Augusta Ada Lovelace: Some Debunking

When I wrote the chapter on women mathematicians, I consulted the usual sources on women mathematicians of the past and came up with the standard list of women who lived before 1900. All of them were included in the chapter, with only one exception: Augusta Ada Lovelace. After reading Dorothy Stein's account of her life and letters, I came to the conclusion that she was not worthy to stand in the company of these other women. I believe that her early reputation was enhanced by the fact that she was a member of the British aristocracy and that her current reputation—especially the commonly heard assertion that she wrote the world's first computer program—is pure hagiography. There is no doubt in my mind that this program was actually written by Charles Babbage, who was willing to let her have the credit for it for the sake of cultivating a useful patron. But judge for yourself; and by all means, read Stein's book before you do so. The following sketch reflects my own interpretation of the portion of the record that I have seen.

Like Florence Nightingale and Mary Somerville, Augusta Ada Lovelace lived among the well-to-do intellectuals of early nineteenth-century Britain. Her mother, Anne Isabella Milbanke (1792–1860), was a member of the aristocracy. On January 2, 1815 she married George Gordon, Lord Byron (1788–1824), who was to become one of the most famous romantic poets. On December 10 of that year Anne Isabella gave birth to a daughter. The baby was named for her father's half-sister Augusta, to whom Byron wrote poems expressing a love so passionate that they lent credibility to rumors of incest. The marriage of Ada's parents was doomed to failure because of the dissolute life of her father. It ended in separation after only one year, and Ada never knew her father. He died of a fever at the age of 36 while engaged in a typical romantic quest for glory, fighting for Greek independence at Missalonghi.

Although he took not the slightest interest in his daughter's welfare and never saw her again after she was one month old, Byron did at least remember her in his poetry. In Canto 3 of his poem *Childe Harold's Pilgrimage* he wrote

> Is thy face like thy mother's, my fair child!
> Ada! sole daughter of my house and heart?
> When last I saw thy young blue eyes they smiled,
> And then we parted,—not as now we part,
> But with a hope.

Ada was raised by her mother and given a grand tour of Europe at the age of twelve. She was not physically robust. She lost the ability to walk as a complication of measles when she was an early teenager, and it took several years for her to regain that ability. She suffered from extreme nervousness her whole life and was completely incapacitated several times.

In her late teens she met two people who were to have a positive influence on her life. One was the inventor Charles Babbage (1791–1871); the other was Mary Somerville, who, according to Stein (*1985*, pp. 90–91) wrote in her autobiography

> Ada was much attached to me and often came to stay with us. It was by my advice that she studied mathematics. . . among my papers lately I found many notes asking mathematical questions, and I heard after I went to Italy that she was very successful as a mathematician.

Stein points out that Mary Somerville's memory may be faulty in this passage, since Ada had been tutored by a certain Dr. William King before she ever met Mary Somerville. Indeed, she attempted to elope with her tutor, which was scandalous behavior at the time that could easily have ruined her prospects for marriage. However, she found an understanding husband in another man named, oddly enough, Lord William King, who a few years later was made Earl of Lovelace. They were married in July 1835, and, despite her frail health, Ada gave birth to two children during the next two years. Judging from her letters to Mary Somerville from these years, which contain very elementary and naive questions in spherical trigonometry,

Ada was not a brilliant student of mathematics.[1] Yet she persevered and asked for physical models to help her visualize spherical triangles. These studies were interrupted by other interests, such as playing the harp.

Ada's marriage, though not the sordid and humiliating matter that her mother's had been, did not encourage independence. Her husband and her mother formed an alliance to look after her, as if she were not quite competent to look out for herself. One may wonder if her bad nerves had any connection with this condescension on their part. That does not seem likely, however. Although many decisions were taken out of her hands, she was not cowed. She had an aristocratic arrogance that was to become more and more apparent as the years went by. And, in the last analysis, neither her husband nor her mother seriously interfered with her indulgence of her own interests. She wrote to Babbage in 1839 asking him to recommend a mathematics tutor for her and specifically noting the pedagogical problems to be overcome.

> [I have] quite made up my mind to have some instruction next year in Town, but the difficulty is to find the man. I have a peculiar way of learning & I think it must be a peculiar man to teach me successfully [Stein, *1985*, p. 65].

Her difficulties with learning were not those of the shy, retiring Princess Mar'ya described by Tolstoy. She had a great deal of confidence in her own ability, confidence that would not seem to be justified, judging from the naivity of the mathematical questions in her letters to Mary Somerville. After a long wait, her wish for a tutor was fulfilled in the luckiest way possible. She was able to take lessons from Augustus de Morgan (1806–1871), one of the giants of nineteenth-century analysis and mathematical logic. The laws for negating logical propositions are still known as de Morgan's laws. De Morgan was a positive-thinking tutor, who kept encouraging her and telling her not to be discouraged by slow progress. His belief in her talent seems to have been sincere, not merely affected for her benefit. He once wrote to her mother that he thought her powers were "utterly out of the common way for any beginner."[2] There is a curious paradox here, since, as already noted, her letters to Mary Somerville seem to indicate rather a *lack* of mathematical ability.

For part of her life she was a woman of a mystical religious turn of mind and fused these mystical tendencies with her love for science. These qualities gave her a confidence in herself that enabled her to undertake ambitious projects. In 1841 she wrote to her mother that she considered herself particularly well fitted to discover the hidden realities of nature precisely because of her highly strung nervous system, which she said, gave her intuitive perceptions denied to other people, and which, combined with her great reasoning powers and ability to concentrate, would lead to great discoveries. What she was fated to create would soon be manifest.

Because of her one scientific paper of merit, Augusta Ada Lovelace has come to be closely associated with Charles Babbage. Babbage was a brilliant scholar who resigned his prestigious university chair in 1839 in order to develop his computing machine. It was this "analytical engine" that led Augusta Ada Lovelace to her greatest (in fact, her only) scientific achievement. This engine was a supreme example of "over budget and behind schedule." Babbage and the British government invested thousands of pounds in its development, but after many years of delays it remained only in the design stage. A working model of part of the machine was built by Babbage's son, Major General Henry Babbage (1824–1918, a signalling expert) in 1888 and tested by computing approximations to multiples of π. The complete machine was never built.

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[1] See Toole, *1992*, pp. 83–89, where the actual questions are unfortunately omitted. Stein (*1985*, pp. 55–58) gives the questions, which are on the level of a junior in high school.

[2] Mayne, *1929*, p. 477, quoted by Henrion, *1997*, p. xxvi. It must be kept in mind, however, that de Morgan was writing to *her mother*; and he suggested that Augusta Ada *should be restrained from attempting too much* because of her frail health. Perhaps de Morgan was something of a diplomat and was trying to avoid offending Ada's mother. On the other hand, it is also possible that he was saying exactly what he meant. Many people who have difficulty with mathematics are quite good at writing or deciphering the instructions for building a cabinet or knitting a sweater, showing that they have the ability to do such abstraction; it only needs to be encountered in the proper context.

In the nineteenth century, it would have required enormous power and been subject to frequent breakdowns, since it had hundreds of moving parts. However, the principles on which it was based, including the use of punched cards to enter data, were incorporated in a later stage of computing technology, in the Harvard Mark I computer (1939) and ENIAC (Electronic Numerical Integrator And Computer, built during World War II, originally to compute ballistics trajectories). [3]

In 1840 Babbage lectured on the analytic engine in Italy, and these lectures were developed into a paper describing the engine, written by a young Italian engineer named Luigi Menabrea. [4] Ada translated Menabrea's article into English. When Babbage learned of this translation, he suggested that she write an exposition of the workings of the analytic engine, illustrating its use. He himself offered to describe how the engine could compute the Bernoulli numbers. According to Babbage,

> We discussed together the various illustrations that might be introduced: I suggested several, but the selection was entirely her own. So also was the algebraic working out of the different problems, except, indeed, that relating to the numbers of Bernouilli [sic], which I had offered to do to save Lady Lovelace the trouble. This she sent back to me for an amendment, having detected a grave mistake which I had made in the process [quoted in Stein, *1985*, p. 89].

To describe the workings of a computer would seem to have been a great challenge for a woman who only a year before was still having difficulty with basic functional notation, and Augusta Ada Lovelace certainly obtained help from Babbage in this effort. Babbage's casual remark that he had designed the algorithm for computing Bernoulli numbers himself is revealing. One of the fundamental techniques in computation, that of substituting one formula into another, baffled Augusta Ada completely. According to Stein (*1985*, p. 90), as late as November 1842 she was unable even to verify that the functional equation $f(x+y) + f(x-y) = 2f(x)f(y)$ is satisfied by the function $f(x) = (a^x + a^{-x})/2$, a problem any high-school junior would nowadays be expected to solve. She wrote to de Morgan that she was ashamed to admit how much time she had spent on this problem, in vain. In words every mathematics teacher has heard countless times, she insisted that she had "tried everything." Still, it is possible that she had this ability, but needed to exercise it in a more concrete context.

Perhaps also, what she had to do was not create the algorithm, but only understand Babbage's description of it. Not everyone can originate an algorithm, but many people can check it to see if it works. Whatever the case, her description of the algorithms was so detailed and accurate that it has been considered the first computer software ever written. The work contained six appendices of a philosophical nature (one containing the computation of the Bernoulli numbers mentioned above), reflecting on the capabilities and limitations of the machine. This paper appeared in 1843, its author being identified only as "A. A. L." It was a great success, and brought many congratulations from scientists such as the great experimenter Michael Faraday.[5]

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[3] One is reminded here of the similarly complicated automatic typesetting machine in which Mark Twain invested and lost a huge fortune; although it was intricately designed, it had 15,000 moving parts and broke down frequently. Like Babbage's machine, it needed the replacement of mechanical connections with electronic ones, in the modern inkjet and laser printers, to make it work feasibly.

[4] Menabrea (1809–1896) was head of the government of Italy from 1866 to 1869. At that time all of Italy except Venice and Rome had been united into a single state. Venice, which had been held by the Austrians, was annexed in 1866, after the Prussians defeated the Austrians. Rome, which had been occupied by the French, was annexed in 1870, after the Prussians defeated the French.

[5] Faraday, though an ardent Christian, was a complete materialist in his scientific work. His debunking of the popular spiritualism of the time earned him the wrath of many prominent Victorians, including Augusta Ada's mother and Ausgustus de Morgan's wife. Mind cures were tried on Augusta Ada herself in her final illness, with no effect upon the course of the disease.

Unfortunately, the collaboration with Babbage was about to take an unhappy turn. As certain hints given above may have suggested, Augusta Ada was not gifted with humility, or even normal human realism, when she thought about herself. She wrote to her mother that Faraday seemed to have the "impression that I am the *rising star* of Science." To Babbage, she wrote

> My own uncompromising principle is to endeavour to love *truth & God before fame & glory*... *Yours* is to love truth & God (yes, deeply & constantly); but to love *fame, glory, honours, yet more*. [Stein, *1985*, p. 118]

In her defense we should note that she suffered from mental illness, almost certainly metabolic in origin and leading (apparently) to delusions of grandeur. She drank heavily, gambled, and had many flirtations. Her interest in science had to compete with more frivolous occupations, and she never again produced anything of scientific significance. She died of cervical cancer in 1852.

In the words of an old Latin proverb, "[Speak] nothing but good of the dead." The Earl of Lovelace rendered the following eulogy on his wife, which seems to be at variance with the facts that are known concerning her mathematical ability and her relations with Babbage.

> She mastered the mathematical side of a question in all its minuteness... her power of generalisation was indeed most remarkable, coupled as it was with that of minute and intricate analysis. Babbage was a constant intellectual companion and she ever found in him a match for her powerful understanding, their constant philosophical discussions begetting only an increased esteem and mutual liking.

The preceding quotation was taken from the "MacTutor" website:

`http://turnbull.mcs.st-and.ac.uk/history/Mathematicians/Lovelace.html`

Whether writing one expository article in which most of the technical details were merely translations of previous work by someone else, and in collaboration with a first-rate intellect like Babbage, merits such high praise may be disputed. As Stein's research (*1985*) shows, there is a great deal of documentary evidence that Augusta Ada Lovelace was mathematically incompetent. In her translation of Menabrea's paper, for example, she even translated a printer's error, resulting in a mathematically absurd statement. Nevertheless, she fulfills a positive role in the history of the women's movement, having become noted as a woman of science. Any woman who helped to combat the prevailing belief that being a woman is inconsistent with being a scientist was thereby making a contribution. That her reputation appears (to me) to be artificially inflated in no way negates this important function. That reputation seems to be secure. She is variously called the first computer programmer in the world and the first computer hacker in the world, the United States Department of Defense named one of its programming languages Ada, in her honor, and several websites are devoted to spreading the glory of her name.

Literature

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