Biography of a Significant Software Engineer: Ada Lovelace
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Ada Lovelace was born in 1815 in London. She was the daughter of Annabella Milbanke Byron, a talented mathematician, and Lord Byron, a poet. She was privately educated, and developed a talent and passion for mathematics under the instruction of Augustus De Morgan, who was also the first professor of Mathematics at King's College London[1].

Lovelace developed an interest in computers in 1833 when she learned of Charles Babbage and his 'Analytical Engine'. The Analytical Engine was a development on his idea for a 'Difference Engine', which was a calculating machine that he had been developing for the British government to help with sea navigation, among other things[2]. The Analytical Engine was a more powerful machine, intended for general-purpose computing. As with modern computers, it had a memory store, a printer, a processing unit (called a mill), and a scanner. The Analytical Engine ran programs by being fed numbers and instructions on punch cards, similar to the Jacquard loom[3]. Said Lovelace of this machine: "The Analytical Engine weaves algebraic patterns, just as the Jacquard-loom weaves flowers and leaves."[4]

Ada Lovelace's most well-recognised piece of academic writing was when she translated Luigi Federico Menabrea's "Notions sur la machine analytique de Charles Babbage" ("Elements of Charles Babbage's Analytical Machine") from French to English. She included extensive and detailed annotations, including observations on how the Engine could compute Bernoulli numbers, as an example of how the Engine could work out a function without it being explicitly fed in by human input. These notes totalled a length three times that of Menabrea's original paper. When Babbage read her translation, he asked why she didn't write her own paper, to which Lovelace replied that the notion hadn't occurred to her[5].

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[1] The Editors of Encyclopædia Britannica. "Ada Lovelace." Encyclopædia Britannica. October 12, 2017. Accessed October 29, 2017. https://www.britannica.com/biography/Ada-Lovelace.
[2] Swaine, Michael R., and Paul A. Freiberger. "Difference Engine." Encyclopædia Britannica. October 07, 2008. Accessed October 29, 2017. https://www.britannica.com/technology/Difference-Engine.
[3] Freiberger, Paul A., and Michael R. Swaine. "Analytical Engine." Encyclopædia Britannica. March 09, 2017. Accessed October 29, 2017. https://www.britannica.com/technology/Analytical-Engine.
[4] The Editors of Encyclopædia Britannica. "Ada Lovelace." Encyclopædia Britannica. October 12, 2017. Accessed October 29, 2017. https://www.britannica.com/biography/Ada-Lovelace.
[5] O'Connor, J. J., and E. F. Robertson. "Augusta Ada King, countess of Lovelace." Lovelace biography. Accessed October 29, 2017. http://www-history.mcs.st-andrews.ac.uk/Biographies/Lovelace.html.

She saw the potential of the engine to go beyond calculating numbers, and supposed the identification and manipulation of abstract objects "*whose mutual fundamental relations could be expressed by those of the abstract science of operations, and which should be also susceptible of adaptations to the action of the operating notation and mechanism of the engine"*[6]. It is this insight, the potential application of operations to abstract objects and the ability of numbers to represent such objects, that made her so visionary, as she realised the Analytical Engine could compute rather than merely calculate. As the first person to expressly describe this idea, Lovelace seemed to demonstrate a more sophisticated conception of what was possible from the Machine than the log tables that Babbage envisioned. Educated in music, she could understand the mathematical patterns that made fine music and wrote that the Analytical Engine could be capable of writing pieces of any length or complexity should it be initialised with a punch-card translation of the "*fundamental relations of pitched sounds in the science of harmony and of musical composition".*

As Babbage never wrote extensively about the possible computational achievements of the Analytical Engine, Lovelace's notes remained the foremost early documentation on early computer programming. Alan Turing read and was subsequently inspired by her notes as he worked in Bletchley Park decoding German messages during WWII[7]. Though Ada believed that a computer could work out mathematical functions and create patterns based on formulae, she didn't believe that a computer would ever be capable of truly original thought. Turing nevertheless developed a theory of the capacity for artificial intelligence in part from the work of hers that he read. He also acknowledged that in Lovelace's time period, she was already a visionary and had no reason or evidence to believe that artificial intelligence was possible. The only "robots" that existed were clockwork automata, and Lovelace and Babbage were working out the possibilities of the Analytical Engine just years after the Mechanical Turk, a chess-playing machine which was touted as an intelligent automata, was revealed as a hoax which was secretly operated by a human[8]. It is possible that Lovelace didn't want to commit anything too fanciful to writing lest the Analytical Engine be written off as another hoax.

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[6] O'Connor, J. J., and E. F. Robertson. "Augusta Ada King, countess of Lovelace." Lovelace biography. Accessed October 29, 2017. http://www-history.mcs.st-andrews.ac.uk/Biographies/Lovelace.html.

[7] Charman-Anderson, Sue. "Ada Lovelace: Victorian computing visionary." Ada Lovelace Day. Accessed October 29, 2017. https://findingada.com/shop/a-passion-for-science-stories-of-discovery-and-invention/ada-lovelace-victorian-computing-visionary/.

[8] Josić, Krešimir . "Engines of Our Ingenuity: The Turk." No. 2765: The Mechanical Turk. Accessed October 29, 2017. https://www.uh.edu/engines/epi2765.htm.

Ada Lovelace died of cancer in 1937. Her written work concerning the Analytical Engine and the potential for computing as a practise has made Lovelace remembered by some as the world's first computer programmer. Ada, an early computer programming language developed and used by the US Defense Forces, is named after her[9]. Ada Lovelace Day is celebrated on the second Tuesday of October every year to recognise her genius and the habitual erasure of women from scientific history. A graphic novel, The Thrilling Adventures of Lovelace and Babbage, was written to document her genius and expose it to a new generation of computer scientists[10].

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[9] Hemmendinger, David. "SQL." Encyclopædia Britannica. February 15, 2016. Accessed October 29, 2017. https://www.britannica.com/technology/computer-programming-language/SQL#ref849835.

[10] Padua, Sydney. "The Book!" 2D Goggles. March 28, 2017. Accessed October 29, 2017. http://sydneypadua.com/2dgoggles/the-book/.