Biography of a Software Engineer

Kathleen Booth and the Impact of Women in Technology

If you type ‘famous software engineers’ into your search engine, you would be forgiven in thinking that women have not had any notable impact on the field. In fact you would have to click next on the scrolling banner of icons twice before the face of Margaret Hamilton, the woman who coined the term, would appear on your screen. She is the 26th result, and the first woman to appear on the list. The next, Mary Shaw, does not appear until the 50th.

One piece of sociological research that has been oft repeated and replicated over the years is the Draw-a-Scientist Test. Primary school aged children are asked, as the name suggests, to draw a scientist. An analysis of the original data collected between 1966 and 1977 shows that of over 4000 drawings, only 28 were of female scientists, and of those 28, all were drawn by little girls. This percentage is stark and disheartening, but unsurprising given the time period. As the decades have passed, the numbers of female scientists in these drawings has increased to roughly 28%, but this is still nowhere near parity. One sad result of the study is that as girls grow older, they are less likely to draw their own gender in lab coats conducting experiments. “At age 6, girls draw 70 percent of scientists as women, but this proportion flips around ages 10 to 11 and by 16, they draw around 75 percent of scientists as men.” (Yong, 2018)

This piece of work was described and assigned to the class on the second Tuesday of October, which also happens to be Ada Lovelace day. First celebrated in 2009, it is a day that aims to highlight the achievements and contributions of women to the field of computer science. (The Independent, 2020) This coincidental overlap of dates bolstered my desire to write about the life and work of a woman in technology, and while Lovelace’s work was groundbreaking it would be a stretch to assign her the label of ‘software engineer’. Though she is credited with writing the first computational algorithm during her work with Charles Babbage and his analytical engine, the first programmable computer was not to be invented until almost a century after her death at 36.

As mentioned above, the term ‘software engineer’ was coined by Margaret Hamilton during her work on the Apollo moon missions to describe the application of engineering principles to the development of software. These principles prioritise robustness, maintainability, dependability and security of code on the micro level and systems on the macro. The software written by Hamilton and her team was written in Assembly language, which is low level programming a step above machine code. Two decades prior to the moon landing it was the work of another woman, Kathleen Booth, that led to the first assembly language. Kathleen and her husband Andrew at Birkbeck University of London, worked together to develop one of the first operational programmable electronic computers in the world, the APE(X)C. While Andrew worked on the hardware aspect, the machines were programmed by Kathleen.

Kathleen Booth was born Kathleen Britten in 1922 in Worcestershire, England. She studied Mathematics at the University of London, obtaining a BSc in Mathematics and a PhD in Applied Mathematics. While working towards her PhD Britten accompanied Andrew Booth on a 6 month placement at Princeton University where John Von Neumann was conducting his groundbreaking computational research. The impact of this visit on Britten and Booth led them to redesign their ‘ARC’ machine, to implement Von Neumann’s theories on memory. The pair soon married and continued to work together on building computer systems in the numeric research department he had founded at Birkbeck for much of the 1950s and 60s.

Their resulting rapid work on the ARC, ARC2 and SEC machines led them to write two reports on their research. The second, ‘Coding for ARC’, is where Kathleen first outlined her ideas for an assembly language and assembler for the ARC2 machine. (Dufresne, 2018) Computers in years prior were programmed at the hardware level, by physically connecting wires in plugboards. Programming such machines, like the famous ENIAC, took weeks of work and the resulting programmes were inflexible and hard to test. Kathleen Booth revolutionized the field by writing this new language, which allowed a layer of abstraction above the hardware. An assembler takes the assembly code and compiles it into machine language, a sequence of binary 1s and 0s. This machine code is then used to flip transistor gates and control the flow of the computation. This remarkable innovation can be considered even more remarkable given the extremely small size of her team and the relative lack of

funding provided by sponsors and the university. I think it would therefore be fair to call Kathleen Booth one of the prototypical 10Xers. She wrote code rapidly, and with extreme ingenuity.

The Booth's work on the ARC projects gave them the theoretical and (albeit limited) financial launchpad to develop their best known machine, the APE(X)C. Kathleen wrote a book on programming the machine, 'Programming for an Automatic Digital Calculator' by K H V Booth (1958), which was unusual both for being an early text on programming software itself and also for being written by a woman. Her department at Birkbeck also received funding to work on natural language processing, text processing and simple machine translation. Booth's book also outlines many of the algorithms the team used to implement accurate translation using word substitution and processing of morphological stems and word endings. Kathleen Booth can also be cited as a pioneer in the field of neural networking, and wrote a programme to "simulate a neural network investigating ways in which animals recognize patterns." She also worked on a neural network for character recognition just four years after the running of the first neural network on a computer. (Dufresne, 2018)

The Booth's moved to Canada in the early 1960s after a perceived snub from Birkbeck, but the pair continued their research and development in Lakehead University for the following two decades. Kathleen Booth retired in 1978, but is still alive today aged 98. Her contributions to the general field of computer science are undeniable, but I would argue that her contributions to software engineering are equally important. Without the development of an assembly language, would Margaret Hamilton have been able to land man safely on the moon? The robustness and complexity of her code, written in assembly, was key to the Apollo mission's success. These two women of different generations, working as part of very different teams contributed to the creation of software engineering as we know it. Other major female figures like Grace Hopper, who developed COBOL, and Mary Wilkes, the first home computer user, did outstanding technical work and yet they often go unrecognised in easily digestible listicles (unless those listicles are based on female only contributions). So while I am submitting this biography a month after Ada Lovelace day, I hope I am contributing to the spirit of it by shining light on a woman's contribution to software.

References

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