ELEMENTS

ADA LOVELACE, THE FIRST TECH VISIONARY

By Betsy Morais October 15, 2013

When Ada Lovelace was twelve years old, she wanted to fly. She approached the problem methodically, examining birds and investigating various materials that could serve as wings—feathers, paper, silk. In the course of her research, which began in February, 1828, according to her biographer Betty Alexandra Toole, Ada wrote and illustrated a guide called "Flyology," to record her findings. She toiled away on this project until her mother reprimanded her for neglecting her studies, which were meant to set her on a rational course, not a fanciful one.

Ada's mother, Annabella Byron, was the straight-laced counterpoint to her father, Lord Byron, the Romantic poet, who called his wife the "Princess of Parallelograms." A month after Ada's birth, Annabella Byron moved their daughter out of their London house, and away from Lord Byron's influence. When, shortly before his death, he wrote asking about Ada's upbringing, Annabella had this to report: "Not devoid of imagination, but is chiefly exercised in connection with her mechanical ingenuity." This was the best she could hope for, having drilled into Ada a discipline for arithmetic, music, and French, according to the biography "A Female Genius," by James Essinger, which comes out today. Essinger writes that Lady Byron wished to suppress her daughter's imagination, which she thought to be "dangerous and potentially destructive and coming from the Byrons."

But Lovelace reconciled the competing poles of her parents' influence. On January 5, 1841, she asked, "What is Imagination?" Two things, she thought. First, "the combining faculty," which "seizes points in common, between subjects having no apparent connection," and then, she wrote, "Imagination is the Discovering Faculty,

pre-eminently. It is that which penetrates into the unseen worlds around us, the worlds of Science."

Augusta Ada Lovelace is known as the first computer programmer, and, since 2009, she has been recognized annually on October 15th to highlight the often overlooked contributions of women to math and science. The main event is being held today at Imperial College London, with the début of an anthology of essays, "A Passion for Science: Stories of Discovery and Invention." "I started to think that one of the biggest parts of the problem was that women in tech are often invisible," Suw Charman-Anderson, the founder of Ada Lovelace Day, told me. After reading a study in 2006 by the psychologist Penelope Lockwood, who researched the dearth of female role models in the sciences, Charman-Anderson thought that a fête for Lovelace could raise awareness of her noteworthy successors. This year, dozens of celebrations will be thrown around the world, including an "Ada Lovelace Edit-a-thon" at Brown University, where volunteers will ramp up Wikipedia entries for female scientists.

Looming in the background of these festivities are findings, announced last month by the Census Bureau, that the share of women working in STEM (science, technology, engineering, and math) has decreased over the past couple of decades; this is due largely to the fact that women account for a smaller proportion of those employed in computing. In 1990, women held thirty-four per cent of STEM jobs; in 2011, it was twenty-seven per cent. Valerie Aurora, the executive director of the Ada Initiative, a nonprofit organization that arranges conferences and training programs to elevate women working in math and science, is participating in the first ever Ada Lovelace conference this week, at Stevens Institute of Technology in Hoboken. "Lovelace is an unusual example of a woman for her time because she was not only allowed to learn mathematics but encouraged to learn mathematics," Aurora said. "She shows what women can do when given a chance."

Lovelace's opportunity came when she met Charles Babbage, the renowned mathematician who would become her friend and mentor. On June 5, 1833, she attended a flamboyant party brimming with London socialites, to whom she was making her début at the age of seventeen. There was Babbage, a widower in his forties, who spoke excitedly of an invention he called the "Difference Machine," a tower of numbered wheels that could make reliable calculations with the turn of a

handle. A few days later, Lady Byron took Ada to his home at 1 Dorset Street to see him demonstrate the device in his drawing room. Ada, intrigued by the incomplete prototype, struck up a correspondence with Babbage about its potential, and her own mathematical studies. The letters between them span from June 10, 1835, to August 12, 1852; he told her about his plans, and she wrote to him of her ambition. "I think your taste for mathematics is so decided that it ought not to be checked," Babbage wrote to her in 1839.

When Babbage began devising a new project, the "Analytical Engine"—sketched out as a hulking machine with thousands of cogwheels that could perform more functions with greater accuracy—Lovelace served as its key interpreter. On a trip to Turin to promote his work, which required considerable financial support, Babbage met a mathematician named Luigi Federico Menabrea, who agreed to write a paper on the machine. It was published in a Swiss academic journal in October, 1842, at about eight thousand words. Lovelace translated it from the French, and added her own notes. Her version came in at twenty thousand words. "The notes of the Countess of Lovelace extend to about three times the length of the original memoir," Babbage wrote later. "Their author has entered fully into almost all the very difficult and abstract questions connected with the subject."

Her translation, along with her notes, was published in 1843, and represent her greatest contribution to computer science: she described with clarity how Babbage's device would work, illuminating its foundations in the Jacquard loom. Just as Joseph-Marie Jacquard's silk-weaving machine could automatically create images using a chain of punched cards, so too could Babbage's system—the engine, Lovelace explained, weaved algebraic patterns. She also wrote how it might perform a particular calculation: Note G, as it is known, set out a detailed plan for the punched cards to weave a long sequence of Bernoulli numbers, and is considered to be the first computer program. "The science of operations, as derived from mathematics more especially, is a science of itself, and has its own abstract truth and value," Lovelace wrote. Essinger interprets this line in his biography, writing, "Ada is here seeking to do nothing less than invent the science of computing, and separate it from the science of mathematics. What she calls 'the science of operations' is indeed in effect computing."

Beyond that, Lovelace articulated, as not even Babbage could, the poetic significance of his machine. She wrote:

> This science constitutes the language through which alone we can adequately express the great facts of the natural world, and those unceasing changes of mutual relationship which, visibly or invisibly, consciously or unconsciously to our immediate physical perceptions, are interminably going on in the agencies of the creation we live amidst.

She continues:

> A new, a vast, and a powerful language is developed for the future use of analysis, in which to wield its truths so that these may become of more speedy and accurate practical application for the purposes of mankind than the means hitherto in our possession have rendered possible. Thus not only the mental and the material, but the theoretical and the practical in the mathematical world, are brought into more intimate and effective connection with each other.

Years later, scholars would dispute that Lovelace actually wrote the notes. The Babbage historian Bruce Collier argued that her contribution had been greatly overstated, and "it is no exaggeration to say that she was a manic depressive with the most amazing delusions about her own talents, and a rather shallow understanding of Charles Babbage and the Analytical Engine." But Essinger, Toole, and others reject this interpretation. "As people realized how important computer programming was, there was a greater backlash and an attempt to reclaim it as a male activity," Aurora told me. "In order to keep that wealth and power in a man's hands, there's a backlash to try to redefine it as something a woman didn't do, and shouldn't do, and couldn't do."

Suw Charman-Anderson said that Lovelace's story resonates "because there are still people who seek to discredit her achievements. It is something that many women working in tech are only too familiar with. We can look at Ada and recognize that our own challenges are similar to hers, and her achievements are the sorts of things that we strive towards."

In the late seventies, the Department of Defense developed a software language called Ada—one that brought together a number of different programming languages. It's fitting for Lovelace—a woman who rode horses and played the harp and studied poetry—to tie seemingly disparate elements together. As Aurora told me, "Computer programming has so many interactions with the rest of the world."

While Babbage possessed technical ingenuity, Aurora said, Lovelace propelled his invention into the nascent days of computing: “She was the first person to see the true potential.” For this, Babbage called her “Lady Fairy.”

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