Alan Turing

While addressing a problem in the arcane field of mathematical logic, he imagined a machine that could mimic human reasoning. Sound familiar?

If all Alan Turing had done was answer, in the negative, a vexing question in the arcane realm of mathematical logic, few nonspecialists today would have any reason to remember him. But the method Turing used to show that certain propositions in a closed logical system cannot be proved within that system—a corollary to the proof that made Kurt Godel famous—had enormous consequences in the world at large. For what this eccentric young Cambridge don did was to dream up an imaginary machine—a fairly simple typewriter-like contraption capable somehow of scanning, or reading, instructions encoded on a tape of theoretically infinite length. As the scanner moved from one square of the tape to the next—responding to the sequential commands and modifying its mechanical response if so ordered—the output of such a process, Turing demonstrated, could replicate logical human thought.

The device in this inspired mind-experiment quickly acquired a name: the Turing machine. And so did another of Turing's insights. Since the instructions on the tape governed the behavior of the machine, by changing those instructions, one could induce the machine to perform the functions of all such machines. In other words, depending on the tape it scanned, the same machine could calculate numbers or play chess or do anything else of a comparable nature. Hence his device acquired a new and even grander name: the Universal Turing Machine.

Does this concept—a fairly rudimentary assemblage of hardware performing prodigious and multifaceted tasks according to the dictates of the instructions fed to it—sound familiar? It certainly didn't in 1937, when Turing's seminal paper, "On Computable Numbers, with an Application to the Entscheidungsproblem," appeared in "Proceedings of the London Mathematical Society." Turing's thoughts were recognized by the few readers capable of understanding them as theoretically interesting, even provocative. But no one recognized that Turing's machine provided a blueprint for what would eventually become the electronic digital computer.

So many ideas and technological advances converged to create the modern computer that it is foolhardy to give one person the credit for inventing it. But the fact remains that everyone who taps at a keyboard, opening a spreadsheet or a word-processing program, is working on an incarnation of a Turing machine.

Turing's 1937 paper changed the direction of his life and embroiled a shy and vulnerable man ever more directly in the affairs of the world outside, ultimately with tragic consequences.

Alan Mathison Turing was born in London in 1912, the second of his parents' two sons. His father was a member of the British civil service in India, an environment that his mother considered unsuitable for her boys. So John and Alan Turing spent their childhood in foster households in England, separated from their parents except for occasional visits back home. Alan's loneliness during this period may have inspired his lifelong interest in the operations of the human mind, how it can create a world when the world it is given proves barren or unsatisfactory.

At 13 he enrolled at the Sherbourne School in Dorset and there showed a flair for mathematics, even if his papers were criticized for being "dirty," i.e., messy. Turing recognized his homosexuality while at Sherbourne and fell in love, albeit undeclared, with another boy at the school, who suddenly died of bovine tuberculosis. This loss shattered Turing's religious faith and led him into atheism and the conviction that all phenomena must have materialistic explanations. There was no soul in the machine nor any mind behind a brain. But how, then, did thought and consciousness arise?

After twice failing to win a fellowship at the University of Cambridge's Trinity College, a lodestar at the time for mathematicians from around the world, Turing received a fellowship from King's College, Cambridge. King's, under the guidance of such luminaries as John Maynard Keynes and E.M. Forster, provided a remarkably free and tolerant environment for Turing, who thrived there even though he was not considered quite elegant enough to be initiated into King's inner circles. When he completed his degree requirements, Turing was invited to remain at King's as a tutor. And there he might happily have stayed, pottering about with problems in mathematical logic, had not his invention of the Turing machine and World War II intervened.

Turing, on the basis of his published work, was recruited to serve in the Government Code and Cypher School, located in a Victorian mansion called Bletchley Park in Buckinghamshire. The task of all those so assembled—mathematicians, chess champions, Egyptologists, whoever might have something to contribute about the possible permutations of formal systems—was to break the Enigma codes used by the Nazis in communications between headquarters and troops. Because of secrecy restrictions, Turing's role in this enterprise was not acknowledged until long after his death. And like the invention of the computer, the work done by the Bletchley Park crew was very much a team effort. But it is now known that Turing played a crucial role in designing a primitive, computer-like machine that could decipher at high speed Nazi codes to U-boats in the North Atlantic.

After the war, Turing returned to Cambridge, hoping to pick up the quiet academic life he had intended. But the newly created mathematics division of the British National Physical Laboratory offered him the opportunity to create an actual Turing machine, the ACE or Automatic Computing Engine, and Turing accepted. What he discovered, unfortunately, was that the emergency spirit that had short-circuited so many problems at Bletchley Park during the war had dissipated. Bureaucracy, red tape and interminable delays once again were the order of the day. Finding most of his suggestions dismissed, ignored or overruled, Turing eventually left the NPL for another stay at Cambridge and then accepted an offer from the University of Manchester where another computer was being constructed along the lines he had suggested back in 1937.

Since his original paper, Turing had considerably broadened his thoughts on thinking machines. He now proposed the idea that a machine could learn from and thus modify its own instructions. In a famous 1950 article in the British philosophical journal Mind, Turing proposed what he called an "imitation test," later called the "Turing test." Imagine an interrogator in a closed room hooked up in some manner with two subjects, one human and the other a computer. If the questioner cannot determine by the responses to queries posed to them which is the human and which the computer, then the computer can be said to be "thinking" as well as the human.

Turing remains a hero to proponents of artificial intelligence in part because of his blithe assumption of a rosy future: "One day ladies will take their computers for walks in the park and tell each other, 'My little computer said such a funny thing this morning!'"

Unfortunately, reality caught up with Turing well before his vision would, if ever, be realized. In Manchester, he told police investigating a robbery at his house that he was having "an affair" with a man who was probably known to the burglar. Always frank about his sexual orientation, Turing this time got himself into real trouble. Homosexual relations were still a felony in Britain, and Turing was tried and convicted of "gross indecency" in 1952. He was spared prison but subjected to injections of female hormones intended to dampen his lust. "I'm growing breasts!" Turing told a friend. On June 7, 1954, he committed suicide by eating an apple laced with cyanide. He was 41.

TIME senior writer Paul Gray writes on a Turing machine

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According to Time Magazine

People who overthrew our inherited ideas about logic, language, learning, mathematics, economics, and even space and time

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Tim Berners-Lee
Rachel Carson
Francis Crick & James Watson
Albert Einstein
Philo Farnsworth
Enrico Fermi
Alexander Fleming
Sigmund Freud
Robert Goddard
Kurt Gödel
Edwin Hubble
John Maynard Keynes
Louis, Mary & Richard Leakey
Jean Piaget
Jonas Salk
William Shockley
Alan Turing
Ludwig Wittgenstein
Wilbur & Orville Wright