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### **Biography: Ada Byron**

August Ada Byron was born in the year 1815, the daughter of the famous poet Lord Byron. She died in 1852 at the age of only 36, but in her short life she made a significant and lasting impact on the world, playing a key role in the early development of what has now become known as computing.

Her mother, who separated from Lord Byron right after Ada was born, raised her. Lady Byron must have left the marriage with a bad impression of poets, because she went out of her way to make sure that young Ada would not grow up to be a poet like her father--full of "helplessness, imprudence, vanity, prevarication and conceit" (Sarles, 2000). She wanted her daughter to be a mathematician and scientist. Despite her mother's efforts, Ada seems to have inherited some of her father's poetic tendencies since she described her personal goals as desiring to become "an analyst and metaphysician." (Toole, 1998) Her combination of mathematical inclinations and imagination would serve her well as she became one of the first great visionaries of the computer revolution...even a hundred years before computers actually existed, as we now know them.

Ada was 19 years old when she first heard of Charles Babbage's ideas for a new "calculating engine" (also known as "the Analytical Engine") in 1834. The basic idea was the hypothetical idea of a machine that could make predictions and act on them (Toole, 1998). She became fascinated by the idea and ended up working on the concept with Babbage for nine years developing the original prototype computer (Sarles, 2000).

Babbage made a presentation on developments in his ideas for an Analytical Engine at a seminar in Italy in 1841, which resulted in an article about him and his ideas, published in French. By this time Ada was married to the Earl of Lovelace and had three young children, and was known as Lady Lovelace. In 1843 she ended up translating the French article into English, and shared it with Babbage. Babbage must have been impressed with her work and/or her personality because he invited her to add her own notes to the text (IEEE, 1994).

Ada had no shortage of ideas on Babbage's theories and she accepted the invitation and wrote extensively. Her notes were three times longer than the original article. Again Babbage must have been impressed with her because a chain of events was set in motion that linked the two of them very closely for the next several years. They began a close friendship and working relationship, as evidenced by numerous letters that they wrote back and forth to each other.

In her notes that accompanied her translation of the article, Lady Lovelace ventured a few predictions of her own that eventually were proven correct more than 100 years later. For example, she suggested that Babbage's machine might one day be used to compose music, produce graphical content, and be useful in practical and scientific ways.

In what is probably her most famous and most often quoted passage from her letters to Babbage, Lovelace wrote that the Analytical Engine "might act upon other things besides numbers, were objects found 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. Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent.” (Toole, 1998)

Lovelace made the distinction between the Analytical Engine and earlier, simpler devices such as Blaise Pascal’s machine, invented in 1640. Pascal’s machine is often cited as the first calculator, as it was basically a simple adding machine (Maxfield and Brown, 1997). By contrast, the Analytical Engine could separate calculating processes from the data being processed. In other words the machine had the capability to store programs as well as data, in a way that is essentially similar to what the computers of today do. Therefore it is this quality which was its main contribution the conception of the modern day computer.

Probably her main specific contribution she is most remembered for was writing a plan for how the Analytical Engine might be used to calculate Bernoulli numbers. This formula for doing the Bernoulli calculations can be considered the first computer program. Therefore Ada Lovelace can take credit not only for being the first woman computer programmer of all time, but simply the first computer programmer.

In her notes to the translated article, Lovelace specified several features that are relevant to today’s computers, including the following:

- Going beyond even what Babbage had in mind for his machine she described an early punch card model of computer, discussing how the analytical engine “could be designed to accept cards,” using terms like “control cards,” “data cards,” and “operation cards.” She suggested that the computer could “analyze

data,” and both numbers and symbols could be “coded” as numerical data, and then output as text. (Sarles, 2000) So, she was using terms that are closely related to the computers of the 1940s and 1950s as well as even the computers of today.

- She further described the Analytical Engine’s functions in terms of memory, which she referred to as “storehouse columns,” even specifically referring to “memory locations” and “addresses,” terms that are in current use today. (Sarles, 2000)
- She described the machine in terms of its accepting “commands” in the same way that we do with computers today.
- Lovelace is also given credit for originating the concept of looping in computers, a very basic function with many examples (for instance subroutines in Perl or other programming languages). In her case it was all done with cards, but she described how a card, having performed a function, would move back into a position where it could be used over and over again for other functions and other data cards, “to secure the possibility of bringing any particular card or set of cards into use any number of times successively in the solution of one problem.” (Sarles 2000)
- She also introduced the idea of building “functions” into the analytical system, noting how a specific set of instructions would accomplish a specific set of tasks or operations. She explained how the looping effect could "solve a system of linear equations" no matter how big it was. (Sarles, 2000)

Ada Lovelace is well remembered today and honored in a variety of ways. The Ada Project (TAP), a clearinghouse for information and resources related to women and computing, founded at Yale University, was named in her honor (Freeman and Hupfer, 1994). Also, a software language developed by the U.S. Department of Defense was named “Ada” in her honor in 1979 (Toole, 1998).

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