

INFORMATION TECHNOLOGY

From the abacus to the modern computer has been an extraordinary journey. Take that journey with us, and meet some great machines. There is the computer that came as a box of parts that you put together yourself, and Deep Blue, the computer that could beat the world's best chess player – sometimes. There is Colossus, that saved lives in the Second World War, and the mobile phones that have helped police to catch criminals.

And as well as machines there are people in this story too – good people and bad, rich and poor, clever and stupid. There are Internet millionaires who have helped people all over the world – and there are virus writers who have done terrible damage to computers in dozens of countries.

Come and discover the stories behind the phone in your pocket, and the computer on your desk.

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1 The computer age

In the nineteenth century, machines changed the world. Suddenly, people could travel more easily and contact one another more quickly. Work changed, too, and many people got jobs in factories. It was the start of the Industrial Age – the age of machines and factories.

The second half of the twentieth century saw the start of the Computer Age. At first, computers were very difficult to use, and only a few people understood them. But soon, computers began to appear in offices and then homes. Today, they are everywhere. Some people still say that they have never used a computer, but they probably use computers every day – they just do not realize it. This is because there are computers in so many things: cars, televisions, radios, washing machines . . .

When the first computers were built in the 1940s and 1950s, they were as big as a room. In 1949, the magazine *Popular Mechanics* made a prediction: ‘One day,’ they said, ‘computers will be really small; in fact, they will weigh less than 1.5 tonnes.’ Now, computer chips can be smaller than the full stop at the end of this sentence. Over the past fifty or sixty years, computers have changed much more than people thought possible.

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2 In the beginning

For thousands of years, humans have needed to count. Families needed to know how many animals, how much food, and how much land they had. This information was important when people wanted to buy and sell things, and also when people died or got married. There were many different ways to count and write down the numbers. The Sumerians had three different ways: they used one for land, one for fruit and vegetables, and one for animals. They could count, but they had no easy way to do calculations.

Around 1900 to 1800 BC, the Babylonians invented a new way to count using place values. This meant that two things decided the size of a number: the digits (the numbers from 0 to 9), and the place where they were put. Today, we still use place values to count. We can write any number using only ten digits: for example, 134 means 1×100 , 3×10 , and 4×1 . Computers also use place values when they do calculations. They only use two digits (0 and 1): for example, 11011 means 1×16 , 1×8 , 0×4 , 1×2 , and 1×1 ($=27$). Without place values, fast calculations are impossible.

Between 1000 and 500 BC, the Babylonians invented the abacus. It used small stones which they put in lines. Each line of stones showed a different place value. To do calculations they moved stones from one line to another. Later, different kinds of abacuses were made. Some of them were made of wood and used coloured balls. It is also possible that the abacus was first invented in China, but nobody really knows.

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Although an abacus can be very fast, it is not really a machine because it does not do calculations automatically. In the seventeenth century, people began to build calculating machines. In 1642, the French mathematician Blaise Pascal made an Arithmetic Machine. He used it to count money. During the next ten years, Pascal made fifty more machines.

In the 1670s, a German called Leibnitz continued Pascal's work and made a better machine. Leibnitz's machine was called the Step Reckoner. It could do much more difficult calculations than Pascal's Arithmetic Machine. Interestingly, Leibnitz's machine only used two digits (0 and 1) for its calculations—just like modern computers! In fact, calculating machines like Leibnitz's Step Reckoner were used for the next three hundred years, until cheap computers began to appear.

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3 The first computers

The word ‘computer’ used to mean a person, not a machine. In the nineteenth century, builders and technicians needed to know the answers to very difficult calculations in order to do their work. They did not have the time to do these calculations themselves, so they bought books of answers. The people who did the calculations and wrote the books were called computers.

In the 1820s, a British mathematician called Charles Babbage invented a machine that did very difficult calculations automatically. He called his machine a Difference Engine. He began to build his machine, but he did not finish it because he had a better idea. (Babbage never finished anything – he always had a better idea and started working on something new!) In fact, more than a hundred and fifty years later, some technicians from the Science Museum in London built Babbage’s Difference Engine. It is still in the museum today. The machine weighs about three tonnes, and it is nearly two metres tall and three metres wide. And it works: in the early 1990s, it did a calculation and gave the right answer – 31 digits long!

Babbage did not finish making the Difference Engine because he started work on a machine called an Analytical Engine. The Analytical Engine could do more: for example, it had a kind of memory. This meant that it was possible to write programs for it, building on each answer and doing more and more difficult calculations. For this reason, the Analytical Engine is often seen as the first real computer.

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However, Babbage never finished building this machine either!

A woman called Ada Lovelace worked with Babbage. She was the daughter of Lord Byron, a famous English writer. Most people did not understand Babbage's ideas, but Ada did, because she was an excellent mathematician. She knew that she could do extraordinary calculations with the Analytical Machine, and she wrote a program for it. Although the machine was never built, Ada Lovelace was still the first computer programmer in the world. In 1979, a modern computer programming language was named ADA.

Babbage's ideas were ahead of their time. Slowly, over

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the next one hundred years, inventors began to build better calculating machines. One of the best inventors of the 1930s was a German called Konrad Zuse. In 1938, he built his first machine, the Z1, in his parents' living room in Berlin. His later machines, the Z3 and Z4, were like modern computers in many ways. They used only two digits (0 and 1) to do all the calculations. Also, Zuse wrote programs for his machines by making holes in old cinema film. When he put the film through the machines, they could 'read' the programs and do very long and difficult calculations.

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