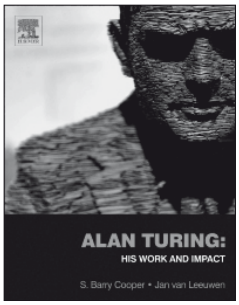
Book Reviews



Alan Turing
His Work and Impact

TS. Barry Cooper and
J. van Leeuwen, Editors

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Reviewer: Jean-Paul Allouche

A hundred years after his birth, who – even without being a mathematician or a computer scientist – has never heard the name Alan Turing? But who can explain his work in detail or at least describe all the directions of his work? The book under review is a monumental (almost 1000 pages) tribute to Alan Turing, which gathers together texts by Turing as well as comments and papers by 70 contributors. The "tour de force" is that it is quite possible, and even recommended, to read the book not linearly but by selecting pieces randomly, just for fun. To quote the introduction: "So we have not tried to reproduce the style of an archive, rather aiming at a book to be read, to be dipped into for pure pleasure, to be enjoyed and browsed in office, on train or bus, or accompanying the proposer to some distant scientific meeting or place of relaxation." Before trying to describe the contents more precisely, we would like to underline, as the authors of the book did, the enormous influence of Turing in many various fields. The regularly updated URL http://ftp.math.utah.edu/pub//bibnet/authors/t/turing-alan-mathison.html shows a bibliography of his work and related works.

The book is divided into four parts. The first of these parts, entitled 'How do we compute? Can we prove?' contains in particular the extraordinarily influential paper 'On Computable Numbers, with an Application to the *Entscheidungsproblem*'. Almost everybody has heard the expression 'Turing machine'. Now the question of whether or not Turing is the real father of computers can be addressed by typing the words 'Turing machine' into a search engine on a … computer, and looking at the approximately 2,200,000 answers. This first part of the book ends with a text by Turing 'The reform of mathematical notation and phraseology', where Turing indicates that his statement of the "type principle" was suggested by lectures of Wittgenstein.

The next part, entitled 'Hiding and unhiding information: cryptology, complexity and number theory', speaks of course of Turing cracking (or seriously contributing to cracking) the *Enigma* (the most important cipher machine(s) used by the Germans during World War II). But this part also contains, in particular, two number-theoretic works of Turing *Some calculations of the Riemann Zeta-function* and (with S. Skewes) *On a theorem of Littlewood*, where the authors prove the existence of some real x greater than 2 and less than a double exponential constant such that $\pi(x) > \mathrm{li}\,(x)$ (where, as usual, $\pi(x)$ is the number of primes less than x and $\mathrm{li}\,(x)$ is the logarithmic integral of x, i.e. the principal value of $\int_0^x \mathrm{d}\,t/\log t$).

Readers interested in the question of intelligent computers or, more precisely, in the possible links between (human) intelligence and "intelligent" computers will be delighted to read the third part 'Building a brain: intelligent machines, practice and theory'. This is, of course, a vast field, whose most popular item is the so-called Turing test: a test to show the ability of a machine to have (or to simulate?) intelligent human behaviour or, more precisely, to have behaviour that cannot be distinguished from an intelligent human.

The last part is entitled 'The mathematics of emergence: the mysteries of morphogenesis'. It is devoted to the important work of Turing in biology. The main points are Turing's 1952 paper 'The chemical basis of morphogenesis' and his work (manuscripts and lectures) on the morphogen theory of phyllotaxis.

Full of enthusiasm for this book, I tried to find at least one criticism. This was not that easy! Possibly a very minor point is that I dislike the word "impact" in the title (Webster: Latin *impactus* p.p. of *impingere*, to push, strike against. See "Impinge"). The deep and longstanding influence of Turing deserves a term better and more elegant than this fashionable and somewhat hollow word.

My short description of this exciting book is probably frustrating, and for two reasons: firstly, because it only scratches the surface of Turing's work; secondly, because it does not (and cannot) give an idea of the extremely interesting contributions of the 70 contributors. We hope that this possible frustration will urge the readers of this brief review to read the book. We are sure that they will definitely enjoy it. It is quite possible that they will also find there ideas or flashes of inspiration for their own research.