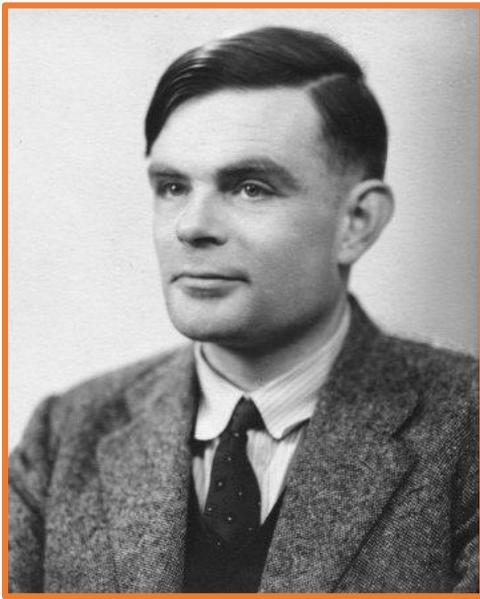


An Introduction to: Alan Turing

Alan Mathison Turing (1912-1954), mathematician, computer scientist, cryptanalyst, philosopher and theoretical biologist gives his name to Turing House at The John Warner School. Turing House represents the academic disciplines of *mathematics and technology* and the school value of *participation*.



Summary of Life

A child genius

It was obvious from an early age that Alan Turing, the son of Julius (a clergyman) and Ethel Turing, was very intelligent.

Turing enjoyed his time at school. In 1926 on his first day at Sherborne School in Dorset, Turing had to cycle 60 miles on his own to get to school because all other transport had been stopped due to The General Strike.

Turing showed an early aptitude and interest in science and mathematics, solving complex problems and making sense of the theories being published by Albert Einstein.

University and computability

Turing studied at King's College, Cambridge between 1931 and 1934 where he was awarded a first-class honours degree in mathematics. His dissertation published in 1935 was so strong that he was elected as a fellow of King's College and his 1936 paper "On Computable Numbers, with an Application to the Entscheidungsproblem (decision problem)" detailed how his 'universal computing machine' would be capable of performing any conceivable mathematical computation if that problem were represented as an algorithm. Many believe that the concept of the modern computer derives from Turing's paper, written at the age of just 23.

Cryptanalysis

Between 1936 and 1938 Turing studied mathematics and cryptology (the study of codes) at The Institute for Advanced Study in Princeton, New Jersey. He returned to Cambridge in 1938 and started working for the Government Code and Cypher School (GCCS), a code-breaking organisation. Before the start of the war, Turing and Dilly Knox had already started to work on the cryptanalysis of the Enigma Machine – a cipher machine developed in Germany after World War One.

Bletchley Park and Bombe

The GCCS was based at Bletchley Park (near modern Milton Keynes) during the Second World War (1939-45). During this period Turing made major advances in cryptanalysis and created an electromechanical machine called 'Bombe' which could break the Enigma Code which was being used to communicate military messages. The first Bombe was installed on 18 March 1940.

While the Bombe was successful in reducing the number of shipping losses in the Atlantic, the Germans were also constantly making adjustments to their Enigma machines, frustrating Turing and his colleagues in their work. They decided to write to Winston Churchill explaining that they could

make a huge impact on the war with very little in terms of resources. Churchill gave this the highest priority and Bletchley Park enjoyed an increase in resources and assistance until the end of the war.

Breaking the Enigma Code

As a result of the letter to Churchill, over 200 Bombe machines were installed at Bletchley during the war. These machines, along with other code-breaking devices that Turing and his team in Hut 8 at Bletchley helped to develop, were instrumental in the Allies defeat of Nazi Germany in World War Two. Some historians have calculated that without this contribution the war could have been prolonged by another two years with the potential loss of a further two million more lives.

Breaking the Enigma Codes was especially important in the Battle of the Atlantic where German submarines (U-Boats) had been causing huge losses to allied ships. Deciphering the codes gave advanced warning of German attacks and ultimately helped win this crucial battle at sea. Defeat in the Atlantic would most probably have resulted in defeat overall.

Early computers

After the war, Turing lived in London and Manchester continuing work on the development of early computers. He helped develop the Manchester Mark 1, one of the earliest stored-program computers. He also, through his continued interest in abstract mathematics, addressed the problem of 'artificial intelligence', proposing an experiment called 'The Turing Test' which would define a standard for a machine to be called intelligent. A version of the Turing test, called CAPTCHA, is used on the internet to determine whether a user is human or a computer.



Mathematical biology

Turing turned towards mathematical biology in the last years of his life, publishing 'The Chemical Basis for Morphogenesis' in 1952. Morphogenesis is the development of patterns and shapes in biological forms and he was especially interested in the existence of Fibonacci numbers in plant structures. Ironically the speed of his work was restricted by the limited capacity of computers at the time.

Conviction for indecency

Turing's 'first love' was most probably a fellow pupil at Sherborne School, Christopher Morcom. Turing proposed to Joan Clarke, a fellow mathematician and cryptanalyst at Bletchley Park in 1941, but their relationship ended when he admitted his homosexuality to her, even though this didn't appear to be a concern for her.

By the early 1950s, homosexual acts were still illegal in the UK (this would only start to change in 1967) and Turing had started a relationship with Arnold Murray while living in Manchester. During an investigation into a burglary at his house, Turing acknowledged that he was having a relationship

with Murray. Turing was charged with gross indecency and convicted in March 1952 leading to chemical injections which were designed to reduce his libido. He also had his security clearance removed and was barred from continuing his work on cryptographic consultancy and denied entry to the United States.

Death

Turing was found dead on 8 June 1954 at the age of 41. The official cause of death was cyanide poisoning and it is largely believed that he took his own life, although other theories exist.

Contribution and Significance

A petition was started in August 2009 by British computer programmer John Graham-Cumming urging the government to apologise for the persecution of Turing as a homosexual. After more than 30,000 people signed the petition, Prime Minister Gordon Brown released a statement that described the treatment of Turing as “appalling”, adding “on behalf of the British government, and all those who live freely thanks to Alan’s work I am proud to say: we’re sorry, you deserved so much better.”



In 2013 following a similar campaign, Turing’s conviction for gross indecency was pardoned by the Queen after passing through both Houses of Parliament – only the fourth time the Queen has issued such a pardon. In 2016 the ‘Alan Turing Law’ was introduced which allowed other men cautioned or convicted under historical homosexual laws to be pardoned.

In 2019 Turing was voted as the “Greatest Person” in the BBC series *Icons*. His advocate in the series, Chris Packham said, “The Nazi Enigma machines were no match for his cunning and wit” but stated that he received no thanks or accolades at the time but instead was betrayed because he was also autistic and gay. His suicide, according to Packham, is “an unforgiving tattoo on humanity’s conscience.”

Turing’s life work was phenomenal. He potentially saved millions of lives by breaking the Enigma Code with his colleagues at Bletchley Park. His contributions to mathematics and technology are still recognised in the very current issue of artificial intelligence and his legacy exists in the mobile phones we carry around in our pockets.

Great thinkers like Turing, hold the key to unlocking humanity’s greatest challenges – we should cherish their contributions as well as questioning why our society allowed prejudice and persecution to bring those contributions to an unwelcome end.