

Grace Hopper : Forever Grace-ing the world by her impact

Grace Hopper was Born on December 9th 1906 in New York . Born with a curious mind she dismantled 7 alarm clocks to see how they work all before her mother noticed and took away 6 of them. This childhood curiosity led to her applying for early admission to Vassar University to study mathematics and Physics . Her application was denied and she was admitted in the following year. She then went on to earn her masters in Yale in 1930 and her Ph.D in 1934 in Mathematics. *(i)*

Her knowledge in Mathematics and her position as a professor of Mathematics in Vassar made her desirable in the U.S Navy during World War 2, despite being denied multiple times before due to gender, age (the “old” age of 34) and her low weight to height ratio (she was 6.8kg below the Navy’s minimum weight of 54kg). Despite this she graduated top of her class in the Naval Reserve Midshipmen's School at Smith College in Northampton, Massachusetts in 1944 and was assigned to the Bureau of Ships Computation Project at Harvard University*(ii)*. There she worked with the Mark 1 computer, also known as the Automated Sequence Controlled Calculator. It was a electromechanical computer that had 60 sets of 24 switches for manual data entry and could store 72 numbers, each 23 decimal digits long.[9] It could do 3 additions or subtractions in a second. A multiplication took 6 seconds, a division took 15.3 seconds, and a logarithm or a trigonometric function took over one minute.*(iii)*

You’re probably wondering why a mathematician , by formal education , was my chosen individual to write a short biography about her work and her impact. Well during World War 2 the US government encouraged women to enter into the workforce and take on “war jobs” while the men were fighting in the war. One of these jobs involved the US military hiring women, particularly mathematicians, to be ‘human computers’. This meant calculating “ ballistics trajectories by hand determining the angle soldiers should fire at based on how far away the target was, what the weather conditions were that day, and

other factors. By 1945, they were part of nearly 100 female mathematicians working as “computers.” (vii)

From there a team consisting of “Jean Jennings Bartik,...Frances Elizabeth “Betty” Holberton,...Frances Bilas Spence, Marlyn Wescoff Meltzer, Kathleen “Kay” McNulty Mauchly Antonelli, and Ruth Lichterman Teitelbaum, ... laid the groundwork for future programmers and software engineers,” (vii) These 6 women coded the first computer called “ENIAC, or Electronic Numerical Integrator And Computer” (vi) , that did the calculations faster however it was arithmetic based.

So where does Grace Hopper come into all of this , well , during her service she headed the team that pioneered COBOL (**C**ommon **B**usiness **O**riented **L**anguage), which is a compiled English-like computer programming language designed for business use. It is imperative, procedural and, since 2002, object-oriented.(iv) COBOL is primarily used in business, finance, and administrative systems for companies and governments. She did not invent COBOL, however it was based off the compiler she wrote which extended her FLOW-MATIC language. She wrote the first compiler because she strongly believed programming languages should be written in English, even though she was told that computers did not understand English and they could only do arithmetic. Grace best describes how her compiler “translated mathematical notation into machine code. Manipulating symbols was fine for mathematicians but it was no good for data processors who were not symbol manipulators. Very few people are really symbol manipulators. If they are they become professional mathematicians, not data processors. It’s much easier for most people to write an English statement than it is to use symbols. So I decided data processors ought to be able to write their programs in English, and the computers would translate them into machine code. That was the beginning of COBOL, a computer language for data processors. I could say “Subtract income tax from pay”(v) instead of trying to write that in octal code or using all kinds of symbols”

From her persistence in writing a language that was grammar based , leading to the spawn of COBOL, which was a major language used in Data Processing,

which opened the doors to all the modern grammar based programming languages we have today e.g Java, Python, Ruby, C, Haskell, Prolog etc. Not only that but she also developed standards for testing computer systems and components which was implemented in early programming languages such as FORTRAN and COBOL, thus laying the foundations for the Unit Test practises implemented in the present day and giving rise to the [National Institute of Standards and Technology](#) (NIST) (a measurement standards laboratory, and a non-regulatory agency of the United States Department of Commerce.)(vi) Not only did she impact programming languages of today by writing the first grammar based programming languages, and Unit testing by developing standards for testing for the new grammar based languages, she also *popularised* the phrases “debugging”, “bug in the system” and “computer bug” after a moth got trapped and died in the Mark II and it had to be “debugged”.

From her work in Navey that brought grammar based programming languages and the idea of standard testing practices for programming languages to fishing of a dead moth out of computer system to popularise “debug”, I think its is more than fair to say that Dr.Grace Hopper’s work as a key mathematician, turned software engineer while serving in the U.S Navy has significantly impacted the programming languages, testing methods and programming vocabulary we use today.

References

- (i) Wikipedia. 2017. *Grace Hopper*. [ONLINE] Available at: https://en.wikipedia.org/wiki/Grace_Hopper.
(Early life and education)
[Accessed 7 November 2017].
- (ii) Wikipedia. 2017. *Grace Hopper*. [ONLINE] Available at: https://en.wikipedia.org/wiki/Grace_Hopper.
(Career subsection : World War II)
[Accessed 7 November 2017].

(iii) Wikipedia. 2017. *Harvard Mark I*. [ONLINE] Available at:
https://en.wikipedia.org/wiki/Harvard_Mark_I.
[Accessed 30 October 2017].

(iv) Wikipedia. 2017. *COBOL*. [ONLINE] Available at:
<https://en.wikipedia.org/wiki/COBOL>.
[Accessed 24 October 2017].

(v) Wikipedia. 2017. *Grace Hopper*. [ONLINE] Available at:
https://en.wikipedia.org/wiki/Grace_Hopper.
(Career subsection : UNIVAC)
[Accessed 7 November 2017].

(vi) Wikipedia. 2017. *National Institute of Standards and Technology*.
[ONLINE] Available at:
https://en.wikipedia.org/wiki/National_Institute_of_Standards_and_Technology
.
[Accessed 6 November 2017].

(vii) Becky Little (September/1st/2017) *The First 1940s Coders Were Women—So How Did Tech Bros Take Over?*, Available at:
<http://www.history.com/news/coding-used-to-be-a-womans-job-so-it-was-paid-less-and-undervalued> (Accessed: 09/11/17).