Turing, Alan Mathison (1912-1954)

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Place: United States of America

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English mathematician who worked in numerical analysis and played a major part in the early development of British computers.

Turing was born in London on 23 June 1912 into a family distinguished by its diplomats and engineers, three of whom had been elected to the Royal Society. He was educated at Sherborne School 1926-31, when he went to King's College, Cambridge to study mathematics. After receiving his BA in 1935, he was elected a fellow of the college on the strength of his paper 'On the Gaussian error function', which won a Smith's prize in mathematics in 1936. The paper was a characteristic example of the headstrong but brilliant nature of Turing's mathematical method throughout his life. He 'discovered' the central limit theorem in utter ignorance of the fact that it had already been discovered and proved.

In 1936 Turing went to the USA for two years to work at Princeton University with the mathematical logician Alonso Church. There he worked on the theory of computation and in 1937 he presented to the London Mathematical Society the paper 'On computable numbers', which was his most famous contribution to mathematics. It constituted a proof that there exist classes of mathematical problems that are not susceptible of solution by fixed and definite processes, that is to say by automatic machines. He returned to King's College in 1938 and after the outbreak of World War II in 1939 was employed by the government Code and Cipher School at Bletchley Park. For his work in designing machines to break the German Enigma codes he was awarded an OBE in 1946.

After the war Turing joined the mathematics division of the National Physical Laboratory at Teddington, where he began immediately to work on the project to design the general computer known as the Automatic Computing Engine, or ACE. Although he left the project in 1947 to return to Cambridge, Turing played an important part in the theoretical work for the production of the ACE; a pilot version of the machine was in operation by 1950 and the mature version (like most computers of the time quickly rendered obsolete by newer machines) by 1957.

In 1948 Turing was appointed reader in the theory of computation at the University of Manchester and was made assistant director of the Manchester Automatic Digital Machine (MADAM). Two years later he published in Mind his trenchant discussion of the arguments against the notion that machines were able to think: 'Computing machinery and intelligence'. His conclusion was that, by his definition of 'thinking', it was possible to make intelligent machines.

In his last years at Manchester much of his work was done at home. All his life he had been concerned with mechanistic interpretations of the natural world and he now devoted himself to attempting to erect a mathematical theory of the chemical basis of organic growth. In this he was partly successful, since he was able to formulate and solve complicated differential equations to express certain examples of symmetry in biology and also certain phenomena such as the shapes of brown and black
patches on cows. On 7 June 1954 he committed suicide by taking poison following a prosecution for a minor homosexual offence.

Turing's place in the history of mathematics rests on the theory of computation which he worked out in 1936 and 1937. He suggested a basic machine that was not a mechanical device, but an abstract concept representing the operation of a computer. Quite simply, it was a paper tape, divided into squares, with a head for erasing, reading, or writing on each square and a mechanism for moving the tape to either the left or the right. The tape could have instructions already written on it and it was of either limited or unlimited length. So Turing's concept contained, in embryonic form, the now familiar notions of program, input, output, and - by implication - the processing of information. Turing machines were therefore of two types: machines designed to carry out a specific function and process information in a specified way and machines of a universal function capable of carrying out any procedure.

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