



Mathematical models: from sundials to number engines

John Napier's mathematical creations

Narrator

John Napier, a 16th century Scottish Mathematician. He produced solid models, which became known as Napier's Rods or Napier's Bones.

In this early set the diagonals go down instead of up so the tens come below the units. Each bone is the multiplication table for a single number.

This 20th century replica has a multiplier rod fixed permanently in place. For this multiplication just three rods are needed. The three, the five and the seven. Reading the diagonals across the foreline, gives one, four, two, eight. Add a zero and you've multiplied by 40. Next, read the diagonals across the seven line. Two, four, nine, nine. It takes just one more addition to get the answer.

Napier was also famous for the invention of logarithms. To multiply two numbers, say nine and ten, just add the logs together. The answer is in another bit of the table. The new logarithm corresponds to the number 90. Like the astrolabe 1000 years before, logarithms were much used on ships at sea.

Doron Swade, The Science Museum

The reason tables were important at the time, was that England was a leading marine nation. And ships relied on determining their position at sea from astronomical navigation. That is determining their position from the position of the stars. They had to take readings to do that and had to use tables to perform mathematical calculations to determine their longitude. The problem was that increasingly, people found there were errors in tables and a random selection supposedly in the 1830' and 40's of forty volumes of printed tables revealed 3700 known errors. The problem of course was not the known errors. Those you could compensate for and get correct values. The problem was the insecurity of the unknown errors.

Narrator

Removing these errors became the lifelong task of the 19th century English polymath Charles Babbage.

Doron Swade

The story really starts with John Hershaw. Babbage's lifelong friend, the famous Astronomer. He and Babbage were sitting at the astronomical society in 1821, checking tables. These are tables calculated by hand. And they were quite appalled at the discrepancies between the two sets of tables. The expected value and the calculated value. And Babbage as it were, clasps his hand to his brow and says 'I wish to god these calculations had been executed by steam'.