

# RECKONERS

THE PREHISTORY OF THE DIGITAL  
COMPUTER, FROM RELAYS TO THE  
STORED PROGRAM CONCEPT,

1935–1945

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Contributions to the Study of Computer Science, Number 1

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GREENWOOD PRESS

WESTPORT, CONNECTICUT • LONDON, ENGLAND

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# Preface

Human agents will be referred to as “operators” to distinguish them from “computers” (machines).

—George Stibitz, 1945

The modern digital computer was invented between 1935 and 1945. That was the decade when the first machines that could be called true digital computers were put together. This book tells the story of that invention by looking at specific events of the 1930’s and 1940’s that show the computer taking its modern form.

Before 1935 there were machines that could perform calculations or otherwise manipulate information, but they were neither automatic nor general in capabilities. They were not computers. In the 1930’s the word *computer* meant a human being who calculated with the aid of a calculating machine. After 1945 the word meant a machine which did that. From that time on computers have continued to evolve and improve, becoming dramatically cheaper and smaller, but their design has not really changed. So the story of what happened in that ten-year period will reveal quite a bit of the entire history of the computer as it is known today.

I have chosen four projects from that era that best illustrate how the computer was invented. These are by no means all that happened, but they are representative of the kinds of activities going on.

The first is the set of electromechanical computers built in Germany by Konrad Zuse, who because of the war had no knowledge of similar activities in America and England. His independent line of work makes for an interesting and self-contained case study of just how one goes about building a computer from scratch.

The second is the Harvard Mark I, built by Professor Howard Aiken and first shown to the public in 1944. This machine was one of the first truly large-scale projects, and because it was well publicized it served notice to the world that the computer age had dawned.

The third project is the series of relay computers built by George Stibitz of the Bell Telephone Laboratories between 1939 and 1946. These machines repre-

sented the best that could be done with electromechanical devices (telephone relays), and as such mark the end of that phase of invention and the beginning of another.

The final project is the ENIAC, the world's first working electronic numerical computer, using vacuum tubes for its computing elements, and operating at the speed of light. With its completion in late 1945 all of the pieces of the modern computer were present: automatic control, internal storage of information, and very high speed.

What remained to be done after 1945 was to put those pieces together in a practical and coherent way. From the experience of building and using those machines there came a notion of what a computer *ought* to look like. The old definition of a computer gave way to the modern one: a machine capable of manipulating and storing many types of information at high speeds and in a general and flexible way. How this notion came about, and especially why the notion of storing the computer's program of instructions in the same internal memory as its data gained favor, are also examined.

This book has a dual purpose. The first is to recount the history of the computer, emphasizing the crucial decade between 1935 and 1945 but including earlier events and more recent trends as well. The second is to explain in simple terms the fundamentals of how those computers worked. Computing has certainly changed since 1945, but the basic concepts have not; I feel that it is easier to grasp these concepts as they were present in earlier, slower, and much simpler computers. I have included brief explanations of some of these concepts in the text of the book; a glossary at the end gives short definitions of many terms of modern computing jargon.

That the computer is having a profound effect on modern life is hardly at issue. Just how and why such a profound change in our society is happening because of computers can better be understood with a grasp of how this technology emerged.

I wish to thank the following persons and institutions for their help with the researching and writing of this book: the Society for Mathematics and Data Processing, Bonn; the Charles Babbage Institute, Minneapolis; the Linda Hall Library, Kansas City, Mo.; the Baker Library, Dartmouth College; and Professors Jerry Stannard, Walter Sedelow, and Forrest Berghorn of the University of Kansas. Konrad Zuse, Helmut Schreyer, and George Stibitz supplied me with personal archival materials and criticized portions of the manuscript. I also wish to thank Bill Aspray, Gwen Bell, and Nancy Stern, who also read portions of the manuscript and gave me helpful advice. Any errors or statements of opinion are of course my own.