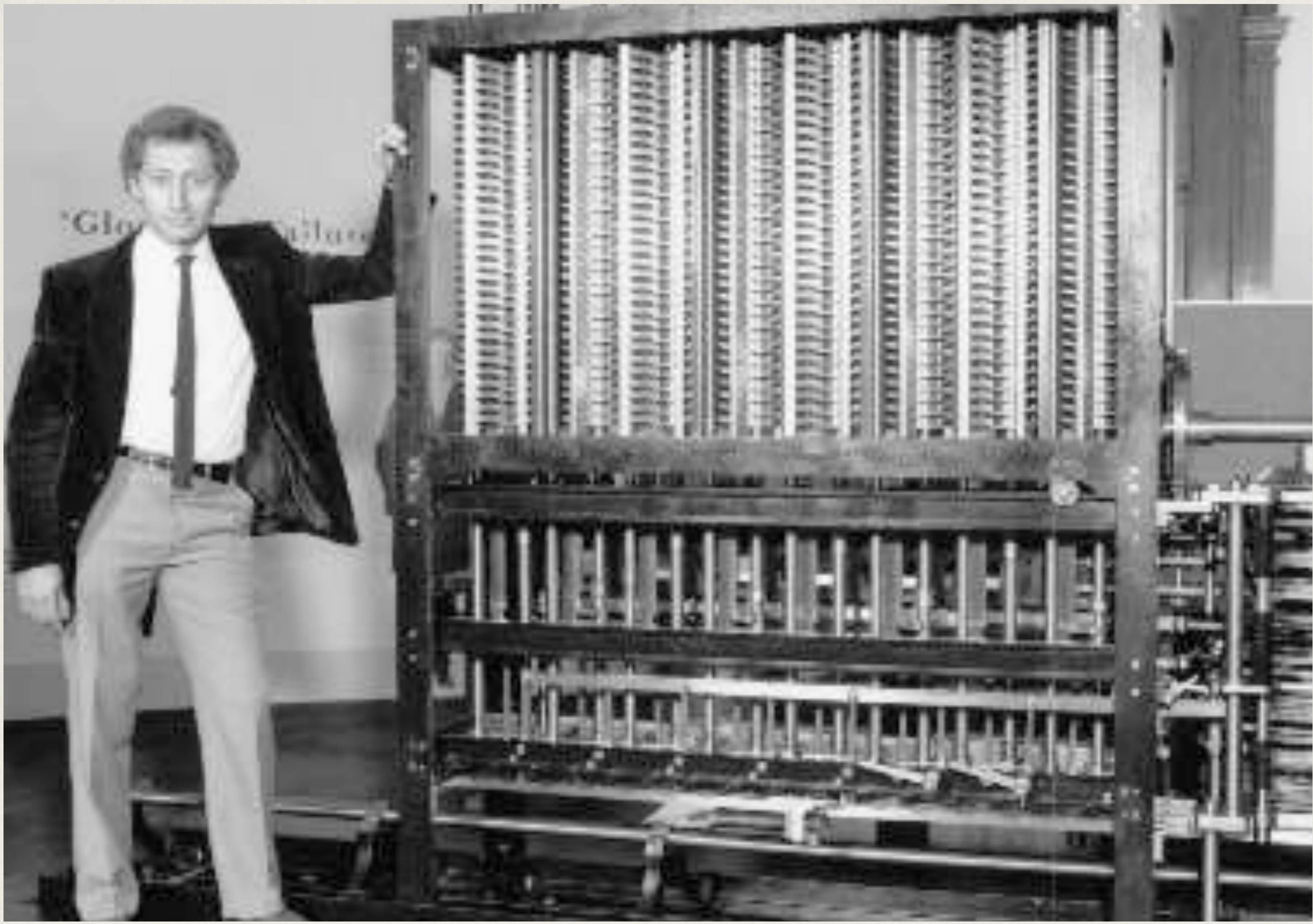


## How do you make a computer engineer?

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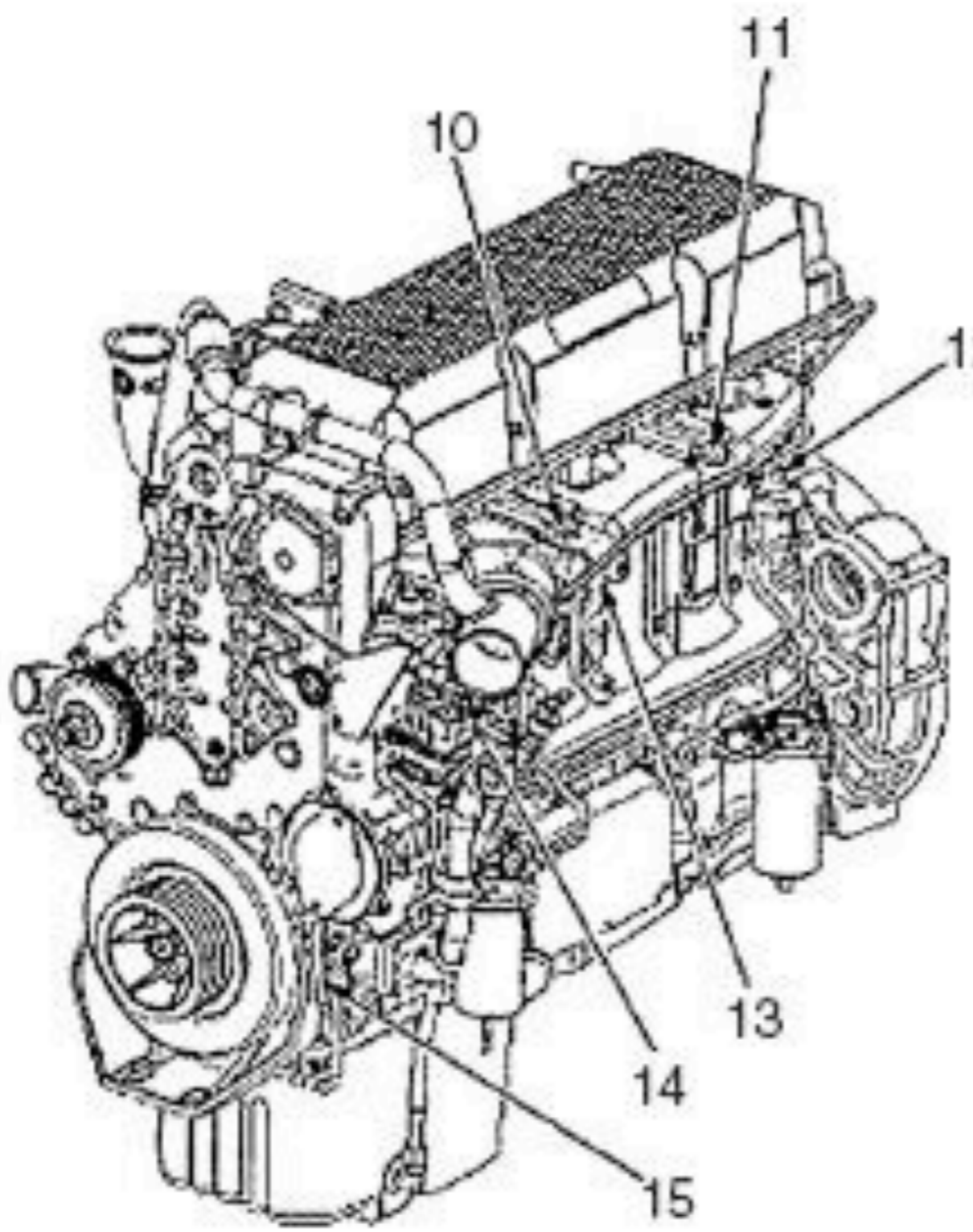
Wednesday, November 5, 14

What a lot of people don't know is that before Grace studied mathematics in the 1920s and 30s (she was born in 1906) she wanted to be an engineer. At the time Grace entered school, women in the US weren't granted degrees in Engineering, in fact, there was only one woman in the world with a degree in Engineering. She earned her degree in Berlin in 1912, when Grace was 6. There were a few women in the US permitted to take engineering courses, but they were denied degrees, they got certificates instead. This was pretty typical of many degree programs in the early 1900s. Women had just fought hard for the right to be college educated and get a job at the turn of the century. When women won the right to vote, Grace was 14! It wouldn't be until Grace was in her 30s though that women would be accepted into degree programs for engineering. Most women who were interested machines and electricity before then had to be exceptionally gifted or wealthy to be let into classes otherwise they would become inventors and learn by trial and error on their own - Though Grace was quite mechanically inclined, she knew engineering was a man's world, so she went into mathematics instead, and went on to be the 32nd or 34th woman in the US to earn a PhD in mathematics. (By the way, this photo is a still from my film, that's my daughter playing the part of young Grace, she's holding up a gear from inside a vintage alarm clock from 1910.)

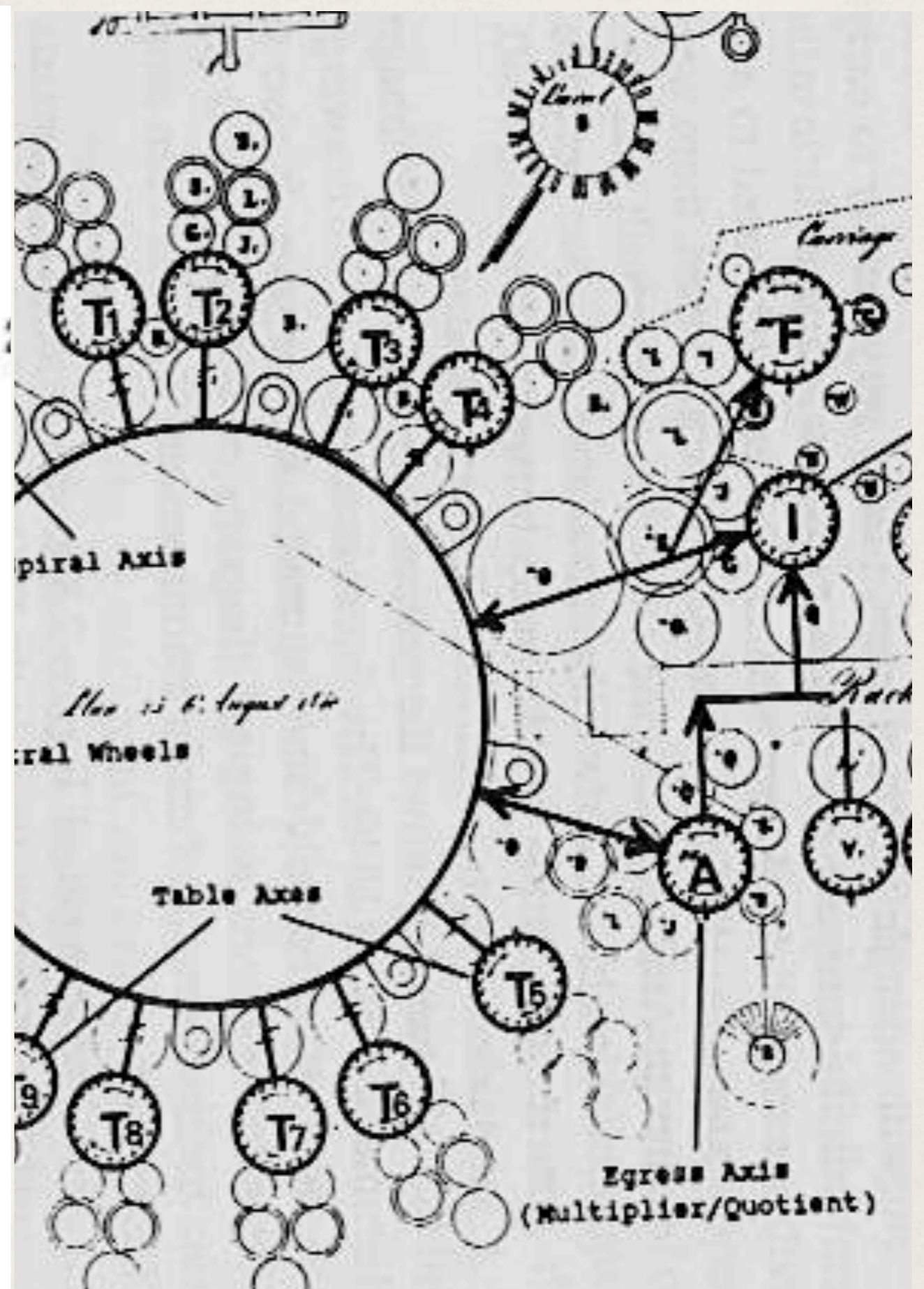


Wednesday, November 5, 14

I mention mechanical and electrical engineering of course, because when computers were first invented, there wasn't really such a thing as software. There was only hardware. This photo is of Charles Babbage's Difference Engine, well, actually he never built one, but he designed it way back in the 1820s. This Difference Engine #2 was built in 1991 and that super hip guy there is not Charles Babbage, but Doron Swade, the curator of The Science Museum in London.



Left side (Front view)



Wednesday, November 5, 14

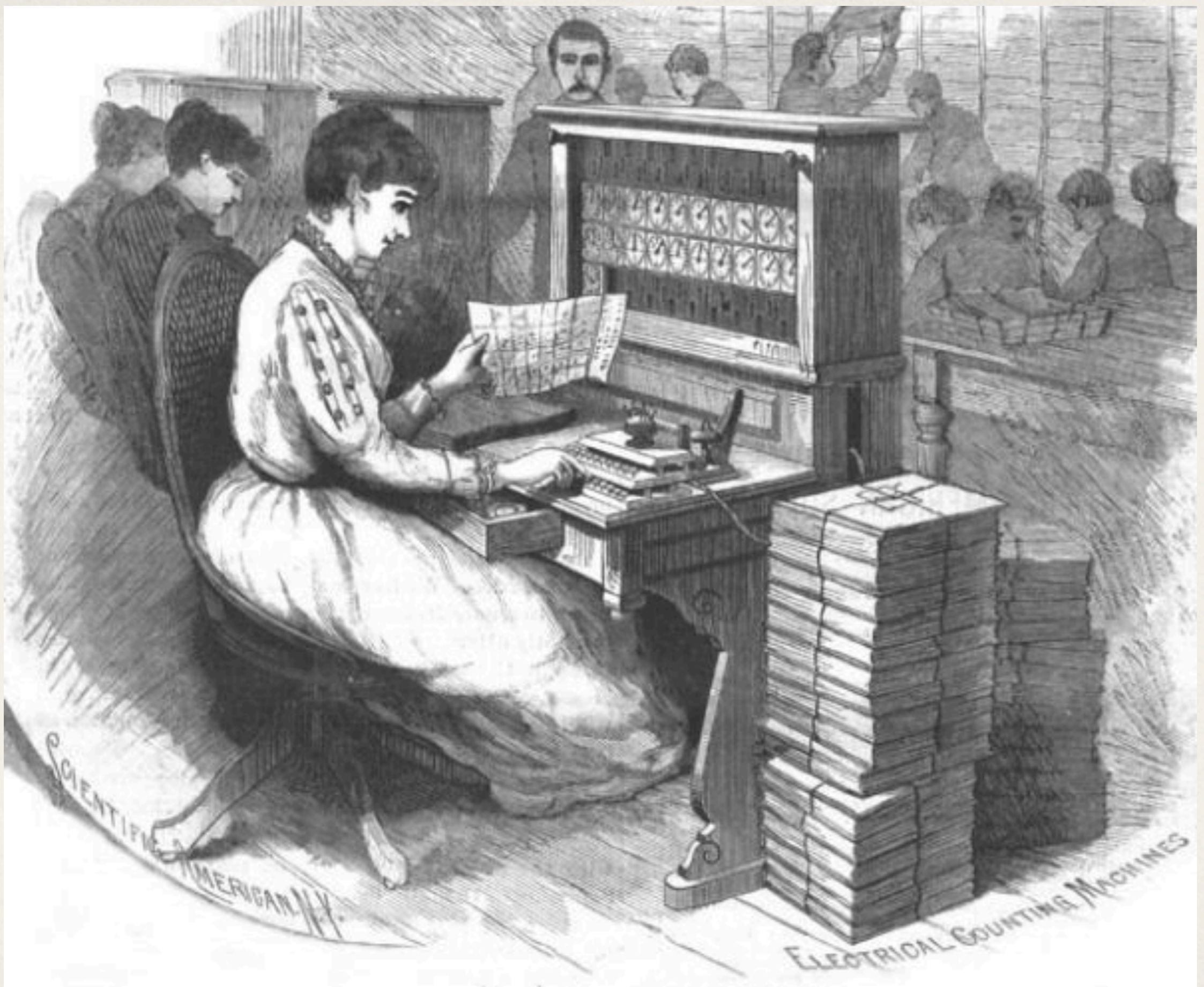
So what makes the difference engine any more significant to computing than my bus's Detroit diesel 2 stroke?

1. It was the first attempt to devise a computing machine that was automatic in action and well adapted, by its printing mechanism, to a mathematical task of considerable importance.
2. It's an example of government subsidizing innovation and tech development, which seems to be the way we make things happen around here.
3. And three ADA the Countess of Lovelace invents what we have come to call, programming.



Wednesday, November 5, 14

Between 1842 and 1843, she translated an article by Italian military engineer [Luigi Menabrea](#) on the engine, which she supplemented with an elaborate set of notes of her own, simply called *Notes*. These notes contain an algorithm designed to be carried out by a machine. And as we all know, algorithm is just a fancy word for instructions which is just a layman's term for a program. Even though the difference engine didn't physically exist, Ada could envision exactly how it worked and what it could do. Alas, when Ada pressed Babbage to become business partners, Babbage refused, she may have been a genius, but she was a she, and that was not ok in the 1820s. We all know what happened next, Babbage couldn't get enough funding to build his machine, and eventually had a disagreement with the man he did partner with which cost him his tools and plans. Ada didn't fare any better, she became an obsessive gambler and died of uterine cancer and probably a little too much bloodletting at the age of 36.



Wednesday, November 5, 14

The next big blip on the computing frontier comes in the form of Herman Hollerith's innovative leap from the punch card operated Jacquard loom to a punch card operated tabulating machine. He introduced this machine in 1887, the same year the 1880 hand counted census had just been completed – so needless to say, the US Census bureau and several other countries were thrilled to have a machine that could do the work in less time. He was a greedy guy though, jacking up leasing prices of his machines until census employees took matters into their own hands and built their own machines and Hollerith's company began to fail as a result... but, as luck would have it, Thomas J. Watson came onboard as a salesman and saved the company, later renaming it to IBM in 1924.

Please note the census workers here doing the math... women, with a male supervisor... a century later we would all think that women were bad at math, but in the culture of the late 1800s, women were known to be accurate, and inexpensive calculators. Something to keep in mind going forward with computer ads up until the mid 1980s – it wasn't just that the women in the ads were pretty faces selling products, it's that until the advent of the PC, computing machines were expensive pieces of machinery, and women in ads were a social cue that if you bought such a machine you could then hire inexpensive labor to run it and recoup some of your costs.





**F**IGURE requirements are piling upon business—today more than ever. Figures are the very lifeblood of business, but unless they are accurate, timely and useful, they clog up the works.

Monroe's whole function, since the first Monroe Adding Calculator was made 25 years ago, has been to speed up and put the ease of business figures. With 17 different models, calculators, adding for report bookkeeping machines, check writers and signers, Monroe has a machine for every figuring need. Every Monroe is compact and handy for desk use, every one has the

feature "Silent Track" to insure that your figures are not out of sequence.

Every Monroe unit, whether by one or two operators, is designed for un-interrupted figure production. For Monroe means wide area operation through 100 Monroe record functions.

Locally approved Monroe units are available and are in operation, ready to use at work in your own figures. The nearest Monroe branch will arrange the without any obligation—write to us at the factory, Monroe Calculating Machine Company, Inc., Chicago, New Jersey.



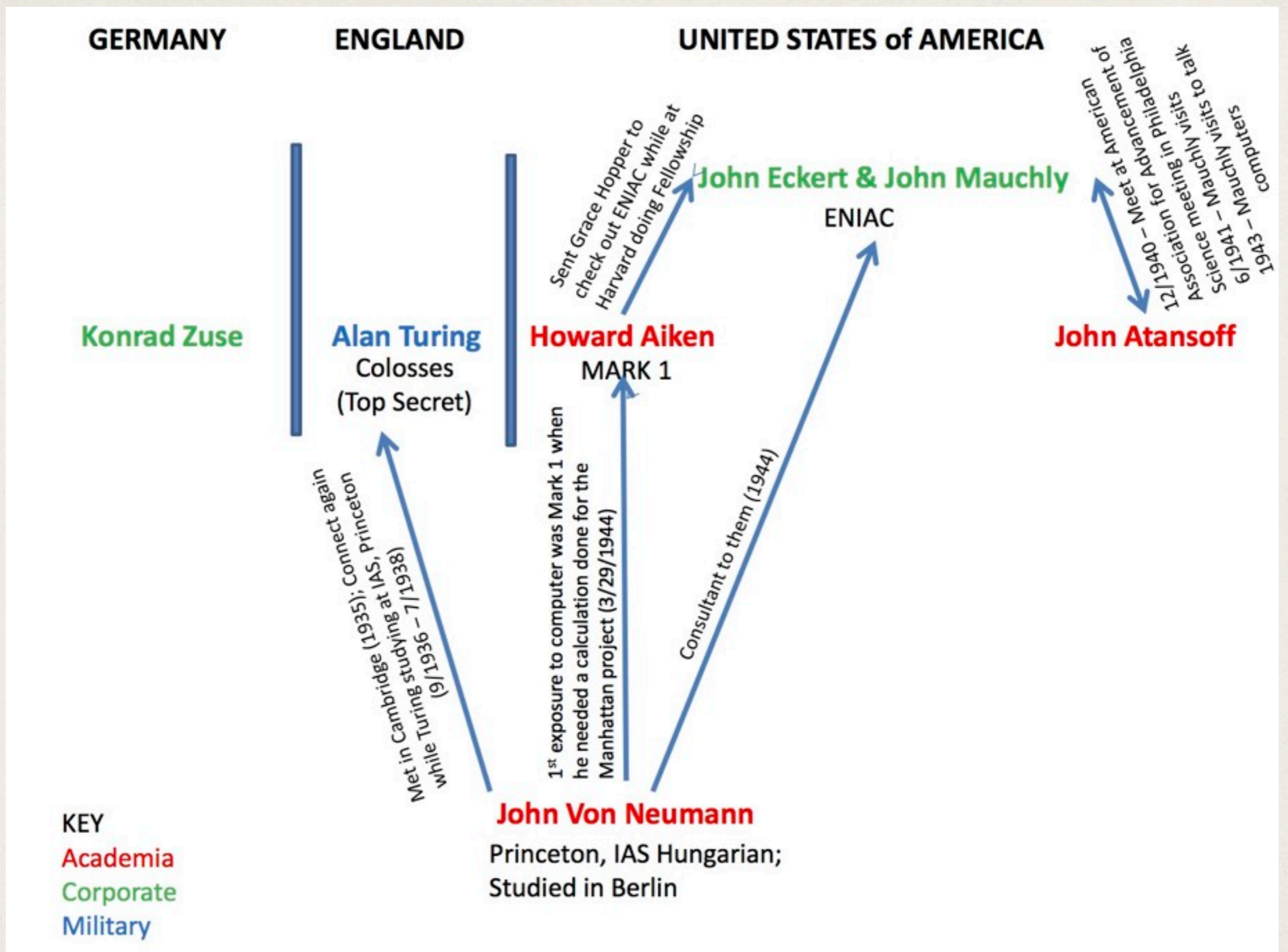
Wednesday, November 5, 14

An exception to this is the 1930s – during the great depression and recovery. Women had fought hard during late 1800s for a right to an education and the right to work, however, women who worked during the depression were seen as selfish and taking jobs away from men. Many of the ads then, like this one for Monroe calculators featured men or just the machines. By the way, this “selfish for working” ideology only applied to white women. Black women were seen as lazy and selfish for NOT having a job. Note this stigma on black stay at home moms is still prevalent today.



Wednesday, November 5, 14

Berlin 1935, Konrad Zuse builds the Z1, world's first program-controlled computer. It uses the binary system and today's standard separation of storage and control. In 1943 he improves upon it and makes the Z3, the world's first fully functional programmable computer. And the next year he writes the world's first computer program, Plankalkuel. Predating FORTRAN by almost a decade. He also is the first person to have a computer start-up, the Zuse-Ingenieurbüro Hopferau. He raised venture capital through ETH Zürich and an IBM option on his patents in 1946. On the left here is the Z1, well, actually it's a replica, the real Z1 was destroyed by allied bombs in 1944. Because of war washing, we don't hear much about Zuse - he built computers for the Nazis, though they weren't as impressed with them as they were with the enigma machines. Most of the the English literature on Zuse says he worked in isolation from all the other computer inventors, but I've got a call in to the Deutches Museum's curator to get some clarity around this. He and John Van Neumann were at the same university and had access to the same academic papers, and Watson of IBM traveled to Berlin in 1937 for the International Chamber of Commerce gathering where the Nazis awarded Watson with the Order of the Golden Eagle metal (which he later returned when it became apparent even to those in the west that the Nazis were bad news)



Wednesday, November 5, 14

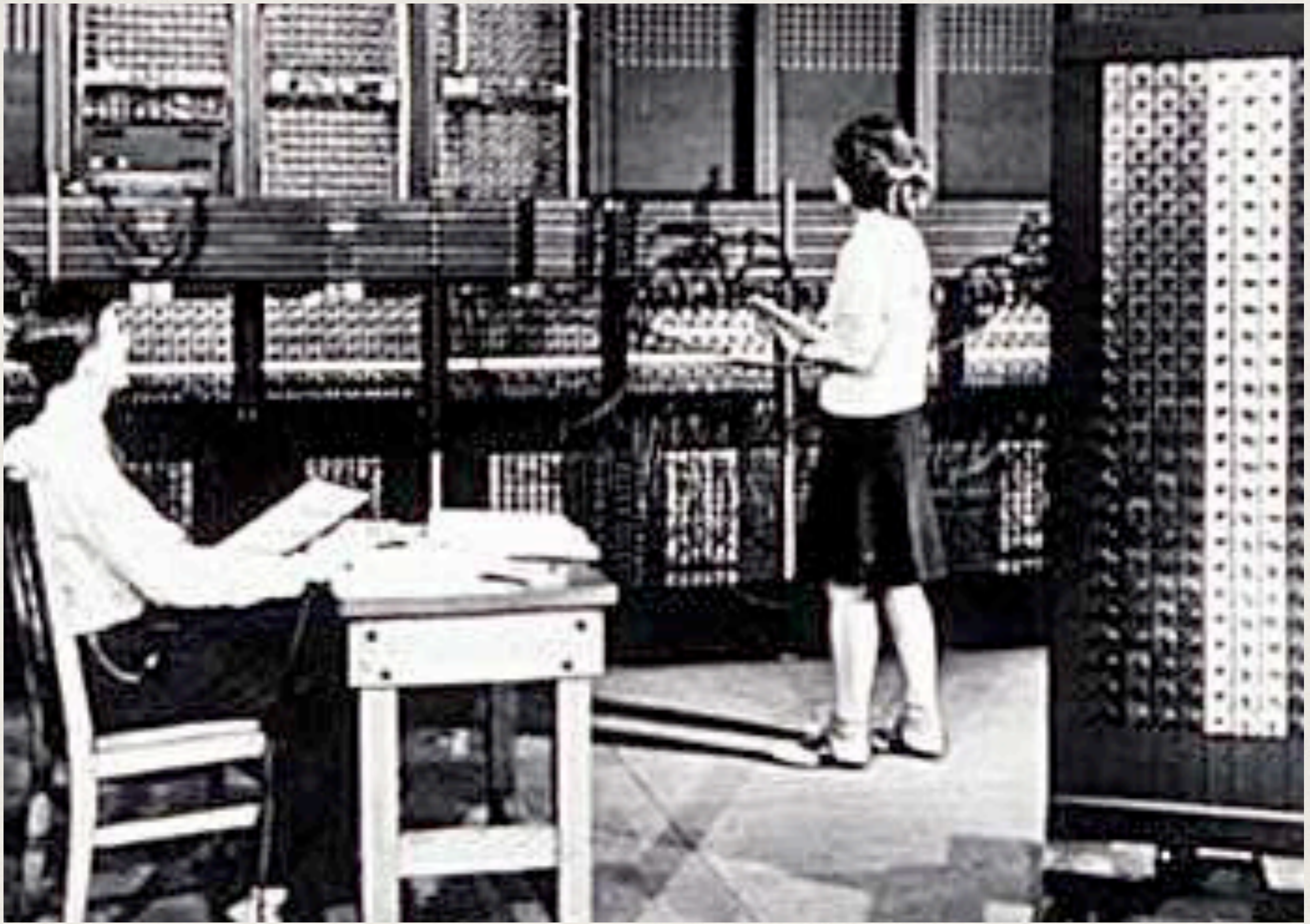
The 1930s was an incredible time for computing and it's a little confusing to figure out who came up with what idea when. Due to Hitler's persecution of the Jews, many scientists and intellectuals were being moved out of Europe to the Princeton, NJ by the Institute for Advanced Study. John Von Neumann, Alan Turing, and Albert Einstein all had offices down the hall from one another. Alan Turing wrote his paper, on Computable Numbers in 1936 - it was shared pretty extensively in academia, so pretty much everyone we know that built a computer in that era read it. Again, we're still unsure if anyone knew anything about Zuse, but what we do know is that they all knew of one another thanks in large part to and physicist John Von Neumann's belief that knowledge was something that should be shared freely for the greater good - he bounced from computing project to computing project gathering and sharing information.



Wednesday, November 5, 14

Harvard's Mark I – Babbage/Ada (Aiken writes the proposal to build it in 1937 and Watson signs off on it in 1939 – it's not complete until 1944)

The mark 1 is the first programmable computer, it uses relays instead of vacuum tubes, and is used to calculate ballistics for the Navy. This is the computer Grace Hopper got her start with, and where she first thought of the concept of compilers. There were about 40 people on the Mark 1 team at Harvard, she was the only woman officer, 2nd in command – though there were plenty of enlisted and civilian men and women working on the Mark 1. The computer ran 24hrs a day for the duration of the war.



Wednesday, November 5, 14

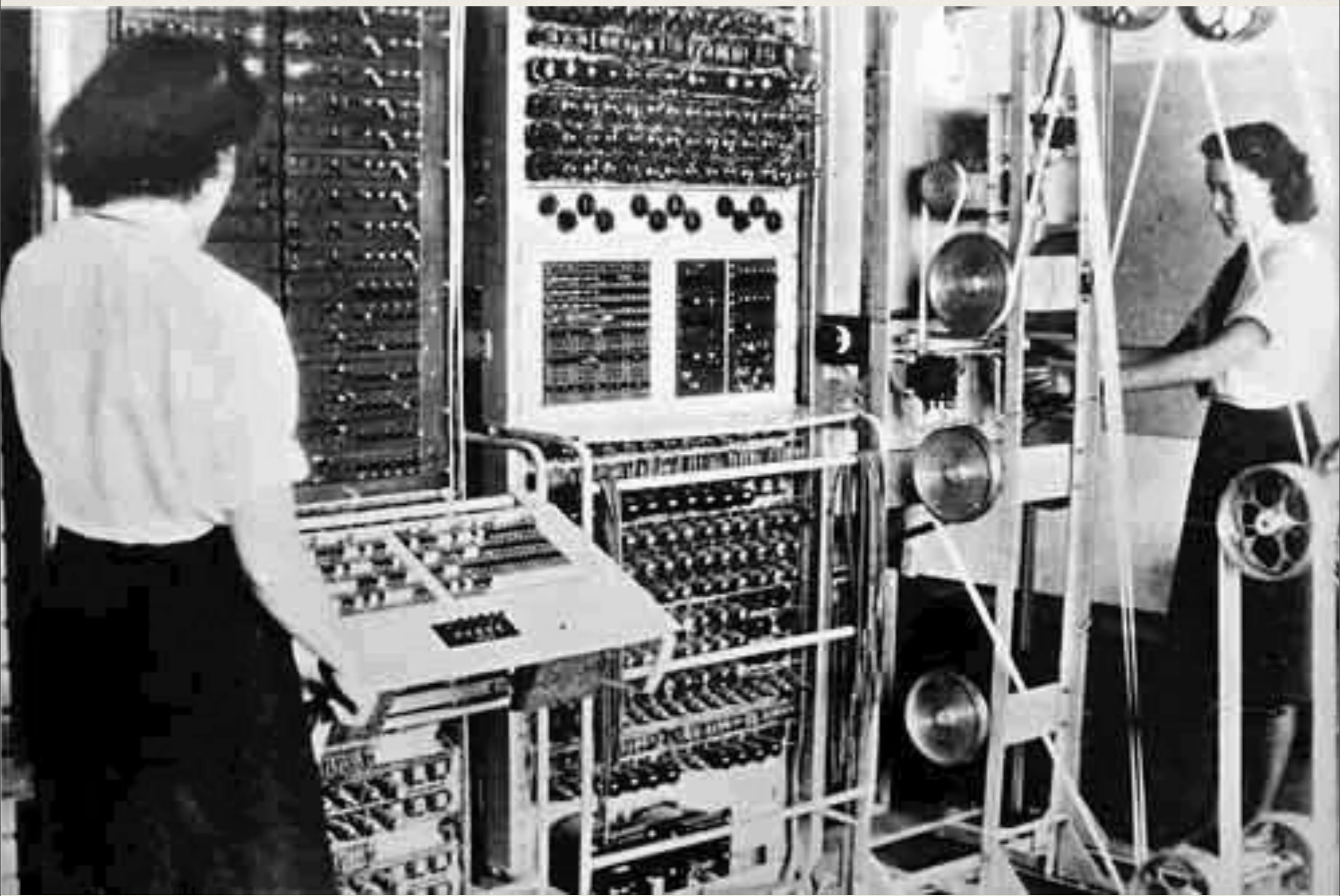
Meanwhile in Philadelphia: Another computer built around the same time as the Mark I was the Eniac, at the Moore School of Electronics for the US Army. This machine is known as the first fully electronic programmable computer, and used vacuum tubes instead of relays. I use the term programmable loosely here because to program this machine it meant you had to physically change the configuration of the machine every time you wanted to run a new program.

The woman pictured in this press photos programmed the Eniac, there were actually 6 of women that worked on this machine. They weren't recognized for their work until almost 40 years later. In fact, when the Army was pressed as to the identities of the women in the press photos, people were told these 6 women were merely refrigerator models.



Wednesday, November 5, 14

Meanwhile, in 1938 Iowa, John Astinoff was also building a computer... it was called Atanasoff Berry\_computer or the ABC, it was also known as the first electronic digital computer! He used it to solve real world math equations. As far as I know, he didn't really have a team and was kind of a lone wolf out there in Iowa, though both Von Neuman and John Malchy of the Eniac did visit him. Later he'd get in a nasty patent dispute with the Eckert and Malchy (who designed the Eniac and later the Univac). Seems Eniac filed a patent for a computer based on Astinoff's invention. The patent dispute wouldn't be resolved until 1973, and would strip Eckert and Malcky of their patent.



Wednesday, November 5, 14

Meanwhile in 1944 England

Colossus was designed by the engineer Tommy Flowers to solve a problem posed by mathematician Max Newman at the Government Code and Cypher School (GC&CS) at Bletchley Park. Alan Turing's use of probability in cryptanalysis contributed to its design. A lot of people make the mistake of thinking Turing designed this machine, but he didn't. He designed the Bombe – and the Bombe, not the Colossus was responsible for decoding the German's enigma machine encryption. No matter, These machines were so secret that after the war Winston Churchill specifically ordered the destruction of most of the Colossus machines and blueprints into "pieces no bigger than a man's hand" and all the men and women that worked there were sworn to secrecy about what they had done for the past few years. Can you imagine gaining all of those skills and knowledge and having no way to put them on your resume or have your work recognized for decades afterwards?

# We Can Do It!



Wednesday, November 5, 14

By now I hope you are all aware that during WWII while the men were off fighting bad guys women were leaving their homes to fill the vacancies these men left in factories etc. – there was a real sense of nationalism during this time as everyone was working towards a common goal. Women had a unique opportunity during this time to do work that would ordinarily be off limits to them. The government was so determined to keep the country working, they even offered universal childcare so that mother's could go to work for America. This is significant because 1 – universal childcare, and 2. At that time, it was expected for women to work before or after raising children, but never during. We were in real trouble if the status quo was being completely discarded.

After the war ended the men came back to their jobs, most of the women went back to doing whatever they did pre-war.

Also note that this is the beginning of the hyper feminine and tightly controlled gender roles in American society. This is especially prevalent in advertising and peacetime propaganda that seems to be saying “now that you don't have to work, you have more time to spend looking beautiful for your man and making his life as comfortable as possible – because your sole purpose on this earth is to be a caregiver”

Anyhow, I wanted to give you that longish overview of the birth of computing because one, it's fascinating and two, it's important to show that women have been there from the beginning and as far as those few machines go, they were on fairly equal footing with their male colleagues with the same jobs.

The women computer programmers were an exception to giving the jobs back to men, however, because their job was invented while the men were away, none of the men coming back knew how to do it, it had been invented while they were away!

It wasn't until the commercialization of computing and the separation of software from





Wednesday, November 5, 14

The 50/60a brought about new computers, of course, and along with them, software.

Grace Hopper creates the A-O compiler

John Baccus speedcodes the IBM 701 computer

Assembly languages

FORTRAN

COBOL

LISP

ASCII

Basic

Unix

Also:

McCarthyism is rampant (Malchy of the Eckert and Malchy who make the Eniac is accused of being a comunist – wierdly, Watson, who got a medal from the Natzis as well as licensed patents from Natzis engineer Zuse, is not. McCarthyism pretty much grinds down anyone who speaks out against the status quo – whether they're communists or just subversive entities.

The civil rights era, there are sit ins and marches and organized efforts for change within the black community –

The book “feminine mystique” is on the bestsellers list – reassuring women that that nagging feeling they have that there is more to life than being a wife and mother, is normal, not a psychosis as freud suggests.

Cold war

cuban missile crisis

men on the moon

You'll often hear reference to this time that there was a “software crisis.” not enough programmers doing good work. Does that sound familiar? That was true in the UK, but here in the US that crisis was pretty much fabricated by the media. We were doing ok. What

# AUTOMATIC PROGRAMMING



Wednesday, November 5, 14

why did software programmers feel the need to become more professional – a few reasons, a big one: advertising. I swear to you that advertising may have been the worst thing to ever happen to computing culture. With the advent of compilers, the sales teams of computing companies started pitching to their clients things like “Now the Univac can tell itself what to do” suggesting that management could phase out programmers altogether. The backlash to this in the programming community was the forming of what Backus called “The priesthood” – programmers started to build up this idea that their skills were so mysterious and complex mere mortals could not understand.

The second reason: “labor shortage” in 1966 we were by some estimates 500,000 programmers short. To make up for this there were several programming schools popping up all over the country. And often even big companies like IBM just gave a logic aptitude test for potential new programmers, they could learn it on the job! Take the courses or this test, get a job in computer programming at the median salary of 13k! (For women it was a little under 8k, the highest for any female occupation at the time)

An interesting thing is that by then men already made up nearly 80% of the of US computer specialists. So even though it was still legal to start a woman’s salary way lower than a man’s, and women were flocking to programming because it was the best they could get. Not a lot of women were hired as programmers (or defined that way,) and when they were at places like IBM, they were not allowed to go into management or any supervisory role because those jobs were only for men, no matter how good the women were. This reinforced that priesthood mentality I told you about, at least among the men.

Another part of this identity crisis was that the 1960s were the decade of software debacles. Projects involving millions of lines of code frequently ended in disaster. They were often over budget and way past deadlines... that was the perception at least, it was a fairly exaggerated. This with the myth that unmanagable programmers were driving up the cost of labor only added to software’s image problem. What’s crazy about unmanagable programmers, is that the traits managers claimed to hate. Egoism, disliking collaborating, risk taking, antisocial –



Wednesday, November 5, 14

## Meanwhile in Academia...

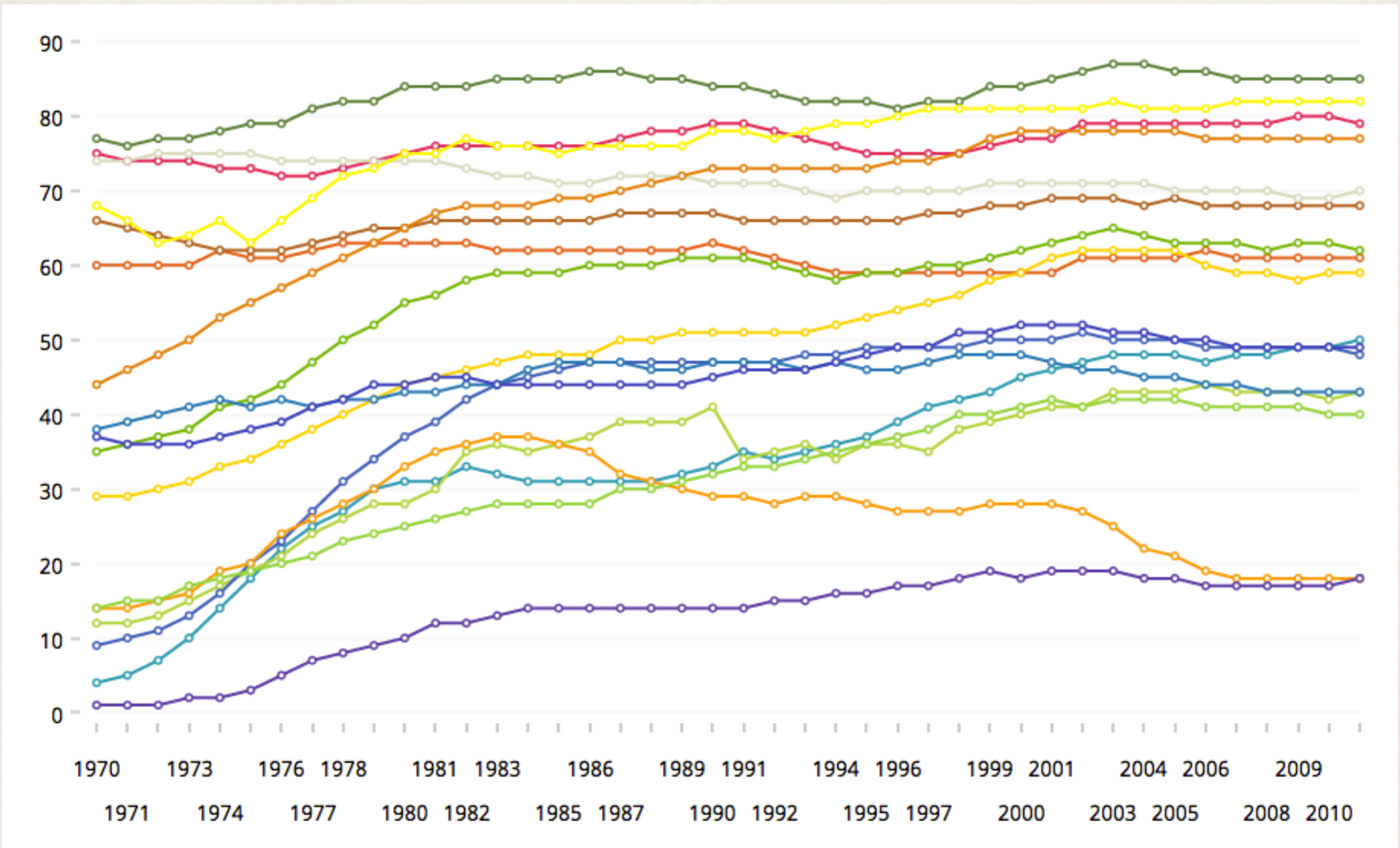
Universities tried to keep up with the demand for computer specialists by starting degree programs! But what to name them? They hit on software engineering and computer science to be provocative and to again – legitimize the profession, it's not soft skills – it's a hard science!. Something to note too is that neither the mathematics departments nor the engineering departments wanted anything to do with computer science schools. To those pure science departments CS was a secretarial school...

so the cheese stands alone but eventually you and I know, cat robots take over the earth.

Right around this time, men's universities start admitting women to their hard science programs – and again, remember that computing was the TOP paying field for women, so – even though they can't really advance in most computing companies, they can get paid.

## Feminization of Mathematics

women w/math degrees were hired as programmers in 60s, however math's association w/women's work was bad for profession: thus engineering



Wednesday, November 5, 14

Here is a cool thing about CS degrees.

This chart is from Silk and shows what percent of women got what degree's over the last 50 years. Computer science degrees are the bottom orange. You can see the decline right around 1984 – this has been researched a lot, and NPR just did a piece about it and blamed, of course – advertising. But what they didn't look at was how over time CS departments associated themselves more and more with engineering and less and less with math. You can see that math degrees stay constant, the CS degrees almost reach mathematics in the early 80s, and then women in CS drops dramatically finding it's level with women in engineering.... oh damn... what fresh hell is this?



Wednesday, November 5, 14

## Legitimacy

Repeating Patterns – we see this software identity crisis repeat over and over again, we're embroiled pretty deeply in it over the next few years.

We saw it again with the advent of the PC – note the advertising! When computers got smaller and less expensive, notice who the computer operators became – Men! Ask yourself why? Because men are more expensive/experienced programmers and you can now afford to pay for the labor.

90s bubble – who did we worship? Hyper masculine personalities in the engineering culture.

2000's – The public can't even distinguish the internet culture from engineering culture right now, and that's a problem.

(which are algorithms which are programs)  
Tech Culture now the most pervasive culture

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