Ada, Countess of Lovelace: a programming pioneer

OR

Ada Lovelace, Charles Babbage and the Analytical Engine

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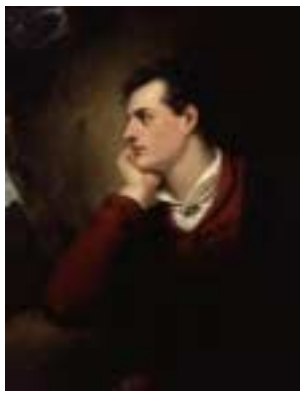
Outline of Talk

- Ada Augusta Byron (later Ada, Countess of Lovelace).
- 200th Anniversary of her birth (Dec.2015) Oxford Symposium.
- The "Computerphile" (YouTube) connection.
- Who was she? Lord Byron's daughter. Her life and education.
- The Newstead Abbey connections.
- Charles Babbage and the Difference Engine (1832).
- Marries William King (later Earl of Lovelace).
- Charles Babbage and the Analytical Engine.
- Publishes "Notes on the Analytical Engine" (1843).
- Death and interment in Hucknall Parish Church.

Ada Byron and her parents

George Gordon Byron
1788–1824



(m. Jan. 1815 — div. Jan. 1816)

Anne Isabella 'Annabella' Milbanke
1792–1860

Ada Augusta Byron (later Ada, Countess of Lovelace)
Dec. 1815–Nov. 1852

Ada Lovelace

The early years

- Annabella Milbanke was always fearful of Ada 'taking after her father'
- Her education emphasised mathematics, science, geography and literature — but no poetry! Very unusual for an aristocratic lady.
- Lived with her mother in London and in rented country houses
- Ada never met her father, but he kept a picture of her on his desk.
- In later life Ada's mathematics tutor was Prof Augustus De Morgan of University College London
- Also became close friends with Charles Babbage and Michael Faraday
- In 1833, aged 17, she was "presented at Court" and shortly after she and her mother were invited to visit Charles Babbage.

The Newstead Abbey connection

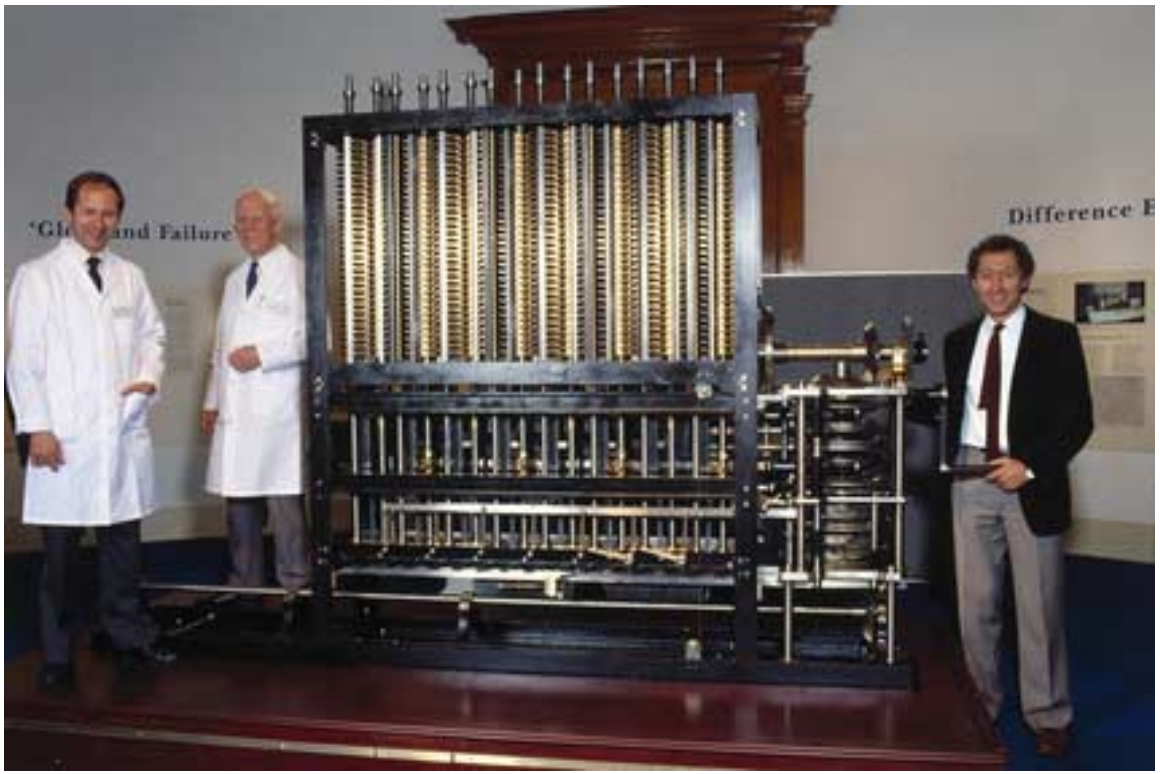
- In 1798 the 10-year-old Byron inherited Newstead from his great uncle. Thus "George Gordon Byron" became 6th Baron Byron of Rochdale.
- Newstead Abbey was in a dreadful state due to deliberate neglect.
- Byron lived at Newstead intermittently from 1808 but always lack of money and the attractions of London drew him away (!).
- Was his marriage to Annabella in 1815 a ploy to raise funds?
- Finally sold Newstead to Thomas Wildman (schoolfriend of Byron) in 1818 for £95,000.
- Ada did not visit Newstead until 1850, 26 years after her father's death.
- Byron himself is buried next door — at Hucknall Parish Church.


Charles Babbage

Charles Babbage and the Difference Engine(s)

- Charles Babbage was a mathematician who became Lucasian Professor at Cambridge (Isaac Newton's Chair).
- Fascinated by the problem of calculating and printing accurate mathematical tables e.g. logarithms.
- Babbage's Difference Engine (DE) used the "Method of Differences".
- The DE (Mk. I) was part-built by Babbage and demonstrated to Ada and others by Babbage himself, in 1833. Expensive to build!
- He drew up plans for DE (Mk. II) but he ran out of money (and Govt. ran out of patience). Babbage nursed furious resentment about this.
- DE (Mk. II) eventually built by Doron Swade (2000) and a team from the Science Museum. Now on display there. Second copy in the USA.

The Difference Engine Mk II (1990)



The Science Museum Team (Doron Swade on the right)


William King

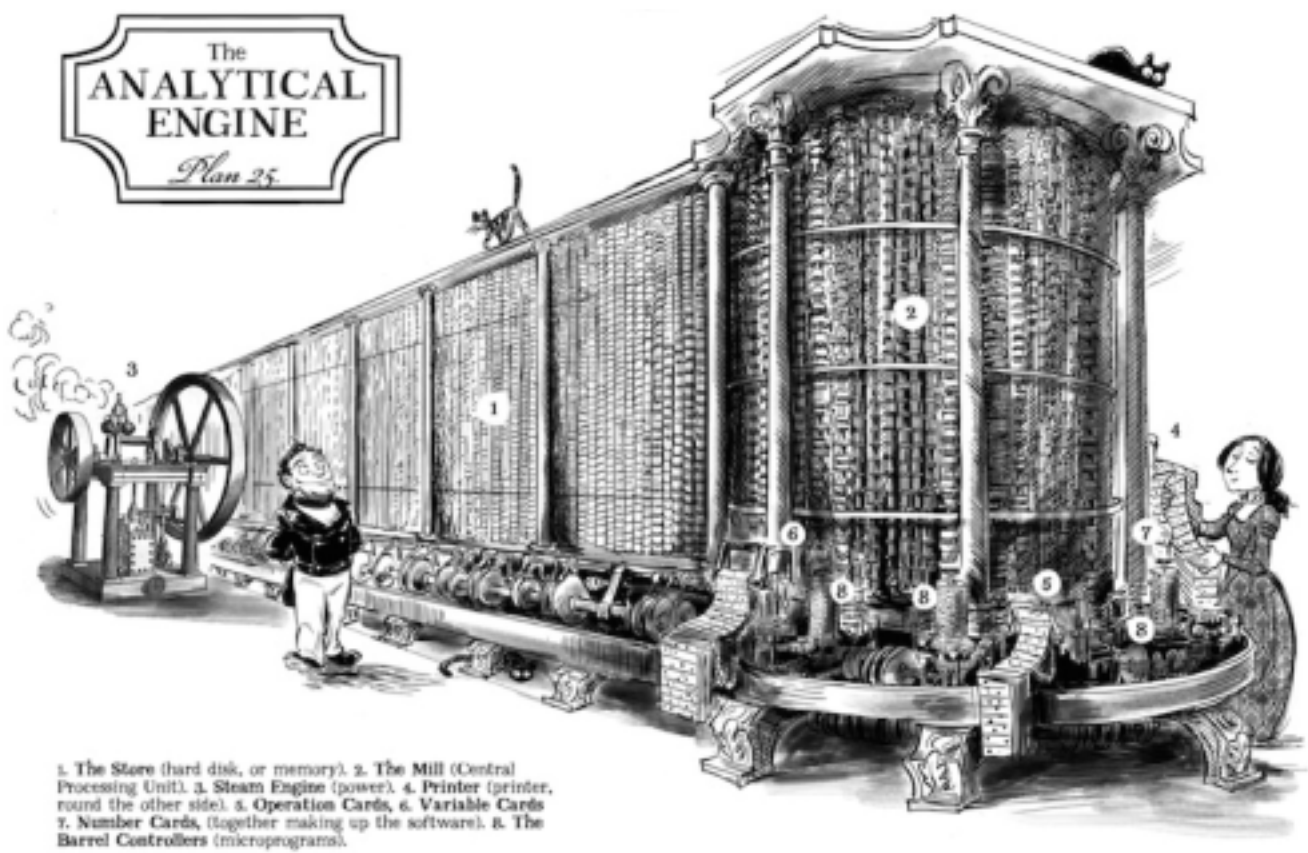
Ada marries William King (later Earl of Lovelace)

- As early as 1834 Mary Somerville reveals to Ada that Charles Babbage is now working on an 'Analytical Engine'.
- In 1835, Ada Byron marries the nobleman the Hon. William King.
- King was created Earl of Lovelace by Queen Victoria in 1838.
- The King family estates were in Somerset and Babbage visited Ada there on several occasions.
- Between 1836 and 1839 Ada had three children (Byron, Anne and Ralph).
- Ada asks Babbage (and others) for help in finding a Maths tutor.
- In 1840 Ada takes up Mathematics again, with Augustus De Morgan.

Charles Babbage and the Analytical Engine

- The Analytical Engine (AE) went beyond the DE in being able to be programmed to calculate anything that could be calculated.
- Although purely mechanical, and to be driven by steam, it anticipated the work of Alan Turing by about 100 years. But it was never built ...
- After 6 years work on the drawings, Babbage gives a seminar on the AE, in Italy, in 1841.
- Luigi Menabrea attends the lecture and publishes a description in a French journal, of Babbage's calculation of Bernoulli Numbers.
- Ada discovers Menabrea's paper and translates it into English. Babbage encourages this work and suggests she adds her own notes.
- These extra notes show Ada's grasp of the AE and some of her truly creative insights as to what it might achieve.

The Analytical Engine (picture courtesy of Sydney Padua)



1. **The Store** (hard disk, or memory). 2. **The Mill** (Central Processing Unit). 3. **Steam Engine** (power). 4. **Printer** (printer, round the other side). 5. **Operation Cards**, 6. **Variable Cards** 7. **Number Cards**, (together making up the software). 8. **The Barrel Controllers** (microprograms).

The Analytical Engine — Part II

- The AE uses Jacquard punch-card technology for data input, memory addressing and operation choice (add, multiply etc).
- Note the three separate sets of cards in Sydney Padua's picture. (This picture is based on Babbage's actual technical drawings).
- Babbage's drawings annotated with his own Mechanical Notation (MN).
- There is an initiative (www.plan28.org) to build the AE.
- If it ever gets built it's likely to be housed at Bletchley Park. Doron Swade tells me, it *won't* be driven by steam ....
- In the early 1840s Ada offered to try raising money to build the AE. The set-up would have had her as CEO, with Babbage as the CTO.
- Despite Babbage's tetchy refusal they managed to stay friends.

Sydney Padua

(Fantasy !) Card Preparation for the Analytical Engine (courtesy Sydney Padua)

Ada Lovelace

Finale

- In late 1840s Babbage and Lovelace worked on joint projects (including a horse-race betting system?).
- Ada's relationships with her mother and husband still difficult.
- Visits Newstead in 1850. Furious row with her mother ensues.
- Health declines rapidly from 1850–1852, Dies Nov. 1852, probably from cervical cancer.
- Ada tells William King in Sept. 1852 "something that greatly upsets him".
- Ada buried alongside her father in Hucknall Parish Church.
- Neither Babbage (her executor) nor her mother attend the funeral. William King does attend — as also does Charles Dickens.

Appraisal

- Alan Turing (in his 1936 work) set out "what can be computed".
- Turing was well aware of Babbage and Lovelace's work.
- Babbage can claim to have written the first test programs for the AE.
- His talents lay in being the designer and the "hardware specialist".
- But Ada can certainly claim a 'world first' as the *computer programmer* for the AE. She acted as the "software specialist",
- In her "Notes" paper she shows true insight, a century ahead of her time, in speculating about the ultimate limits of computing.
- Her poetical inheritance, plus a logical/mathematical training, were ideal for creating a first pioneer of computer software.

Ada Augusta King, Countess of Lovelace