Biography of an Influential Software Engineer: Alan Turing

Introduction:

Alan Turing (1912 – 1954) was an English mathematician, cryptologist and computer scientist, commonly thought of as the "father of computer science". The Turing machine, created by Turing, can be considered the model of general purpose computers. He was a man before his time, as he met an unfortunate death at a young age, before he really fulfilled his potential as a computer scientist.

Early Life:

Alan Turing's story was not one of family or tradition but one of a quiet and autonomous mind. From his parents, Turing did not inherit much intelligence in the fields of mathematics and science, apart from perhaps the engineering base of his mother's family, in particular applied science.

Turing's particular excellence in mathematics wasn't nurtured in his public school, Sherborne School, situated in the centre of Sherborne, Dorset. The school primarily focused on the classics, such as Latin, and so his excellence in number related subjects wasn't put to great use until college. The only challenges he had intellectually were with another pupil of Sherborne, Christopher Morcom. He gave Turing the sort of companionship he had been lacking and introduced him to cryptology. The friendship ended with the death of Morcom in February 1930.

After Sherborne, Turing enrolled at King's College in Cambridge, where he could finally express his love for mathematics and science, and really excel in his field. During his time at King's College was when his homosexuality began to become a definitive part of his identity. He graduated with a distinguished degree in 1934, which was shortly followed by a Fellowship of King's College in 1935, for work on probability theory.

The Entscheidungsproblem:

An integral part of why Turing became so important to computer science is his work on the Entscheidungsproblem, or Decision Problem. Mathematicians sought an effective method for solving the fundamental problem of determining exactly which mathematical statements are provable within a given formal mathematical system and which are not. Turing's work showed that there is no such effective method to solve these computational problems. It was during his work on the Decision Problem that he invented the Turing Machine, an abstract computing machine that encapsulates the fundamental logical principles of the digital computer.

Bletchley Park:

Alan Turing was made famous to the public during the 2014 film "The Imitation Game", where he was portrayed by Benedict Cumberbatch. The central focus of the film is of Turing's influential work during World War 2, where he was a leading participant in wartime code-breaking, namely trying to break the Enigma machine (seen here on the right), a type of enciphering machine used by the German armed forces to send messages securely. The standard Enigma machine had over 150 million, million, million settings and so therefore required a high computational device to crack the daily setting

Turing worked for the British wartime cryptanalytic headquarters. There had already been an existing machine capable of deciphering the German messages, but worked far too slowly, and as the Germans were now changing the cipher daily, the British needed a faster way to decipher the messages. Turing took the ideas of the Polish, where they were embodied in a machine called a Bomba, and generalized it into a far more powerful device, capable of breaking any Enigma message, where a small portion of plaintext could be guessed correctly. This allowed for Britain's food and supplies to be shipped across the Atlantic without the worry of running into German U-boats

The machine that was created by Turing and another fellow code-breaker at Bletchley Park, Gordon Welchman, was named the Bombe (seen on the right), in honor of the earlier Polish code breaking machine. Although it is impossible to exactly say what impact Turing had on the second world war, some military historians estimate that the war would have continued for at least another two years and two million more lives would have been lost as a result.

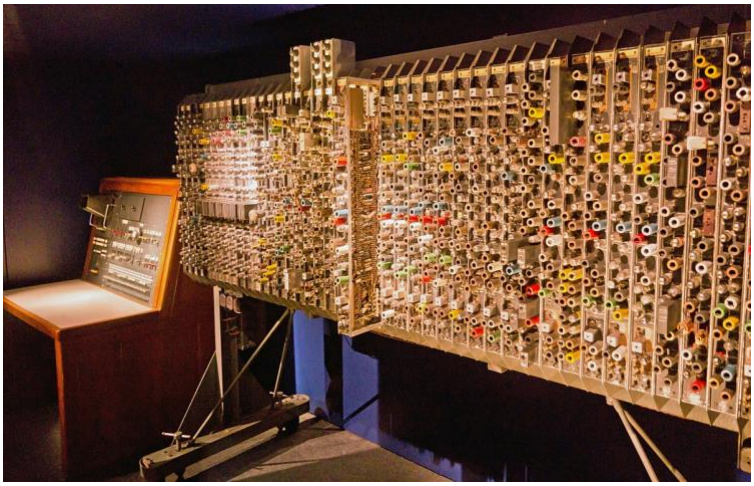
Turing's hand in aiding the war effort didn't finish in Bletchley Park. As the United States were becoming a more prominent force in the war, Turing was flown across the Atlantic in November 1942, for highest-level liaison not only on the desperate U-boat Enigma crisis, but on the electronic encipherment of speech signals between Roosevelt and Churchill.

Automatic Computing Engine:

Towards the end of the war, Turing was in possession almost uniquely of three key ideas that would form the basis of his next machine.

- He had already worked on a machine that could simulate a Turing machine, called the Universal Turing machine.
- He had worked with speedy and reliable electronic technology, thus giving him the confidence that machines could carry out operations as fast and as competently as humans were doing at the time.
- During his work on the decision problem, he came to terms with inefficiency in designing different machines for different logical processes. He knew that a single machine would have to be able to compute multiple different computations

Turing was captivated by the potential of the computer he had conceived. Although his earlier work on the universal Turing machine had limitations, this spurred his desire to create a greater machine, one which would fulfil his dreams of a machine not unlike a human brain.



After the War, Turing went on to invent and improve technologies that sparked a technological revolution that he would never witness unfortunately. Not only did he develop the two of the first modern computers, he also pioneered what we know today as artificial intelligence. Turing led the design work for the Automatic Computing Engine, or ACE (seen above), and ultimately created a groundbreaking blueprint for store-program computers.

Turing knew that superior technology would soon make his design outdated, so he therefore concentrated on making his machine fast in every sense. This meant, in contrast to his American counterparts, he implemented arithmetical functions by programming, rather than building in electronic components. His design of the ACE was the first complete specification of an electric stored-program all-purpose digital computer. The concept of the ACE is the model which tech corporations have used for years. His use of programs within his machines, as opposed to hardware components was vastly ahead of other pioneers in the field. Turing projected a computer being able to switch seamlessly between numerical work, algebra and even playing chess. In 1947 his Abbreviated Code Instructions marked the beginning of programming languages

Later Life:

Turing went on to hold high-ranking positions in the mathematics department and later the computing laboratory at the University of Manchester in the late 1940s. He was elected to Fellowship of the Royal Society in July 1951, for the work done fifteen years before, a high honour, yet his life was about to become very hard.

Turing was gay in a time when it was illegal to be gay. In 1952, Turing's home was burglarized, and a subsequent police investigation turned up evidence that Turing was having a homosexual relationship with a 19 year old man. He was convicted of "gross indecency" – that is to say homosexuality, and was given the choice of spending a year in prison, or allowing himself to be treated with an experimental hormonal therapy. He accepted, for a period of a year, a series of injections of oestrogen intended to neutralize his libido. He continued his work but now that he had a criminal record, he would never be able to work again with the British government's postwar code-breaking centre.

Turing died on June 7, 1954, at the age of 42. Following a postmortem exam, it was determined that the cause of death was cyanide poisoning. The remains of an apple were

found next to the body, yet there were no apple parts found in his stomach. It is still unclear as to whether this was a suicide or merely an accident, as he was using cyanide as part of a chemistry experiment.

Commendations:

In 2009, the then-prime minister Gordon Brown made a statement, on behalf of the British government, which posthumously apologised for the way Turing was treated after the war. In 2013, Queen Elizabeth II posthumously granted Turing a rare royal pardon almost 60 years after he committed suicide.

Conclusion:

Without Alan Turing, who knows where the world of computer science would be today. He was an incredibly influential engineer in the makings of what we now know today as computers.

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