CSE 440H
Winter 2019

Charles Babbage

Early Life

Charles Babbage was born in the year 1791 as one of four children to a banker in London. His love of mathematics was fostered at a library in Holmwood Academy and through several tutors. Babbage was accepted into Cambridge University, where he continued to study mathematics.

Difference Engine No. 1

Babbage drew motivation from numerous amounts of errors in manually calculated tables to design a machine to revolutionize calculation through mechanization. His design, Difference Engine No. 1, was the first complete design to automatically produce a series of error-free polynomial calculations. The process works through the method of finite differences. This method utilizes only addition, which is suitable because multiplication and division are more challenging to mechanically implement.

The completed portion of the Difference Engine No. 1 (1)

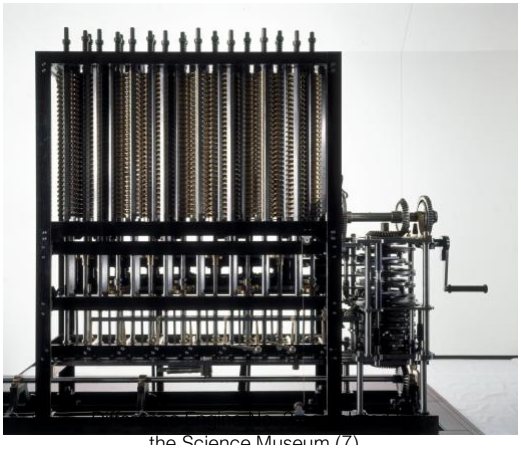
Babbage worked closely with Joseph Clement, a master toolmaker who would make the parts, of which there would be 25,000. The project ultimately ended over a dispute between Babbage and Clement in combination with a lack of government funding. They had completed only one seventh of the calculating section of the machine, which was occasionally demonstrated for guests.

Analytical Engine

Babbage next worked on the Analytical Engine, a general-purpose calculation machine. He developed three iterations of this design. This machine "features many essential principles found in the modern digital computer" (3). For instance, the machine was programmable using punch cards. Ada Lovelace participated in this project and wrote a detailed explanation of how the machine could calculate Bernoulli numbers. Lovelace's contribution is often considered to be the first computer program (6).

Difference Engine No. 2

In 1847, Babbage noticed that he could simplify the designs of his Difference Engine 1, which lead to the design of Difference Engine No. 2. This new design only requires 8,000 parts, about a third of the parts that the first design required. It also prints the results on paper and empresses them into a soft material of which a mold could be made. There was no attempt to build this machine in his lifetime.



the Science Museum (7)

Death & Legacy

Babbage died in the year 1871 at the age of 79, without building his difference engines, but insisting that "future generations would prove his idea was sound" (4). His belief was correct; in 1985, the Science Museum in London decided to create Babbage's Difference Engine No. 2 in hopes of completing it for the 200th anniversary of his birth in 1891. The aim was to determine if

Babbage's machine would have worked and could have successfully completed using the materials available in his time. Doron Swade, Curator of Computing at the Science Museum, led the team as they used 20 of Babbage's detailed design drawings. They were only able to complete the computing portion of the machine by Babbage's 200th anniversary. The rest of the machine, including the printing apparatus, was complete by 2002 and successfully computes as Babbage had hoped. It is now on display in the Science Museum in London. Halves of Babbage's brain are also currently preserved in two museums in London.

Resources

1. Charles Babbage
   https://www.britannica.com/biography/Charles-Babbage
2. Charles Babbage
   http://www.bbc.co.uk/history/historic_figures/babbage_charles.shtml
3. A Brief History
   https://www.computerhistory.org/babbage/history/
4. The Babbage Difference Engine No. 2
   https://www.computerhistory.org/exhibits/babbage/
5. A Modern Sequel
   https://www.computerhistory.org/babbage/modernsequel/
6. How Ada Lovelace's notes on the Analytical Engine created the first computer program
   https://www.sciencefocus.com/future-technology/how-ada-lovelaces-notes-on-the-analytical-engine-created-the-first-computer-program/
7. Difference Engine No.2, designed by Charles Babbage, built by Science Museum
   https://collection.sciencemuseum.org.uk/objects/co526657/difference-engine-no-2-designed-by-charles-babbage-built-by-science-museum-difference-engine