

AT: Welcome to the Infinite Women podcast. I'm your host, Allison Tyra, and today I'm joined by Aida Brankovic, a research scientist with CSIRO, to talk about software engineer Margaret Hamilton. So let's start with what she is best known for professionally.

AB: Among all great things that Margaret did, I would start with the fact that she introduced actually the term software engineering. And what is more interesting, it was, I guess, in 1976, the term was introduced. But what is more interesting to me is that that term probably wouldn't reach us today, unless she would have great support of the men, because the great hardware and hardware guru at the time, who actually supported her idea. And that's why we still have this term nowadays, like well established.

AT: She has said that she began to use it because she wanted to distinguish it from hardware and other kinds of engineering, but treat each of them as part of the overall systems engineering process. But I think there is also an element that because, so the earliest people writing code were predominantly women, and I think adding engineer to their title may have helped shift perceptions around the work they were doing, and sort of, I don't want to say legitimized it, but...

AB: Recognizing, yeah, I agree. And it was, I think, important historical moment when we talk about computer science to see software recognized as an engineering discipline that has enough weight to be treated equally important and equally hard, like the hardware development.

AT: And she was also the director of the software engineering division at the MIT Instrumentation Laboratory. So one of, if you've seen a photo of Margaret Hamilton, there's a very good chance that it is a picture of this woman in the '70s standing next to a giant stack of paper. So the photo is actually from 1969, so not actually the '70s, but this stack of paper is almost as tall as she is, and it is basically printouts of all of the guidance software that she and her team developed for the Apollo missions at MIT.

AB: That's fabulous and very inspiring photo, and this is actually what attracted me to Margaret. First time, a few years back, when I saw this photo I wanted to learn, who is this lady standing beside a bunch of the papers. But there are two things I would like to mention here. When you look at the 11 engineers of Apollo missions, I think when even I found it on the official NASA site, you will not find her name, but I find a little bit disappointing. You will find 11 men names who were engineers responsible for the for the Apollo mission. So still doing great thing and being one of the key personnel, I would say for intelligent part of the mission, she has been still not recognized at the same level like men. But what I would like also to say is the path that brought her there, because like in early career, she had the great support of the professor Florence Long for a university that actually helped her to pursue her degree in math. Then she was lucky enough to start working with the Edward Lorenz at the Meteorological Department at MIT. And I think that was pivotal point at her career where she would start doing some important work. And later her work that she did with another project, I think it was semi-automatic ground environment project that aimed at searching for possibly unfriendly aircrafts, was actually the pivotal project in her career that launched her as a star that could be at the level to deliver

successful Apollo flight software. It was not out of the blue that she started with Apollo. She had to prove herself very strongly to be given this opportunity. So once she started leading the instrumentation lab and leading this Apollo guidance computer lunar exploration program, she did the great thing. She simply mastered her work that she already started in the past years with the previous programs. And some things that she could foresee as a potential problem were actually crucial and that reflected the importance of that in the moment when Apollo was landing because there was a problem that Apollo was landing. And because the software at the time could handle seven programs running parallelly while the engineer requested eight to be run. So this wouldn't be actually handled unless she came up with the concept, integrated that concept which was like priority alarms. So that actually enabled to put the priority, solving the priority alarms and eventually the mission was successful. So she introduced many many concepts in the software engineering and also ensured early detection and recovery techniques that would be useful even up to date and that were kind of basis for this reliable software development and quality assurance.

AT: And as you mentioned from 1961 to '63 she worked on the semi-automatic ground environment or SAGE project at the MIT Lincoln Lab. So this was working for the US Air Force programming software for a prototype that was used by the US Air Force to search for potentially unfriendly aircraft.

AB: In the organization when she joined the organization she was just, obviously, really starting her career but the thing was for all new beginners it was the custom to assign them program which nobody would ever find working or running. So basically she came across the software that had even, like comments in Latin and Greek. So after managing to run that program she actually proved that she is capable of doing serious tasks. And being successful there actually opened the door later for the Apollo flight software mission.

AT: And in addition to being a software engineer and coining the term software engineer she was also a businesswoman who actually founded two different companies in the 1970s and 1980s.

AB: Yeah she seems to have also entrepreneurial spirit and as you said she founded one company that was continuing basically her work related to Apollo mission about error prevention and fault tolerance. And another company was in 1986, Hamilton Technologies at Cambridge and that was associated to automated environment. So all basically her work was related to the software, software quality, fault tolerance, error prevention and reliable software development.

AT: So for those of us who are not as technologically savvy as you are, she was basically helping develop early software to make it work better so that, yeah we don't have a lot of the problems that they would have had back then because she - and other people - but she was working on solving these things so that our generation doesn't have to deal with them.

AB: Yeah I guess it is still evolving process and something that continues developing with the

development of the technology, new languages and their infrastructure but certainly she said the base of which basic principles are still there and leading the reliable software development.

AT: And often my guests have a particular reason that they want to talk about a given person. So what drew you to Margaret Hamilton specifically?

AB: Women are very often undermined and their names are not loud. For example she is the very first woman introducing this word "software." but for example it's not the first woman that did something great and revolutionary I would say. Because for example when we think about first university it was not funded by some man. It was funded by lady called Fatima al-Fihri, the first university according to UNESCO in Guinness World Records. It was in 859 and it was the first university that was awarding degrees according to different level of study and at that time it was providing studies in math, grammar, medicine and Islamic study. So what I would like to point out, the women are there and I think at some points they were making pivotal inventions and the things that were revolutionizing the way we are living now but my impression is that there is not strong voice about their achievements. So this Fatima al-Fihri or when we talk about Margaret Hamilton these are great ladies about who we know very little and that are not very much known.

AT: And for anyone who's interested in learning more about that you can look up the University of al-Qarawiyyin which as you mentioned was founded originally as a mosque by Fatima al-Fihri around the year 858 and it's located in Fez, Morocco.

AB: Correct it is the oldest still existing and operating university in the world. The second is Bologna and it was like two centuries later and it was oldest western university, but it's not heard about them.

AT: I know that you work in eHealth and obviously Margaret Hamilton was a software engineer but are there other connections between the work that she did and the work that you're doing today?

AB: Yes certainly. From my masters on I've been working on the complex algorithms in the past years focusing more on algorithms in the scope of the artificial intelligence that are deployed for the novel medical devices and decision support tools that would improve the provision of health and help in changing the lives of the patients. To that end I have been also given a chance to work on very first portable medical device for scanning the brain that would address some of the shortcomings of the existing technologies. Firstly it being portable and affordable and to be to have something for the for the diagnostic at remote places similar to some extent to what Margaret did when she worked on the first code for the first program, portable computer so I would make the parallel she was programming first portable computer. I had an opportunity to make a software for the first portable brain scanner.

AT: So with all of the women in early computer programming history from Ada Lovelace being

the first computer programmer to Grace Hopper, we've got the ENIAC programmers and even at NASA there were Katherine Johnson and the other so-called hidden figures. What is it about Margaret Hamilton specifically that inspires you?

AB: So probably being person from the shadow and giving such a big impact and being somebody who relates to my field doing software programming and all these things were key elements for picking Margaret to talk about here.

AT: Join us next time on the Infinite Women podcast and remember well-behaved women rarely make history.