

2.2_Closure

The development of computing relied on the use of number systems.	It is not clear when these began to emerge; one estimate is that this began with the development of the decimal system in India about 1,500 years ago. The earliest computers were people who used decimal numbers to keep track of money transactions. To increase the speed at which they could calculate, they developed the abacus: rows of beads on a frame. The abacus worked on the same principle as the decimal number system. When each row was filled, one bead in the next row was moved to represent the filled row. In this way, large numbers could be added or subtracted very quickly by an experienced user. Advanced users could also use the abacus for multiplication and division. The simplicity and reliability of abacuses means that they are still in common use in many countries today.
Mechanical computing was another important stage in the development of computing.	Mechanical computers worked on the same principles as the abacus, but they used wheels and gears instead of beads to input and calculate numbers, and to show the output. The gears meant that turning one wheel ten times would turn the next wheel once. The Pascaline, invented in France around 1650 to help calculate taxes, was an important example of a mechanical computer. In the early 1800s Charles Babbage used machine computing principles to design a Difference Engine, which could add and subtract large numbers. The machine was not built at the time because the technology was not advanced enough. Babbage also designed an Analytical Engine which also used the same principles, but which was much more advanced. The Analytical Engine is sometimes seen as the beginning of modern computing because it could be programmed to carry out many different kinds of calculations.
Storing information on punched cards was an important transition stage in the development of the computer.	Punched cards were first used with the Jacquard loom to weave very highly decorated cloths. Almost a hundred years later, the Hollerith Company developed a tabulating machine which used information stored on punched cards to process data from the US Census. Data about each household was entered onto the cards by making holes to represent one bit of information about each person, such as whether they were male or female. The cards were processed by pressing a frame of little pins down on the cards. Where there was a hole, an electric current flowed through and incremented a counter. Where there was no hole, the counter did not change. At the end of processing a batch of cards, the outputs could be read from the dials and written down to create a log of the transactions. In this way, the Hollerith Company was able to complete the processing of the US Census in two years. The previous one had taken eight years. The company continued to develop its technologies and later became International Business Machines (IBM), a world leader in computing for many decades.

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Electricity was to play a key role in the further development of the computer.

In World War Two, the British government created a number of computers to help them break codes used by their enemies. One type of computer used the same principles as the mechanical computers but used electricity to turn the wheels. The other type of computer, called Colossus, used vacuum tube valves as switches to carry out the operations. This represented a major step forward, because the operations were no longer carried out by physical movements, but by electronic switches. After the war, many new computers were developed with the same principles of electronic computing as the Colossus. These became known as mainframe computers because of the large frames needed to hold the components.

The next key stage of development was the first transistor, patented by Bell Labs in 1947 in the United States.

The transistor did the same work as the vacuum tube valves, but it used a solid piece of silicon. Compared with the vacuum tube, the transistors were smaller and needed less power. This meant that computers could be reduced in size and would require less power: a major step forward. The invention of transistors led to another invention, one which would completely revolutionise the development of computers: the integrated chip. This was a piece of silicon which contained a whole electronic circuit. The first commercially produced integrated circuits (ICs) became available in 1961, made by the Fairchild Semiconductor Corporation in the US. From then on, computers began to be made using ICs, rather than individual transistors and other components. The microchip had arrived and, with it, computing entered a new era.