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Georges Ifrah
The Universal History of Computing.
From the Abacus to the Quantum Computers
Translated from French and with notes by E.F. Harding, assisted by Sophie Wood, Ian Monk, Elizabeth Clegg and Guido Waldman.
New York-Chichester-Weinheim-Brisbane-Singapore-Toronto: John Wiley & Sons, Inc., 2000
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REVIEW

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The book under review is a sequel to the author's 1999 book[1]. It consists of two parts. Part One is a summary of the major results of the 1999 book and includes a chronology recapitulating in a mere eighteen pages what this earlier book covered in over 600 pages. Next there are about forty tables in which the world's many different number systems are classified into three basic types: additive, hybrid and positional. Unfortunately, there are many mistakes repeated from the 1999 book (the description of mistakes can be found, *e.g.*, in the review by Joseph Dauben published in *Notices of the American Mathematical Society* vol. 49, No 1 (2000), 32-38, where he mentions that a group of French academics discussed the mistakes in two issues of the *Bulletin de l'Association des Professeurs de Mathématiques de l'Enseignement Publique* in 1995 after the French original had been published).

Also in Part One one finds chapters entitled, "From the Particular to the General: Arithmetic Leads to Algebra", "From Calculation to Calculus", and "Binary Arithmetic and Other Non-decimal Systems".

Part Two consists of three chapters: "From Clockwork Calculator to Computer: The History of Automatic Calculation", "What is a Computer?", and "Information, the New Universal Dimension". These chapters address the main subject of the volume under review. The first

[1] *The Universal History of Numbers. From Prehistory to the Invention of the Computer*, translated from the French by David Bellos, E.F. Harding, Sophie Wood and Ian Monk, New York, John Wiley & Sons, 1999, xxii + 633 pages.

chapter begins with a description of the evolution of computers starting from the calculating machine designed by the German astronomer Wilhelm Schickard in 1623, and ends with John von Neumann, the first generation of true computers, and pocket calculators. What is here is only a listing of the names of people and the names of machines usually without any interpretation or analysis of the significance of the items. The next chapter contains material about what a computer is, and the last chapter is an attempt to tie everything together and to show the perspectives. Unfortunately, this is nothing more than a collection of views of such authors as: Molière, d'Alembert, Gonseth, Bergson, Piaget, Ellul, Brunschvicg, Comte, Hadamard, Poincaré, Bachelard, Blondel, Lévi-Strauss, Rabelais. One finds here neither a critical analysis nor a discussion of the recent work of the past decade on the subject of information. What is amazing is that the Internet is not even mentioned here—although the translators do add notes with reference to information available on the World Wide Web.

There are two remarkable and negative features of Ifrah's book. First, it is not a universal history of computing as the title says. His account provided stops some thirty years ago with the introduction of microprocessors in the mid-1970s. There is no hint of quantum computers (though the subtitle says: From the Abacus to the Quantum Computer), no mention of Japanese efforts related to supercomputers, and almost nothing on the importance of software in the computer revolution. Secondly, in many places the translators attempted to add the needed or omitted material and to offer more information. One finds this early on page two, and continues to the end of the book. But even these additions cannot rescue the book. There are just too many mistakes and errors of omission of the most recent research and scholarship.

Then too in many places the author offers only a listing of names, dates and historical facts instead of giving a deeper analysis and interpretation. As an example, consider the list on page 85 where he is talking about the contribution of Western mathematicians and logicians to the development of contemporary mathematics and logic. Here the author provides only a list of twenty two names—nothing more about them can be found in the book, and nothing is listed for them in the index. Ifrah does not have a good understanding of set theory and its history—see for example his remarks on axiomatic set theory which, according to him, can be found already by Cantor (page 263) or his remarks about Dedekind and Cantor concerning the set of reals and its cardinality (page 84). In fact Cantor did not propose axioms for set theory, just the opposite, he never treated his theory axiomatically, it always remained to him a naive theory. On the other hand Ifrah quotes Dedekind to the effect that "the straight line is infinitely richer in points than the set of algebraic numbers is" (page 84). This is a misquotation. Dedekind did not refer to algebraic numbers but rather to the set of rational numbers. He had no idea how much "richer" the set of reals was. It was Cantor who proved that the set of real numbers is nondenumerably infinite.

The book under review contains some interesting material and the reader can find some important information. But he/she should be warned—one can also find misleading information. The book must be read very critically.

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