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Preface

The history of data processing is now an established field for study, joining with a contemporary fascination for events taking place in the area of computing and the information processing industry. Just in the past ten years the number of publications on the subject has exploded. Publications are coming from vendors and users of information processing products; from journalists writing biographies, company exposés, or surveys of the industry; and from participants in the industry and professionally trained historians. Increasingly, those viewing the industry are taking its past into consideration. That development should be of no surprise. The portion of the data processing industry that has relied on computers dates back some forty years, and its predecessor—the office appliance industry—came into existence a century ago. In addition, computers are being put into the hands of millions of users who did not have access to this technology a decade ago, thanks to the introduction of micro-computers. That exposure to computing has encouraged growing interest in the general subject.

The purpose of this bibliographic guide is to serve as a general introduction to the literature of the industry. Cast in historical terms, it provides an annotated list of published materials describing the history of the industry as well as items of importance to those interested in the general topic. It includes listings of current publications of relevance to those focusing on today’s events, such as computer magazines. There are also citations of a strictly historical nature. The bibliography includes many historically important contemporary publications, such as those describing hardware and software of past decades, seminal technical papers (some dating back more than a half century), application briefs, and industry surveys. I included contemporary material on punch card technology and its use, since tabulating equipment was a source of technology inspiring the emergence of the computer and later, an incentive for early users of the new machines. The volume also includes developments of the 1970s and 1980s, such as the expanding role of Japan and other countries in the industry and the emergence of microcomputers.

In 1983 I published a short Bibliography on the history of computers (An Annotated Bibliography on the History of Data Processing, released by Greenwood Press). That volume was an
initial survey of materials focused on history and included only minimal references to technical or contemporary materials. This second publication is quite different in a number of ways. It is much broader in scope, reflecting the changing needs of those looking at the subject. Although this second project encompasses all the titles listed in the original book with corrections, those titles represent a minority of the entries. Historical surveys missed the first time are included here as well as those that have appeared since the first volume. The number of chapters has increased from four to nine and the number of subheadings from 63 to nearly 100. The number of titles has more than tripled. The material has been reorganized and new subheadings added to reflect emerging topics and the growth of literature on particular aspects of the industry. Thus, for example, as devices or organizations appeared in the literature, these were grouped in new sections. Each chapter is introduced with a short review of historically important issues, comments on the literature and on the challenges awaiting those interested in understanding the industry and its technology. As an attempt to keep the bibliography's usefulness current, the reader is guided to ongoing publications for new references that might appear after the publication of this book. Finally, the index has been greatly expanded to include subject references as well as author citations. As in the earlier work, all bibliographic citations are annotated with a brief description of either the work's contents or on its historical importance.

The nature of the literature has been changing, as reflected in this book. With an increased appreciation of data processing's history, which dates back many decades before the arrival of the computer, historians have been uncovering thousands of publications relevant to the topic. To a large extent this bibliography reflects a growing breadth of definition, which was not obvious as recently as the mid-1980s. The need to acknowledge the extensive impact of punch card, adding and calculating machinery, and their applications as precursors of modern computing is recent. That implies a recognition of the office appliance industry and a broad range of technologies, which laid the foundation for modern data processing, stretching back to at least the 1860s. The listings in this book, while reflective of this view, are nonetheless limited to what could fit into a single volume. The actual number of descriptions, for instance, of how machines were used in any decade would fill many volumes. What becomes obvious from the titles included is the growing importance of the role played by office equipment and that industry in the economic activities of large organizations in the twentieth century. As historians move away from a narrow technological view of computing dating back to the 1930s and toward a complex perspective on economic and technical activities internationally and over the past century, bibliographic needs change. That evolution alone makes most bibliographic collections too narrow, requiring the kind of tool offered with this volume.

This publication continues Greenwood Press's commitment to publishing essential reference tools dealing with the history of information processing and with American industries at large. These are critical aids for historians and those working in American industry. Cynthia Harris at Greenwood encouraged me to work on the project and advised me on how
Preface

best to pull together such a work of reference. I also want to acknowledge my appreciation to my two daughters, Beth and Julia, who helped with the indices. I hope that this book provides the kind of tool the reader is looking for; errors that might be found are a reflection of my own limitations for which I apologize in advance.
Chapter One contains reference materials, such as bibliographies, surveys of archives, and dictionaries, along with general surveys, major periodicals, and other titles related to the general theme of information processing. While there has been a substantial increase in the number of basic reference materials on the subject over the past five years, much remains to be done, particularly guides to the collections of archives, bibliographies of major libraries, and biographical or institutional histories.

Several developments currently underway are augmenting the sources available to researchers. The Charles Babbage Institute (CBI), housed at the University of Minnesota in Minneapolis, publishes a newsletter that lists new publications and reviews developments in archives related to information processing. This publication is a useful barometer of events and stays current. The Annals of the History of Computing also reviews new publications in addition to publishing articles of historical interest. CBI publishes, on a periodic basis, detailed bibliographies and other reference materials. These publications are essential tools for students of the history of computing and information processing. Finally a number of American publishers are beginning to introduce books on the subject. Two recent leaders include Greenwood Press with works of reference and The MIT Press with monographs, memoirs, and reprinted classics. Increasingly during the 1980s, commercial and university presses have released books on the subject as well.

In the United States major collections are being developed at various archives. The U.S. National Archives, the National Museum, and the Library of Congress have active programs to expand their holdings and are continually cataloging their existing and large collections. Major corporations in the data processing industry also maintain archives and are increasingly allowing historians to use them. Examples of the better organized ones include those at IBM and Unisys. NCR's archive contains massive amounts of material, but it is not organized and at this time is understaffed. Others exist but are not available to the public at all. Important collections are growing at Harvard, MIT, Stanford, the University of Illinois, University of Pennsylvania, and Dartmouth College. Smaller collections are
now expanding at smaller state universities and at all the U.S. national laboratories. MIT and Dartmouth have published guides to their technical collections; one can expect other guides to appear in the next several years. Clearly, there is a move afoot to build collections and publicize their contents within the United States. To a lesser extent, the same is true in Great Britain and sporadically across Western Europe. Surveys of collections are now routinely published along with descriptions of the archives themselves. For example, the IEEE Center For the History of Electrical Engineering includes such surveys in its Newsletter.

Museums provide another source of currently expanding reference materials. The National Museum in Washington, D.C. (part of the Smithsonian) maintains a permanent exhibit on mechanical computing and periodically creates others on the same theme. The Computer Museum in Boston is a monument to computing and focuses primarily on computers and software since the 1940s. It is rapidly becoming the attic for the industry as more old devices are contributed to its collection. Each major vendor also stores, restores, and occasionally exhibits its old products. Recent examples of this kind of activity involved IBM, NCR and AT&T.

Minimal work has been done on the historiography of computing and its industry. Some attempts have been made, however, to link issues in information processing to themes commonly looked at in the field of technological history. Linkages and issues are periodically reviewed in such publications as the Annals of the History of Computing. Much of the historically useful publications have been memoirs or histories of specific machines. Better work has been done on the history of printing and publishing, telephony, and mathematics than in the field of computing and its related industry. What little general survey work has appeared is included in this chapter. Publications that review in general terms narrower subjects or limited periods are listed in subsequent chapters.

Archives

This publication describes the kinds of materials which should be preserved for historians and how to do it. It is available free by writing to AFIPS, N. Lynn St., Arlington, Va. 22209.

This project involved collecting oral histories of pioneers in the development of the computer and related technologies.

The brochure describes what to save and why and is very similar to the first entry above.

This article is on the status of historical research in computing activities and defines the mission of CBI.


This describes CBI's collection of over 150 transcripts of oral history abstracts and includes an index.


This work describes the major holdings in the U.S. at such places as the Computer Museum (Boston), Smithsonian Institution (Washington, D.C.), MIT Archives (Boston) and at CBI (Minneapolis) with a total of nearly 500 interviews.


This guide provides brief descriptions of U.S. and Canadian archival collections related to the history of computing primarily since 1935. It does not survey holdings retained by government archives and agencies.


They describe typical industrial actions in high-technology companies and then illustrate a method for collecting relevant documentary materials on such activities. Their intent is to identify the kinds of records that should be preserved and used.


The chapters in this guide, written by archivists, survey major holdings dealing with computing, data processing, and its industry back to the nineteenth century.

This describes current actions taken to preserve the history of computer-related materials and the problems associated with that mission.


This guide describes the collection, including photographs, manuscripts, and artifacts.


This article is a survey of CBI's activities between 1977 and 1980, of its objectives and role as computing's archive and historical research center.


This survey of the collection includes the papers of Elmer Sperry, Sperry Gyroscope Company, Sperry-UNIVAC, on the IBM antitrust and technical lawsuits of the 1960s and 1970s.


This survey is part of the Smithsonian Computer History Project and an early description of its work.


This is an illustrated history of the archive which dates back to 1913.


This includes material on Silicon Valley, Stanford, and other institutions on the west coast of the United States.


The guide to MIT's archival collections includes over a dozen entries dealing with computing, research projects and individuals, primarily for the period between the 1930s and the 1960s.


This describes TI's archives, which includes files on Jack S. Kilby's integrated circuits of the late 1950s.


Tropp was very active in supporting historical examination of data processing's past and in the preservation of its records in the 1970s.


This pamphlet describes the initial purpose and goals of the Computer History Project supported by AFIPS for the preservation of historical materials.


He provides a family tree with roots leading from basic research to branches, such as types of vacuum tubes.


He describes the creation of this department and its activities of the late 1980s.

Bibliographies

This 576-page bibliography is the single most useful publication on the subject available.


This is an index of publications dealing with all aspects of data processing literature. The first volume (1964) covers publications which appeared in 1963. Many of the issues are massive with thousands of titles.


This contains hundreds of citations organized alphabetically by author.


This is a four-page annotated list of 32 titles that serve as an introduction to the subject.


This bibliography was prepared for the U.S. Office of Naval Research (ONR) as a guide to DP publications on applications, management issues, and technology. It is a good introduction to the growing body of literature which appeared during the 1960s on data processing, particularly in the United States.


This 66-page bibliographies was one of the first to focus on the literature of computer uses, listing a wide assortment of publications, mostly published during the early to mid-1960s.


This was an early specialized bibliography on computer applications. It is the major list of publications on the use of data processing in education during the 1960s.


This publication, and the revised and expanded second edition of 81 pages, offer a variety of IBM and trade publications describing specific uses of this company's products. This was the first of many such publications issued by IBM.


This lists 400 non-technical publications on microelectronics.


RAND was a major consultant to U.S. Government and defense industry organizations on computing and related technologies during the 1960s, and thus its publications can aid in understanding how computers were used, especially by the government.


This bibliography surveys scientific literature for the period 1946-1949, offering over one hundred titles.

35 Bibliography on Electronic Computing Machines. Teddington, Middlesex: Mathematics Division, National Physical Laboratory, June 1948.

This three page document lists 52 articles and books from the period 1940-1947. They are technical publications especially useful on the work of British and American scientists working on computers.


This is the first bibliography to appear on the Japanese computing projects of the 1980s known as "Fifth Generation" hardware and software.


This is a bibliography of artifacts, photographs, articles and books in an exhibit entitled "The History of Data Processing" at the Museum of Industry and Technology at Vienna, Austria.

This bibliography covers all aspects of the subject and is an earlier edition of the current publication. All of its entries are included in this volume.


George Stibitz developed a series of computers at Bell Laboratories, beginning in the late 1930s and through the 1940s. This inventory catalogs his papers housed at Dartmouth and includes a short biography of him.


This 616 page book includes material on societies, directories, catalogs, and publishers.


This is an annotated bibliography of over 1,500 titles, and although primarily on mathematics, it has sections dealing with the science of computing and about information processing in general.


This is a 26-page list of German collections on data processing and includes documents, pictures, machines and parts, and descriptions of 22 locations with addresses and telephone numbers. One is in Vienna, the others in West Germany.


This is a general bibliography covering all aspects of data processing technology, applications, and management.


This is the first bibliography to appear in English.
Reference and Introductory Materials

on the subject of Soviet computing publications.
The focus is on materials of the mid-1960s.


This 33-page paper has some material concerning data processing. The primary concern is with quantitative applications and sociological issues.


This is a bibliography of the Harvard Business School's library, covering all aspects of business and includes data processing both by topic and alphabetically. It has hundreds of titles on data processing through the early 1970s along with standard library call numbers and references.


This directory includes bibliographic references, lists of organizations within the information processing industry and other data on the subject.


This is a list of publications from a wide variety of periodicals (some 7,000 titles) covers computer-based applications in business, science, engineering and other fields, published during the 1960s and early 1970s. It is the largest bibliography on the subject of applications.


Lowenstein focuses primarily on the literature of modelling, covering both basic elements involved and the use of computers to execute such games.


This reviews over 300 entries dealing with calculating machinery, slide rules, etc., of the late 1800s and early 1900s. There are materials on applications and machine descriptions.

This bibliography does for mathematics what this bibliography does for data processing by providing a broad brush review of the literature by topic. It includes some material on the relationship of mathematics to computers.


While largely a bibliography of application material, it includes considerable data on punched-card systems and on the use of computers.


This provides an evaluation of computers that were available during the late 1960s and 1970s with considerable reference to other publications.


This is a highly specialized, 275-page listing of material on manufacturers, consultants, companies, and publications.


This is a monumental two volume collection of over 6,000 titles on all aspects of the subject.


This presents a large collection of publications on data processing, library science, and other related fields of information handling. Primary focus is on publications which appeared during the 1950s and early 1960s. Technical material is presented along with items dealing with applications in a wide variety of fields.

This 49-page publication is dedicated to literature on time sharing applications existing in the mid-1960s, a period when this form of computer usage spread widely both in the United States and in Europe.


Forty subject groups of publications appearing in print prior to 1958 are presented with cross-references listed by author with categories. It is an important list of the first decade of operations research, involving the use of computers.


This covers publications which appeared between 1951 and 1974, offering some 100 titles, a subject area which early-on caught the attention of librarians attempting to use computers effectively.


This bibliography covers all types of information in a narrative form and is an excellent introduction to the literature of computer science.


This was the first complete bibliography on the subject of computing's history to be published. It is annotated and includes some unpublished material not included in the Cortada bibliography. All other citations are, however, included.


The primary focus is from Charles Babbage (1800s) through the 1950s, with the majority of titles concerning computing from the 1930s to the late 1950s.


This is an excellent source for articles on all aspects of data processing. It is an essential source for the study of contemporary developments as reflected in widely-read magazines in the United States. The material is grouped by topics and indexed.

One thousand titles are presented that deal with technical issues, logics and mathematics. Von Neumann's papers are listed, beginning with his earliest publications to the 1950s.


This bibliography surveys material which appeared during the 1950s and 1960s, offering valuable source material on public attitudes toward data processing, descriptions of computer technology, and about its uses and impact.


More than 600 titles are presented. It suggests that the interest in computers in education was far more than is usually noted by historians.


This is a 34-page list of key journals of the 1970s making this an essential reference work on a growing list of data processing applications.


This is a massive, annotated bibliography of papers prepared by or for the U.S. Department of Defense between 1953 and 1963.


This is a 53-page bibliography on all aspects of the data processing industry and is not limited just to a review of computers.


This is one of the earliest bibliographies to appear
on the subject of data processing technology and its applications.


This bibliography concentrates on publications of the 1960s, a period of considerable activity in the field of computer languages.


This is a newer edition of bibliographic entry No. 55.


This is an excellent bibliography covering articles, conference reports, and books on all aspects of data processing: the industry, technology, economics, and uses. Other volumes were published, most notably No. 2 (1967) covering 1964-1967.

Courses on Data Processing History


Associated with Lehigh University, the author offers an early attempt to provide instruction on the subject.


This surveys how electrical engineering, as a subject of study, evolved between 1880 and 1900. The topic was a root of modern computer science. For additional comments on the theme see Annals of the History of Computing 74, No. 1 (January 1985): 72-73.


This article describes a course for computing students taught at the University of Alberta. It covers the subject from the ancient Egyptians to the present.

77 Stern, Nancy. "The History of Computing: Its Place in
She argues for the teaching of data processing's history in college curriculums.


He describes a course taught on the subject at the University of Calgary. The focus of the class is on the evolution of calculations down to the present.

Electricity and Electronics


This is a history of the evolution of European electronics from 1930 to the 1980s and is well illustrated.


This is a detailed (over 300-pages) chronology covering all aspects of the subject and includes material on computer science.


Chapter One discusses the technical and social environment of the 1930s while the second reviews major technical events prior to 1930. Computer history is discussed throughout the book. Chapters Seven and Eight are dedicated to computers. The book is well illustrated.


This is a general history of electricity in the United States. Although not a good study, it does, however, set the background and illustrates the motivation for electrification of calculating devices during the early years of the 1900s.


Although it has no history in it, the volume helps to set the technological stage for what computers are all about and thus serves as good technical background material.
Reference and Introductory Materials


This history of electronics goes from the 1700s to the transistor in an easy-to-read style for the non-technical reader. It is useful for placing into context the role transistors played in the broader field of electronics.


The author invented the term "tyranny of numbers," which he describes in this book on electronics. It is a phrase that has influenced historical perspectives on the role of electronics in the post-1950 period.

Encyclopedias and Dictionaries


To many in the data processing industry, ANSI standards on technology and, in this case definitions, are the norm. This dictionary is complete accumulation of many technical terms.


This is an excellent, detailed source for terms used in the 1950s and 1960s. The book reflects a continuing project by ANSI to define the vocabulary of computer technology down to the present.


While essentially a bibliography, it introduces definitions of terms. It appeared continuously in various editions throughout the 1970s.


This contains a variety of articles relative to early computers and their developers. It runs to multiple volumes in several editions.


This is a useful publication on the terms in use.
during the 1950s and contains some words no longer in use. Edmund Berkeley was a major consultant in the field of data processing in the 1950s and 1960s.


He dates its origin to the 1950s and explains how it came into existence.


This is a typical, but good, example of many such dictionaries available in the 1980s on data processing terms.


This loose-leaf publication appeared in various editions and additions in the late 1960s and is a comprehensive collection of information on all aspects of the data processing industry of the 1960s.


More than a dictionary of terms common in the 1960s, Horn's book is also a guide to managerial issues of the period and to its technology.


3750 terms are presented covering all aspects of computer science as of the early 1980s.


This massive dictionary has appeared in various editions throughout the 1970s and 1980s. This particular edition reflects the convergence of computer science, telecommunications and application terms through its content. Its definitions rely on industry standard interpretations, such as those from ANSI.


This dictionary provides definitions commonly
in use during the 1970s. The phrases presented also reflect terms used in the 1960s.


This is a massive and fundamental reference work on data processing. It covers all aspects, including the history of machines, software and biographies.


This second edition is 488 pages in length, making it one of the more complete and larger dictionaries of the period.


This is the first edition of No. 100 above. It contains some 300 pages on the DP industry, contemporary products, services and software.


One of many such dictionaries to appear in the 1960s on the subject. It does contain, however, material on programming, circa 1960s.


He traces the term back to its origins in the 1940s and provides its most complete history available.


This is the first known dictionary to appear on the subject published by the U.S. Government and reflects growing need for such tools within government agencies.
20 Bibliographic Guide


The focus is on data processing language.

General Histories of Calculators


This particular issue reviews briefly the work of Napier, Pascal, Leibniz, Thomas, Odhner, Felt, Bollée, Hollerith, Babbage and Scheutz, and thus serves as an introduction to the history of calculators prior to the advent of electronic digital computers.


This is a lengthy chronology on the invention of calculating machines. It is illustrated with pictures of inventors and their devices.


These authors provide a major study of mechanical devices, most specifically of automons, mostly driven by pegged cylinders, from the 1600s down to chess playing machines developed by Torres y Quevedo.


This is a short history of automata, well illustrated.


This is a general history of calculating machines, beginning with the abacus down to Napier's bones, and includes the work of Leibniz, Odhner and others.


This is a speech focusing on the work of Pascal, Leibniz, Thomas, and Torres y Quevedo.

112 d'Ocagne, M. "Vue d'Ensemble sur les Machines à

This is a solid review of how calculating machines developed. He discusses Pascal, Tchebichef, Felt, Leibniz, Thomas, Maurel, Odhner, Burroughs, Bollée, Scheutz, Babbage, and Torres y Quevedo.


Pages 23 through 48 review devices made by Pascal, Leibniz, Thomas, Mercedes-Euklid Machine, Odhner, the "Gauss" circular device built by Hamann, Steiger's "Millionaire" Machine and other difference machines.


This is a detailed history of calculating devices. It includes the abacus, Napier's rods, Pascal, Leibniz, Thomas, difference engines, arithmometers, Odhner wheel machines, key driven adding machines, and the "Millionaire."


This reviews briefly devices from the abacus to the then current devices, and how they were designed and used.


This publication provides details on commonly available devices of the early 1900s: their history, description, and use, along with illustrations.


This covers briefly people from Schickard to the inventors of the transistor.


This covers both digital and analogue devices in addition to the more standard topics of Pascal,
Babbage, Thomas and others, particularly of the 1800s.


Essentially this is an earlier version of his article cited in No. 118.


This discusses a variety of calculating machines and their inventors such as Leibniz, Grant, Baldwin and Rachnitzer.


Part 1 of this book is an historical survey of calculators. Subsequently some 250 pages are taken up with listing over 200 calculators, beginning with Pascal's of 1642 down to the 1920s. The book is well illustrated.


This surveys developments in mechanical calculating machinery of the 19th and 20th centuries.


This is a good reflection of a large number of slide rules, adding machines, surveying equipment, many of which are reviewed here, available in the 1880s.


This is a history of devices for calculating with primary attention going to those beginning with the abacus and ending with mechanical desk calculators. There is only a passing discussion of digital computers.


This illustrated 48-page booklet tells the history of European calculators and of the Brunsviga devices.

This summarizes applications of many devices, including those of Morland, Stanhope, Hamann, Burroughs, and Scheutz.


This reviews early devices by such inventors as Vaucanson, von Knaus, Maillardet, and Torres y Quevedo. Many were automata devices.


This starts with Müller's 1786 proposal and ends with the use made by Comrie and others of commercially available desk calculators and accounting machines as difference engines. There are thoughts of Deacon, Grant, Ludgate, Bolleé, Hamann, Thompson, Scheutz, Babbage and others. It ends chronologically in the period just before World War II.


He covers the period from early calculating methods to electromechanical calculators of the 1940s.


Written by an important computer scientist, eight stories are told: Broesel's programmed weaving device of the 1740s, Maelzel's programmable music machine of the early 1800s, Petzel's calculator of the 1840s and 1850s, Schaeffler's work in the 1870s, on Torres y Quevedo's work of the early 1900s and especially with chess machines, and ends with Tauschek's bookkeeping systems of the 1930s. There is also material on post World War II computing including on the Vienna Definition Language which evolved between 1958 and 1960.

General Histories of Computers and Data Processing


This is a beautifully illustrated history with many photographs of old computers and their developers.

This is a general history of computing, covering all aspects from the ancient abacus to the electronic digital computer. The bibliography included suggests a thorough job of research covering developments worldwide.


This publication focuses primarily on the evolution of computers in the USA during the 1950s and 1960s and is well illustrated.


This is a beautifully illustrated, very reliable account of the machines, including the micro computer—a technical history for the layman. It includes a chronology.


This is a popular history of computers, covering all the obvious people and their work from Babbage to Aiken, Stibitz, Eckert, Mauchly, von Neumann and others. It is a short but competent introduction to the history of computers.


This is a general overview of computing devices from ancient times to the present. The main thrust of the work is to provide an illustrated survey; the photographs make this an important source work on illustrations.


This is an important publication—a minor classic in the historiography of computing—on the history of calculating and computing equipment. It contains a great deal of useful information on Babbage and on projects of the 1940s.


This is as much a history of information processing by mankind as a history of computing equipment.

This is a photo essay by an historian of computing. He takes the story from the Stone Age to the present with particular emphasis on the impact of computers on people's lives.


This is a slide show with text on calculating devices beginning with the abacus down through the Harvard Mark I. It offers considerable information on American scientists such as Baldwin, Monroe, Avery, Friden, Hopkins, Grant, Burroughs, Dalton, Sundstrans, Ellis and Felt. Also covered are the projects by Hollerith, Aiken, Scheutz and Babbage.


This is a 33.5 minute-long VHS video cassette that reviews the general history of computers and then how computers work. It is suitable for basic class room use.


This was published as a supplement to the journal. It has some material on computers written by pioneers in their development. They include: Dick Hamming, Nick Metropolis, Kelly Gotlieb, Allen Newell, and Tony Oettinger.


This has entries on all major computers, peripheral equipment, software, technical concepts, on calculators and other mechanical devices ranging from ancient times down through the early 1980s. Each entry also includes bibliography.


He reviews a number of then currently available calculators, punched card devices, and computers such as the Mark I, ENIAC, that of the Institut Blaise Pascal, and Babbage's Analytical Engine.

145 de Beauclair, W. "Geschichte Entwicklung," in K. Steinbuch (ed), Taschenbuch der Nachrichten Verar-
The history of digital computers is presented in a brief fashion, taking the story down to the 1960s and with a detailed bibliography.


This is a well illustrated account of the origins of digital computers up through the early 1960s. It is an extremely informative survey of all the key technologies involved.


This reviews how the digital computer came about in general terms; complete with a bibliography that is extensive.


The author provides considerable data on machines from Schickard's calculator to the early stored program computer.


This takes the story of the micro computer down to the 1970s, beginning with the abacus and ending with the transistor and integrated circuits. Evans is a participant in the computer industry and wrote a useful, short introduction to the subject. This book is an illustrated version of his earlier volume, The Micro Millennium (New York: Viking Press, 1979).


He defines super computers, describes various early attempts to build such machines in the period from the 1950s. He describes the role of IBM, governments and other organizations. The author is an active participant in the super computer sector of the data processing industry.

This is a profusely illustrated history based on an IBM exhibit. It is organized by decade and contains considerable amounts of little-known pieces of data and photographs on the history of computing.


This publication traces the history of measurements and data in physics since the days of Newton.


This is a brief illustrated history and has some errors in facts.


This is a beautifully illustrated introduction to early counting systems and mechanical devices, automata, and to the work of Charles Babbage, Herman Hollerith, Zuse, and to such machines as the Mark I, SSEC, and early IBM electronic multipliers.


This is a short history of computers.


This reviews computers and old mechanical devices of the pre-computer era by two scientists active in computer science.


Written by a close associate of von Neumann, this brief account takes the story from Schickard (1592-1635) down to his own work on the computer at the Institute for Advanced Studies at Princeton, NJ in the 1940s.


This covers all aspects of computer science with cartoons. It contains an enormous amount of detail hard to find on history, systems, logics, etc. while offering some humor.

This reviews 350 years of computing machines in a series of lectures given at the University of Tuebingen.


This is a popular history that focuses on machines and their inventors and less on the modern industry that bears its name.


Douglas Hartree was an early computer scientist and this book, considered a minor classic in the field, describes differential analyzers, the technology of the digital computer of the 1940s, and then the work of Babbage, Aiken, the IBM SSEC and other projects and technical issues of the day.


This is a brief overview of Charles Babbage's Analytical Engine, the Harvard Mark I, and the ENIAC.


This is a useful, well-documented overview of computers within an historical context.


They survey the history of computers from the abacus to the early 1960s with most of the attention paid to post-World War II developments.


This computer scientist provides a general, illustrated history of computers from Babbage to the 1970s.

This has a large variety of short entries from counting tables to modern machines; includes a bibliography.


This is a brief survey with its focus on very early digital devices.


This general history is one of the better short surveys and takes the story down to about 1950. The Oxford publication of these multi-volumes (16 in total) was a major event in the historiography of technology as a whole.


This is a short history of computers.


This French IBM technical manager/executive provides a history of computers and of his industry, with primary focus on the period from the 1930s to the 1980s.


This reviews the role computers have played in fiction, especially in that of H.G. Wells, A. Bierce, E.L. Rice and others. The author also has a section on the role of post-World War II literature and the social impact of computers.


The author is the head of the research division at Bell Labs. He describes basic computer architecture with a short history of its evolution. His focus is on information handling from cave wall drawings to computers.


This focuses very much on hardware developments.

This is a very brief history of digital computers from Babbage to the first stored program devices.


This is an important publication on the history of computer technology. It contains over 30 papers on the subject; a critical source on scientific developments.


This is a collection of brief stories, old tales, some oral history, and trivia written more for entertainment than scholarship.


This reviews the early history of computer technology through histories of inventors and machines, most of the period since the 1930s.


This is an early, illustrated history of computers in the USA with considerable material on the evolution of data processing technology in the 1940s and 1950s.


Computer history is presented as a general overview from its earliest days down to the mid-1960s with illustrations.


A variety of inventors are surveyed. The author argues that many concurrent activities led to the development of the computer.

This is a general survey of people and machines intended for a non-technical audience. The author also speculates about the future of computers; well written.


Although a general overview of the relationship of computers to mathematics, there are included examples from Babbage, Turing, crystallography and tomography.


This has a great deal of information on data processing activities in the United States up to the early 1960s with primary focus on the 1950s.


This is a collection of six illustrated brochures surveying the history of calculators and companies and computers from Napier through the first generation of processors.


This beautifully illustrated volume has a short chapter on the history of various computers.


This is an illustrated history with brief comments, on the significance of individuals important to the history of computing. It includes a list of some 260 important individuals.


Pages 5 through 91 deal with calculators and computers in an historical context down to 1950. It discusses how they work and offers considerable bibliographic references.

General Histories of Technologies


While it glories in the accomplishments of the past
century, it nonetheless talks about what happened in some detail, thereby providing useful background material.


This is a general introduction by a leading historian of technology in this century.


More than simply a history of automatas, particularly of the eighteenth century, this is also a technical explanation of how they worked.


Originally published in Dutch in 1950, this scholarly book is a survey of the mechanical philosophy of science down to Leibnitz.


This book is dedicated to the broad theme of plant and assembly-line automation, mechanized transportation and the general acceptance of machines to do the jobs of society. It identifies many of the social and economic impacts which were to be repeated with the wide use of computers and its variants of automation.


This was one of the first serious studies made on the dynamics of change in science. Many of the issues raised in this book have subsequently become standard topics for historians of data processing. It is a useful introduction to the understanding of how a variety of technical innovations could build on each other, allowing for the digital computer, for example, to develop.


He lists 30 ideas that had the greatest influence on the development of computer science and data processing.


This discusses the evolution of industry and, in the
United States, industrial arts with its associated technologies.


This surveys the history of the Morse telegraph. That technology had a profound influence on future engineers who worked on radios and later, on digital and analog computers.


Included in this book is a discussion of a variety of business machines, precursors to the modern calculators and computers.


This is a very influential book that suggests how technology and science evolve. It was the most important book on the subject for nearly a quarter of a century and significantly influenced the thinking of many historians of science during the 1960s, 1970s and 1980s.


Mason offers an historical survey of electrical and mechanical filters from the 1800s, when electricity was in its infancy as an area of scientific activity down to the 1940s.


This is a fundamental book for understanding the environment in the United States which made research and development of high technology possible.


The author focuses on the theme of technological innovations and how they came about. These were ideas expanded further in his 1974 book (entry No. 200).


This is a widely read study on the subject, highly influential on historians of technology.

Attention is drawn to developments of the nineteenth century and their influence on American economic affairs.


This offers background on the growth of technology in general over the past several hundred years.


This is a treasure of articles by specialists on all aspects of technology from ancient times to the present. Comments on the rise of computers can be found in the volumes after No. 4.


This provides background information on scientific developments in general and on their characteristics, many of which are repeated with the evolution of computer-based technology.


This contains a great deal of information on the history of radio tubes for home radios but also vacuum tubes which were early components of the digital computer of the 1940s and 1950s.


These are scientific papers published on logic design, arithmetic algorithms and computer architecture which appeared for the first time from 1919 through the 1950s that would be of interest to historians of such technology. They are all period pieces.


Its focus is on the role these tubes played in the development and use of radio. These components were also used in early digital computers.

This very interesting book has a discussion of mechanical-dynamic technology in the era before the creation of early mechanical calculators and adding machines.


This is a basic text on all aspects of the subject and has a section on computer developments set within the context of social, economic and political issues. It is of great value to historians wishing to pursue the history of data processing outside the confines of technical details.

**Historiography**


He argues that technology in general is not a society's product as a whole but comes from parts of it which in turn then can create social change.


Ceruzzi is a leading historian of the early digital computer. His article focuses on the development of the computer as unplanned and underappreciated in its potential.


One of his arguments was that technological innovation simply encouraged Americans to do what they seem to do well. His comments applied to all forms of technology, not just to computer science.


Although not an historical piece, it nonetheless offers a model of possible use to historians by which to measure past events.

This is a very short philosophic essay introducing the subject of computing history.


He surveys literature on the history of computing and, more importantly, the issues raised as they apply to general themes in the history of technology.


This is on the historiography of computing with emphasis on the attitude of people that should be taken toward the subject.


Norberg, the director of the Charles Babbage Institute, evaluates the status of research on the history of data processing as of the mid-1980s.


This IBM engineer/executive describes the effort to produce IBM's Early Computers (Cambridge, Mass.: MIT Press, 1986) and the work on its sequel dealing with the IBM S/370 line of computers.


This distinguished IBM scientist shares his thoughts on what computer science is about and what it teaches us.

Mathematics


This book discusses the mathematical basis of automata. This essential aspect of the evolution of computer technology is covered in detail. It also has a section on Turing machines.

He discusses, in part, binary numbers, their systems and significance to science and computers.


Of particular interest is the material on Charles Babbage's writings (pp. 125-126) for their impact on other mathematicians.


This is a fun, clever book on all aspects of mathematics, including Boolean and binary systems.


This is volume 29 of the AMS Contemporary Mathematics Series. It discusses mathematics since 1950s as applied to proving theorems.


This was his major work on the calculus of variation, a subject critical to the mathematics of ballistics and hence motivation for the development of calculation devices of great capacity, such as computers.


This massive work covers all aspects of the subject and thus is good background material. It takes the history of mathematics well into the age of computer technology.


This is the second edition and has passing references to Charles Babbage and to a variety of calculating devices popular in the late 1800s/early 1900s.


This book does not contain any discussion of mechanical aids to calculation. However, it does provide a good survey of the role of numbers in American society of the 1600s and 1700s.

231 Dauben, Joseph W. *The History of Mathematics from Antiquity to the Present: A Selective Bibliography*. 

Scanned OCR with permission of Greenwood Press [19 June 2009]

This selective bibliography offers some 2,000 titles which are annotated covering all aspects of the subject.


This is a good one volume introduction to the history of mathematics. It also discusses computational devices and why they were needed, offering a partial explanation for the incentives leading to the development of the computer.


This collection of essays contains a paper by E.M. Bruins on "Numerical Solutions of Equations Before and After al-Kashi."


This is a one paragraph review of the piano arithmétique designed to determine if certain types of numbers were prime.


This is a well-written history covering the years 1500-1965. It ends with the ENIAC computer project.


This is a history of algorithmic solutions to this problem. It is a highly technical paper.


This textbook was written by a leading computer mathematician on a subject basic to much computer science and technology of the 1960s and 1970s.


This is an illustrated article and contains material on IBM as well. It is a very technical paper.

A great deal of information is provided on the evolution of arithmetic and calculators down to the early days of computer technology.


This is a primary source of his ideas on mathematics.


This is a primary source of his ideas on mathematics.


He offers theory on how mechanical aids work and has good material relevant to the precursors of the computer of the late 1940s and early 1950s.


All 4 volumes serve as excellent introductions to the subject and hence as background to computer science. Volume 3 has a discussion of Boolean logic.


Its focus is primarily on contemporary mathematics but also has some material on the history of computing: logic and computers (pp. 137-165) and on von Neumann and the IAS (pp. 166-194).


Lambda-calculus, combinatory calculus, is key to computational theory. This technical paper explains its features and recent history.


This older general history is still useful since it reviews the work of some nineteenth century mathematicians, such as Charles Babbage.

It has three chapters with material concerning computers.


Emphasis is placed on the evolution of mathematics from earliest times to the introduction of mechanical aids to calculations.


This is a history of work done at Bell Labs by Richard Hamming on error-correcting codes in mathematics and includes the work of others on information theory. It is a clearly, thorough study.


This is a biography and analysis of the work of a mathematician who lived in the 800's A.D. It is illustrated and well done.

**Museums and Exhibits**


This is an illustrated history and description of the Boston-based Computer Museum and about his views as its director. He is also famous for having developed the DEC PDP-11 mini-computer.


They describe the work being done at the Computer Museum by its directors. The Computer Museum is a major repository of computer hardware and software.


This is an illustrated description of the 12 panels in the exhibit on the history of data processing from Pascal to the chip at the Museum of Technology in Vienna developed by Zemanek.

He describes the Computer Museum in Boston.


This is a detailed, positive account of the museum which opened in late 1984. It is a description of its exhibits and objectives.


This illustrated account has a chapter entitled, "Electronic Computers: PHILBIC electronic analog computer" and also describes the Ramo-Woolridge RW-300 used for process control at Texaco's refinery at Port Arthur, Texas beginning on March 13, 1959.


This is a description of the large exhibit at the Museum by a staff member covering items from early slide rules to Babbage machinery and finally, to electronic digital computers.


This is an illustrated, detailed description of what was on exhibit as of 1985. At that time it had over 1,000 items from 250 companies in its collection.

Periodicals


This contained numerous articles on the history of computing.


These seven volumes contain thousands of titles on computers, applications, programming, data processing and other related topics.


This two volumes represent a variant of numerous
bibliographies published by ACM of current technical publications on data processing.


These two volumes are similar in scope to No. 261.


A second volume covering 1964-1965 was published in late 1965.


This is the main publication of the ACM and often where the first formal explanation of a new technology or programming language appeared.


This is a technical journal, reflecting the significant amount of activity present in the area of software development.

266 *Burroughs Clearinghouse* (1916--Present).

This is a monthly, internal organ on all aspects of the company's activities.


The focus was on the company's products.


This quarterly is a major source of information on historical activities. For details it is the best quick reference. Charles Babbage Institute, 103 Walter Library, University of Minnesota, Minneapolis, Minnesota 55455 (USA).


This British journal is the organ of the British Computer Society and is a technical publication.

270 *Computer Talk* (1967--Present).

This quarterly offers information on current industry trends and news.

As the data processing industry acquired definition, such publications appeared. This one is the most complete and widely-used publication of this type.

272 **Computers and Automation** (1951--Present).

This monthly is one of the oldest publications in the industry and is a technical journal.

273 **Computerworld** (1967--Present).

This is the data processing industry's weekly newspaper. It began publication in June, 1967. Issues run to over 100 pages and cover all aspects of the industry's activities.

274 **Datamation** (1957--Present).

This is the single most widely-read magazine in the data processing industry until the advent of PC-oriented publications by the late 1980s. This monthly carries articles on vendors, analysis of the industry, product and application news, managerial issues, and periodically on the history of the industry.

275 **Digital Computer Newsletter** (1948--Present).

This quarterly focuses primarily on technical issues.


This has articles on applications, products, technologies, and on rare occasions, on historical issues.


This is a technical journal covering major developments in computer science. On occasion it will publish articles on the history of IBM technology.


This contains news about IEEE activities, news about research on the history of electricity, computing, and other related fields. It publishes a bibliography and articles on key archival collections.


This monthly is useful for understanding technical developments in computer science, especially for the period of the 1960s and 1970s.

280 **Mathematical Tables and Other Aids to Computation** (1943-1960).
This was the most important source of articles dealing with computer science in the 1940s and very early 1950s. It served as the primary publication outlet for many technical articles of the period. In total 14 volumes of issues were published.

Published semi-annually (at least in the 1970s), this has listed over 3,000 names by 1985, providing an individual's name, title, company, address, when and where with IBM.

282 Simulation (1963--Present).
This journal is devoted to contemporary work with analog computers and hybrid systems.

This is the single most important source of material on the history of information processing, particularly on its technology. It also contains book reviews, bibliography, obituaries and other useful information. For details write to Springer-Verlag, 44 Hartz Way, Secaucus, N.J. 07094 (USA).

284 Think (1935--Present).
This is IBM's employee magazine. It contains articles on the company's major activities, operations in various countries, and biographies of key executives. It is published monthly.

This is a two-page column appearing since 1980 on all aspects of the industry's history.

Printing

This is the best account of the subject with its focus on the consequences of this communicating technology. It teaches us a great deal about the issues facing historians of data processing's technology.

This is a well-organized and detailed history that views the coming of this technology in terms useful to historians of computer technology. Many of the issues faced hundreds of years ago were replicated in the 1950s and 1960s with computers.


He focuses on the first century following the development of Gutenberg's printing methods for social and intellectual historians. Many of the issues faced by printers are instructive for the 20th century data processing industry.


The high priest of the "media is the message" in this book discusses the impact printing had on information handling and culture. It is a seminal work on the subject.

Telephony


This comprehensive book focuses on all types of technology, including early computer-like devices.


This is a biography of an early, influential president of AT&T. At the turn of the century Vail took a small high-tech company and made it a major industrial force.


In this brilliant study, Pool examines the telephone's sociological role and historic impact on society. It is a classic study illustrating how to examine the impact of one form of communications on society.


This describes the acquisition of Western Electric by the American Bell Telephone Company and is thus an early example of how technological and strategic business problems were solved.

The author surveys the invention and implementation of long-distance telephonic technology. Besides contributing to our knowledge of a company active in the data processing world, it offers insight on the tactics required of a firm to implement and expand the use of a communications technology.
Pre-History of Information Processing

This chapter focuses on the development of the earliest aids to computing, with particular emphasis on seventeenth-century European events and others of the Far East. This is an especially fertile period in the history of computing and it has been well studied by historians, although historians have usually had the intent of either writing biographies or of studying the development of early European mechanical adding/calculating machines rather than the intention of studying computing. Such studies were besides to broader concerns regarding scientific explorations. Many of the inventors of early mechanical aids to computing were also major figures in the history of mathematics and physics. John Napier (1550-1617) developed logarithms, while Gottfried Wilhelm von Leibniz (1646-1716) and Blaise Pascal (1623-1666) were both important mathematicians. In a later period, Joseph-Marie Jacquard (1752-1834), the last of this group, invented the programmable loom. Their work with computing devices was generally described as an integral part of the development of modern science and it was described more effectively than the work of others during later periods. The bulk of all histories of computing machines—particularly for the nineteenth and twentieth centuries—have not integrated such events as completely into the mainstream of the history of technology.

In fact, the literature on computing during the eighteenth and nineteenth centuries remains too limited, suggesting opportunities for historians. Many of the monographs listed below were the by-products of research conducted in archival collections in Europe for the period prior to the early 1800s. Those holdings, often housed at national or royal academies of science or mathematics, remain sources yet to be studied in light of the development of the modern computer. The one major subject of the 1800s that did see attention, and thus is an exception to the otherwise weak historiography, is Charles Babbage about whom there are many fine studies.

Titles listed below contain the most important materials focusing attention on mechanical computing activities. They are not complete on the lives of such individuals as Pascal or Leibniz since a complete list of all references would have been book-length. Items have been selected for inclusion on
the basis of their contribution to the general theme of the
bibliography. Many of the themes covered below are also the
subject of many titles listed in the previous chapter as well.

Abacus and Soroban

295 Araki, Isao et al. (eds). Encyclopedia of Soroban (In
Seventy-three contributors wrote over 1600 pages on
the Soroban and its use. This book has a history
covering over one hundred pages. It is a definitive
work on a device which still is made and used.
Currently some four million are manufactured each
year.

296 Knott, C.G. "The Calculating Machine of the East: The
Abacus," in E.M. Horsburgh (ed), Napier Tercentenary
Celebration: Handbook of the Exhibition (Edinburgh:
This is a short history of the abacus that explains
how it is used to do multiplication, division, square
roots and cube roots.

297 Li, Shu-T'ien. "Origin and Development of the Chinese
Abacus," Journal of A.C.M. 6, No. 1 (1959): 102-
110.
The history is taken back to 1100 B.C.

298 Porter, G.N. From Abacus to Addo. London: Addo Ltd.,
1965.
This pamphlet is an illustrated history of calcula-
tors with special emphasis on the Addo series of
devices first introduced by H. Agrell in 1917. It
also describes the abacus.

Hutchinson, 1968.
This is a 127-page history covering its origins as
a calculating device. It describes variations,
including jetons.

300 Smith, D.E. "Computing Jetons," Numismatic Notes and
Society, 1921.
This surveys the abacus, along with an explanation
of how it works.

301 Yamazaki, Yoeman et al. The Soroban in Japan (In
This is a history of the Soroban—Japanese abacus
of Chinese origin. It is well illustrated.

This history of the abacus also traces the etymology of the word. It is a useful, enthusiastic introduction to the subject by a computer scientist.

Ancient Devices and Methods


This is an annotated and illustrated translation of a 13th century Arab document describing mechanical automata, many using pegged cylinder sequencing mechanisms. Most were driven by water wheels to control the movements of model figures.


This illustrated history and description of an Inca mathematics system is the only known publication devoted to the subject; it covers the period 1400-1560 A.D.


Reviews the evolution of such machines including the designs of Ramon Lull (13th century Catalan), Stanhope, Jevons, Kalin, Burkhart and others.


This describes a robotic automata device.


This reviews a Moslem mathematician's work with calculating equipment.


This describes a special purpose machine used in calculating decimal fractions.


This surveys the life and work of a fifteenth-century
Moslem mathematician who studied astronomy and
designed devices to help in such work.

This is on the early history of mathematics, important as evidence of early needs for aids to calculations.

This includes a biography of Derek (a computer scientist) and then some information on an old Greek device; includes bibliography.

This third volume contains material on mathematics and aids to computing in China.

He describes the Antikythera device which he believes could have been used to determine longitude and solve equations of the sun.

Rogers offers an illustrated description of an instrument used for addition similar to Napier's rods which he discovered in Mexico.

This is an illustrated article on using pegged cylinders and ropes to control a sequence of programs in ancient times.

Counting Systems and Aids

This is an excellent history of the subject. These aids to computation were in wide use up through the early modern period in Europe.

The author describes an aid to counting in ancient China, probably dating from before the birth of Christ.


This briefly surveys aids to counting in ancient China.


The knotted cord is an ancient aid to counting. The early Hebrews used it to aid memory, even in the days of Moses.


This is a good survey of ancient writing and oral reading methods.


This describes an early system for counting using stones, in Europe.


This describes a medieval calculating device and its cryptological use in the 1600s in England. They argue that research and development on such a device had been done earlier by Venerable Bede (673-735) and by Robert Recorde (1510-1558); illustrated.


This is an illustrated review of a mechanical writing machine that also drew, made by Maillardet in about 1805. It is now at the Franklin Institute.

Joseph-Marie Jacquard


The works of Bouchon, Falcon, Vaucanson, Jacquard, Bonelli, Bolmida, Vicenzia and others are reviewed. Vincenzia's efforts in the 1850s with electro-magnetic methods for reading patterns and controlling looms receives considerable attention in this book.

He discusses early programming methods for looms using cards to set weaving patterns in the 1700s.


This details the work of Bouchon, Falcon, Vaucanson, Jacquard and others in the development of looms.


This is an extremely detailed study. Some material on textiles and looms may be found in volume four.


This details the work of Bouchon, Falcon, Vaucanson, Breton, and Jacquard on the draw loom.


This contains details on the Jacquard loom.


This is a detailed account on the workings of the loom and is heavily illustrated. It is particularly useful for understanding how the cards were used, often considered an early form of machine programming.


This contains a discussion of Bouchon, Falcon, Vaucanson, and Jacquard among others.

Gottfried Wilhelm von Leibniz

This volume has a great deal of information on his mathematical ideas and about his calculators. It does not provide an adequate amount of technical details on the device. Otherwise, this is a useful, scholarly book.


This short, illustrated biography also defines his significance for the history of data processing. It focuses also on the development of Leibniz's device.


This is a translation of a 1685 document describing the four basic arithmetic operations.


This illustrated biographical note contains a review of his calculator.


This describes binary representations and the design of a binary calculator with the use of moving balls to represent digits.


This is a basic reference on Leibniz, covering all aspects of his scientific work and ideas, not just about calculators.


This is a useful source for basic information on his calculators. He built the first one and designed a second.

This collection of calligraphic symbols suggested ideas in favor of a logical language of thought similar to Leibniz's.


This is a short review of Leibniz's device.


He briefly reviews Leibniz's wheel, Odhner's device and then the Mercedes-Euclid and Millionaire calculators.

Samuel Morland


The author has prepared a well-researched monograph which includes discussion of pumps, steam engines, cryptography, and calculators; includes illustrations.


She surveys the life of Morland (1625-1695) and the development of his calculating machines, including two hand held devices (1673), using gear wheels driven by a stylus.


He describes his own machine, making this both an early "product" publication and one of the first "application briefs" to be published.


This 164-page book focuses on the mathematics of the devices and less on their mechanisms. Sir Samuel did not hesitate to publicize the virtues of his inventions, and this publication was part of the effort to make known his own creations.


This has a biography complete with detailed notes.
on bibliography covering this inventor of the 1600s.


It contains some material on Morland in Sweden.

John Napier


This is a short biography with details on logarithms.


An early twentieth century expert on calculating machines discussed the importance of logarithms in an historical context.


Napier's rods received detailed attention early-on. These authors described his "multiplicationis promptuarium" for multiplication.


The author reproduces a translation of a paper by Napier, dated 1617, explaining the use of rods to help process multiplications.


This is one of the better accounts of the subject.


This is an abstract of the author's Ph.D. dissertation in which he reviews the origins of logarithms, Raddologia and other topics. The dissertation itself is 1,044 pages in length.

Jones focuses on the origins of the rods developed by these two mathematicians and discusses the relationship of their work to each other.


Pages 259-295 reviews Napier's rods and their use in determining square and cube roots of a number. The rest of the book is a good reflection of mathematical thinking of the late 1600s.


This is a very early account of Napier's logarithms, clear evidence of their immediate impact on mathematicians.


Written by the inventor of logarithms, this book is not about mathematics but instead on society and mankind in general.


It is in this book that he describes for the first time in detail his "bones"—logarithms.


This is a biography and description of his invention.


Besides reviewing his own ideas on mathematics, he discusses the use of Napier's bones.


The article is proof of Napier's logarithms being accepted in many parts of the world quickly after their development.

Blaise Pascal


He discusses Pascal's work with early calculators.

This is a full biography of the mathematician and about his work. Although Pascal died at the early age of 39, he accomplished a great deal, including the development of a calculator described in this book. The majority of the volume, however, is devoted to his work in mathematics.


This brief biography focuses on his work with the calculator.


In this, the most famous encyclopedia ever published, a leading French light wrote the first full account of how Pascal's machine worked.


He surveys Pascal's role and views regarding calculating machines.


This short, illustrated biography also places Pascal's contribution into perspective as it affects computer science. The article also describes clearly Pascal's calculator.


This is a translation of an advertisement prepared by Pascal in 1649 for his calculator.


The author describes eight copies of Pascal's calculators.

He covers a variety of inventors such as Pascal, Schickard, Leupold, Braun, Hahn and others.

Wilhelm Schickard


The author describes how this man's work was introduced and how the machine functioned. Although a brief article, it is well done.


The author tells how he found letters by Schickard addressed to Kepler about his calculating device and on its use.


Focus is on the astronomer's work in a very short biography.


This describes Schickard's machine.


This is a brief overview of the device based largely on Schickard's letters to Kepler on the subject.


He continues the same theme as the previous two entries but this time with illustrations.


He focuses on recently discovered descriptions of Schickard's machine.

This is a brief, illustrated description of Schickard's device.


This is a survey of the life and work of Schickard by the most knowledgeable expert on the man.


Although this contains a great deal of material on Leibniz, and to early aids to enumeration and calculation, it is also a good source on Pascal and on Schickard.


This illustrated history of calculating machines reviews devices made or designed by Schickard, Morland, Schott, Kircher, Lucas and Genaille.

Jacques Vaucanson


This is a lengthy biography with considerable attention paid to his mechanical automata and his draw loom.


This illustrated account discusses how mechanical automata emerged, with particular focus on Vaucanson, von Knaus and other inventors of the eighteenth century.


This has several chapters on automata and about the work of Vaucanson and Maelzel.

This is a translation of his 1738 publication along with another piece on other automata: a duck and a flute and drum playing figure.


This describes a device automating a flute, with its blowing and fingering using pegged cylinders for sequence action control. Unfortunately, the 15-page pamphlet was not illustrated.

Machines and People (1500-1800)


This reviews from primitive astronomical devices through Hollerith machines in Vienna. It provides details on Schickard's calculating device, draw-looms and "Broselmachine" (1680-1690), and modifications to Hollerith machines by Schäfier.


This is a collection of biographies of and bibliographies about 53 compilers including Babbage, Burgi, Comrie, Napier and Wiberg.


Maelzel was an early nineteenth century German builder of musical automata.


The second edition contains 1,510 entries with all the major figures of computing represented.


This has a great number of historical details on the work of Bouchon, Falcon, Vaucanson and Jacquard.


This is an illustrated history of machinery beginning with Heron of Alexandria down through James Watt. Included are devices by Vitruvius' (Hodometer) and another by Leonardo da Vinci, both of which recorded
travelled distance by the controlled release of counting balls into a container. In reality, da Vinci developed a design for geared counting wheels.


This suggests that the odometer existed in the fifteenth century and definitively by the late 1500s.


This is a good survey covering hydraulic and pneumatic equipment, mechanical clockworks, pegged cylinders, and presents the highlights of Vaucanson's work. This article is illustrated and contains bibliographic references.


As with weaving devices, various methods were developed to command musical machines to perform specific functions. A variety of automatophonic instruments are described and illustrated, including barrel organs, music boxes and pianolas.


This 48-page illustrated review covers Gerbert, Pascal, such devices as jetons, Campos bookkeeping units and logarithms. It has an illustration of a Campos machine.


The focus is on pre-electric calculators; illustrated.


This philosophe of the eighteenth century dedicated a chapter of this work to automatic pipe organs, described how they worked, and offered details on their construction, finally comparing their pros and cons to manual systems.


He discusses Colmar's work and device on the occasion of the unveiling of a statue to Colmar.

This discusses the gunner's compas, a tool used to help set the elevation of the barrel.


The author provides a description of the compass, which is a sector, made in the first decade of the 1600s or in the very late 1500s.


This is a good overview of calculators used to do simple mathematical functions. It also surveys astronomical instruments.


These short 14 pamphlets survey manual and machine calculation. Topics include Pascal, Morland, Schott, Leibniz, Perrault, Poleni, and Leupold.


This was a press report on the discovery of the Antikythera Device which scientists later concluded was a very early drive mechanism used to help in performing astronomical calculations.


This is an illustrated description of each device.


This briefly covers Morland, Leibniz, Poleni, Leupold and Pascal before offering considerable details about his own machine: what it is, how it works, and when it should be applied.

This is a superficial account of Pascal, Morland, and Leibniz.


He describes his own calculator, one of several built by European mathematicians in the 1600s.


He describes a machine designed by him based on the use of Napier's rods; illustrated.


This is on Sir Francis Bacon, Gray and Baudot, surveying their work in mathematics.


He describes this 13th century monk's ideas for a mechanically produced set of syllogisms, making it an early logic system.


This is a biography of the mathematician of the 1600s.


This is a biography and contains a description of his calculator.


This reviews a Moslem mathematician's work on calculating equipment.


This describes a draw loom with sequence control mechanisms made up of wooden pegs on a canvas. It was invented in Austria in about 1740 independently of Bouchon's and Falcon's machines.

This surveys the Antikythera Device and its possible use in ancient Greece.


He argues there was a parallel development from Greek times of astronomical and anthropomorphic devices.


This is an early account of Wolfgang von Kempelen (1734-1804) and of his fraudulent chess-playing machine, the Turk, which toured Europe in the late 1700s.


This discusses a calculating machine made by a Hebrew clockmaker named Jewna Jacobson at Neiswiez, Lithuania, no later than about 1770. It could add, subtract, multiply, and divide up to nine digits, although it was used for up to five.


He reviews Pascal's calculator and those of early developers in Europe.


This tracks the idea from Descartes' machine to La Mettrie. The latter stated that man was simply a machine.


The needs of navigation led to such aids to calculation as the astrolabe which are described here.

This is an illustrated account of a fictional device in *Gulliver's Travels* that could write.


This is on the evolution of calculators. Some which are mentioned include those by Pascal, Gersten, Leibniz, Poleni, Leopold, Hahn and Müller.


The author reviews some calculators built by Pereire, Leupold, and Stanhope in the 1700s.
3

Origins of Modern Computing

During the period from roughly 1800 to the end of World War I, both Europe and the United States shifted from an overwhelmingly agricultural economy to one dosed heavily with industrialization. Mechanical devices for all manner of human labor came into their own, and that included aids to computing. Modern adding and calculating machines, typewriters, slide rules of all sizes and shapes, the cash register, and punch card technology were introduced on both sides of the Atlantic. Elegant and complex "engines" were conceived by Charles Babbage (1791-1871), while others worked out the theoretical backgrounds in mathematics and logic used in the twentieth century in the creation of the computer. Thus, for example, the work of George Boole (1815-1864) proved important to computing in general.

This chapter contains recent monographic works and contemporary publications detailing the large number of developments in the era of the Industrial Revolution. These two types of materials reflect the available sources, since the period as a whole has not been effectively covered by historical surveys. Literature on Babbage himself represents an exception, almost a growth industry, while materials on other inventors are only now beginning to appear. The section on adding machines and calculators contains references to the major vendors of the age, as do those on Felt and Hollerith. Someone interested in early punch card activities would consult the sections on both that subject and Hollerith. The general subject was broken out into two because of the large amount of material of a biographical nature and on the nature and use of his technology.

The most useful studies to date for the period are biographical surveys of Hollerith and Babbage. Much is yet to be done on other inventors of the period. Full-length biographies, based on significant research, are lacking for such major figures as William S. Burroughs (1855-1898) and Leonardo Torres y Quevedo (1852-1936). Institutional histories of adding and calculating machine vendors, such as Burroughs and Felt & Tarrant, and of cash register companies, such as NCR, have yet to be written. There are useful studies of the role technology has played in national census-taking for both the nineteenth and the twentieth centuries, primarily in the United States.
Material in this chapter has been organized largely by biographical categories, since many of the developers worked independently of any institution and were not a part of some recognizable industry-wide movement. When sub-sets of equipment existed, such as punch card devices and adding machines, separate sections on these were created. This work does not attempt to provide a detailed catalog of fiction dealing with computing; one exception has been made—The Wizard of Oz, since that body of publications became extensive and proved very visible at the time. Monographs dealing with mechanistic motifs, such as Frankenstein, can be found most easily through the general index to this bibliography. However, as a general comment, the amount of monographic material on computer/robot fiction is very limited.

Adding Machines and Calculators


This is a short review of ten important adding machines developed by W.J. MacNider.


This is a history of W.T. Odhner's calculator which dominated European and Russian calculating machine technology from the 1870s to the 1920s. It is a company history but also contains biographical data on the inventor himself.


This is nearly 700 pages in length, and reviews in part mechanical calculators at the Paris show. Two which are described were made by Musina—a pocket calculator for adding—and the other a Thomas Arithmometer. The book also has a survey of the history of calculators in general; see especially pages 629-648.


This is a catalog of the Museum's collection of early calculating devices, and including pieces of machine's built by Babbage and Scheutz. The publication describes these in some detail.


This author lectured on then current technology, surveying efforts by Babbage, Morland, Stanhope.
Thomas de Colmar. He paid particular attention to a device made by Tate called an improved Thomas Arithmometer and another called the Edmondson "circular machine".


This is an illustrated description of the device. Burroughs was, by 1907, one of the largest suppliers of calculating equipment in the world.


This is a ten-page catalog of technology that had not changed fundamentally since the turn of the century.


This 98-page publication describes the complex use of many products offered by Burroughs by 1911 and illustrates typical applications of the age.


This author traced the rise and evolution of the accounting profession, particularly during the 19th century with some mention of the role of technology in the performance of an accountant's job.


Originally written in 1951, this is on a device that composes Latin hexameter verse and on the inventor, John Clark (1785-1852). The title is a verse created by the device. This machine was exhibited in London in 1845. The article includes a photograph of the machine.


By 1917 complex adding/calculating devices were available for accounting applications, particularly from Burroughs.

This offers a good explanation of Napier's rods, and a brief review of machines circa 1940.


This is based on a large number of business histories and corporate records to present an extremely crucial story. It was in this environment that all manner of office machines were used.


This 24-page, illustrated pamphlet is an operational guide to an arithmometer with a description of its design.


This is a pamphlet written by a professor of accounting at the University of London. He describes existing machines, their recent history, and how they are beneficial.


The author built a variable motion drive mechanism to do arithmetic in the 1880s.


This is an important publication that reviews calculators, slide rules, nomograms, difference engines, and devices by Babbage, Pascal, Burroughs, Felt, Leibniz, Müller, Thomas, Maurel, Tchebichef, Odhner, Selling, Scheuz, and the work of Bollée. A third edition (published in 1928) was completely rewritten to account for technology introduced since 1905. The third edition includes material on Torres y Quevedo.


It lists calculating devices with short descriptions. This is particularly useful for a quick appreciation of what was available in Europe in the 1890s.


This discusses difference engines, and machines made
by Morland, Stanhope, Thomas, and Grant.


This covers the development of devices to help reasoning and problem solving in formal logic. It argues that Marquand was the first to design an electric logic device in 1885 and that Burack was the first to make one in 1936.


This is a lecture he gave on a system of rods similar to Napier's.


This is primarily about calculating devices drawn from U.S. patent records and describes the work of Castle (1850) 10 key adding machine, Riggs (1854) similar device, Teasdale's multiplication machine (1871), and then a variety of equipment from Felt, Burroughs, Dalton, Moon-Hopkins, Grant, the Millionaire and others.


This is a good review of the author's device for calculating and about its technology.


This reviews his work with calculating machines as of about 1880.


The author was the founder of the U.S. gear-cutting industry. In this article he describes a device he built in the 1860s which weighed over a ton and had 15,000 parts.


Chapter One gives an historical overview on the origins of computer and about the effort to make a commercially viable calculator in the 1800s.

This 24-page pamphlet describes the use of an early mechanical calculator.


This is an illustrated and detailed survey of the evolution of calculating and bookkeeping devices such as punch cards, relay and electrical computers, and such older devices as were made by Leibniz, Poleni, Roth, Odhner, Baldwin, Müller, Thomas, Burkhardt, Hamann, Bollee, Steiger and Burroughs.


The author was a French military officer interested in mathematics and ballistics. He describes various uses for mechanical aids to calculations.


This has a description of calculating devices made by Hahn, Burkhardt, Unitas, Archimedes, Brunsviga, Monopol, Mercedes-Gauss, and Millionaire, all from the very early 1900s.


This is an illustrated review of calculating machines made by Goldman, von Mayer, Felt & Tarrant, Burroughs and by Brunsviga, Thomas, Selling and Baldwin all of the late 1800s/early 1900s.


This details a machine made by Ramon Verea in 1878 which employed a mechanical multiplication table equaling ten faced prisms each of which had nine pairs of holes.


He surveys developments from the 1870s to the 1920s, a period in which enormous strides were made in the United States in the development of many calculating machines.

This offers a description of a circuit diagram made up in about 1885 by Alan Marquand for an electrical relay device executing logical inferences.


Pages 236-267 offers a useful historical review of calculators from Pascal to Felt and includes those of Leibniz, Thomas, Maurel, Bollée and Steiger. It also discusses difference engines and contains bibliographic references.


A contest was held in France between a man and a calculator; the machine proved faster.


This is a description of a French device for doing fast multiplications and is illustrated.


This describes the use of calculators to do such work as design ships.


This focuses on Marquand's electrical binary logic machine of the 1880s.


He describes the work of Percy E. Ludgate (1883-1922), Leonardo Torres y Quevedo (1852-1936), and Vannevar Bush (1890-1974). It is detailed, well documented, clear and illustrated.


He has a section devoted to "read-only" memory in Morse code.

The author describes Jacquard and player piano technology and the role of perforated paper tape in controlling instruction of machines.


As a part of a new type of business literature on how best to manage offices, this book reviews data processing technologies of its day as part of that discussion. It comments on tabulators, adding and calculating machines, and typewriters.


This refers to the increased use of computing equipment in American offices at the turn of the century.


This is an illustrated description of an arithmometer and on the work of Thomas de Colmar, and his son Thomas de Bojano, inventors of the device. It is a useful and detailed article.


Like a new wave of office management books to appear in the early 1900s, this one acknowledges the useful features of using office equipment. It describes also how to cost-justify their acquisition.


This has some analysis on the world-wide industry but is most useful for its detailed tariff schedules. It is surprising how many countries at that time already had focused on office equipment.


There was considerable interest in office equipment.
in Russia, similar to what was going on in Western Europe. The most popular devices were Odhner-based technology for calculators. These are described in this publication.


This is an early European source on mechanical aids to calculation available in the late nineteenth century.


This is an historical review along with an account of the mechanization of calculations of actuarial tables. It is a very early publication on nineteenth century calculators and indicative of which industry was one of the earliest to adopt such technology.

Charles Babbage


This reviews Babbage's relations with the British government and his work on the design of an analytical engine.


This is a short review of both the Difference and Analytical Engines.


This is a short bibliography on the life and work of Charles Babbage.


This describes the Difference Engine made in 1833 and an exhibit on it at the Museum.


This was his first publication on the Difference Engine.

He reports on Scheutz's engine in a positive light. This machine had been under development throughout the 1830s and 1840s and was completed in the 1850s.


This is the first article in which Babbage discussed the design of the Analytical Engine and what made it unique from the Difference Engine.


He has a chapter on "Calculating Engines" and another on "Intrigues of Science" which reviews the relations of the government regarding calculating machines. Here we see some of his views about the impact of the government on his own work and on the analytical engine while providing much social commentary.


This 16-page pamphlet reproduces a paper written by Babbage in 1829.


This suggests that Babbage spent the past six months working on a new machine that could execute sequences of mathematical operations.


He discusses his views on various projects and machines, and offers a history of his efforts at making difference and analytical devices.


The first part describes his son's drawings using
"mechanical notation" of Scheutz's engine. Part two is correspondence regarding his engine.

This is a paper he read on December 13, 1822 on the value of removing restrictions of the Difference Engine to functions with some order of difference being constant.

This is a significant paper because for the first time he describes mechanical notation, a fundamental concept behind his engines.

This is his most complete description of the Analytical Engine.

This is an early discourse on mathematical machinery and how it relates to his own work with engines.

Several chapters deal with the difference engine and the subsequent analytical engine.

He describes the machine made in Sweden which won a gold medal in Paris in 1855. Babbage admired the machine.

This describes the work oh H.P. Babbage following
This is a very readable account of Ada Byron that is

This surveys various mathematical tables for which

Table: "Professional Magazines" (May 1847): 355-
Table and Printing of Mathematical and Astronomical
The Mechanics, 7-10 Jan. 1847. Annual of the
Babbage, R.H. "The Work of Charles Babbage, "Proceed-

He offers a brief description of mechanicl notation.

Beaconet of Scence (1839): 203-205.

Equipment design.
Beaconet of Scence (1839): 203-205.

He does descuss the fourth mounent of this career in India.

General H., Babbage, London: Privately Printed,
This reprint of many papers; the volume is edited by


Orations of Modern Computer.

Scanned OCR with permission of Greenwood Press [19 June 2009]
weak on facts but useful for discerning her personality. It also describes her relationship with Charles Babbage to some degree.


This is a useful catalog of the Museum's collection of early calculating devices, including Babbage's difference engine, and another made by Scheutz. Parts of Babbage's analytical engine are also here and described in this publication.


This is a serious biography of Babbage.


Booth comments that early pioneers in computers did not know of Babbage's work or that he had already developed the logic of a digital computer—a controversy that continued throughout the historical literature into the 1980s.


This is a shorter version of his 1960 article on the same subject (see entry number 506).


He reviews in general terms the work of Charles Babbage and Lady Lovelace.


He delivers the same message and material as in the previous two publications.


The author headed up the ENIAC project in the 1940s and states that that work was done without anyone being aware of Babbage's accomplishments with regard to digital devices, especially concerning the Analytical Engine.

He describes Babbage's Difference Engine.


This contains a short account of Babbage's Difference Engine, first published in 1832, along with an account of Babbage's demonstration of the device.


This is the same as item number 510 reprinted.


These are the memoirs of Menabrea, in French, which in part (pages 36-38) reviews his meeting with Babbage and also about the relations of both men with Lady Lovelace.


This is a useful, technical review of his engine and of its design.


This is a detailed, technical review of Babbage's architecture and design for both the Difference and Analytical Engines; excellent.


Babbage's correspondence with various Italian scientists regarding his work is presented here, a great deal is from the 1840s. These papers are today at the British Library.

This is a competent biography of Prandi, friend of Babbage, while in London. The paper is based on primary sources.


Buxton, with the cooperation, wrote this biography which he completed after Babbage's death in the late 1800s but which is published now for the first time. It is edited by a leading biography of Charles Babbage.


This is a detailed review of the engine, with some discussion of his other devices and those of other people of the period.


This is a defense of Babbage's efforts; rivals is used here to define his critics.


This focuses on difference engines, including those of Babbage and Scheutz.


The article reviews how he produced what was considered the most accurate logarithmic table of its day.


This is a brief overview of Babbage's work; an obituary notice.


The material includes the quote "It substitutes mechanical performance for an intellectual process" to describe the functioning of his Difference Engine.

This is a well-researched technical review of Babbage's work.


These are recollections of a visit to Charles Babbage's home and discussion of the Difference Engine.


He includes material on a conversation with Babbage and Lady Lovelace.


He reviews a conversation with Babbage during the 1850s concerning analog devices and Lady Lovelace.


He includes a one-page obituary of Lady Lovelace which appeared originally in the Examiner.

529 de Morgan, S.E. Memoir of Augustus de Morgan, With Selections From His Letters. London: Longmans, Green and Co., 1881.

He has passing comments on Babbage and of a visit to him.


It comments in part on Charles Babbage.


Published nearly two years after his death, this is a report on Charles Babbage's life and work. It does include quotes from his writings and an obituary notice.


He presents an essay on his (Babbage's) thinking as it applied to his "computers" or engines. The term computer is used prematurely in this article.

This is a scholarly review of the subject and of his machines based on the Babbage Papers.


This is the revised, improved, and published version of his 1968 dissertation.


The author had invented and brought to market a very widely used desk-top calculator by the time he wrote this article. In this piece he describes the difference machines built by Babbage and Scheutz and compares their design and function to his own Comptometer.


Babbage's work is reviewed based on an interview with H.P. Babbage.


It lists some 2,600 items from Babbage's personal library with discussion.


This surveys Babbage's work, offering an abstract simulation of the Difference Engine, written in APL. For a useful analysis of this article see Annals of the History of Computing 5, No. 4 (October 1983): 411-415.


This a biography for the general reader and which is critical of his engines.


This is a short biography of Babbage.


Pages 240-254 reviews Babbage's life and work, paying attention to his two important machines.


This important book has some material on the role Babbage played in the field of nineteenth century British mathematics.


This is a popular, functional biography of Charles Babbage, based on secondary sources in large part.


The author includes some thoughts on Babbage, on his relations with Lady Lovelace, and on their contribution to computation.


This is especially useful for the phases Babbage went through to arrive at his views on general programming of sequence control and about Lovelace's calculations of Bernoulli numbers.


This is simply a summary view of Babbage and his work on calculating engines.


This is an introduction to Babbage's friend.

This is an illustrated account of the correspondence between Lovelace and Babbage and on their work.


This is the best biography on Babbage. The research is thorough, is based on primary materials, and covers his life and work in a balanced, full manner.


More than a dictionary, it contains material on Babbage.


He details the place and birth of Charles Babbage.


Although the birth year is off, this wall chart has accurate information on Babbage's engines, especially the Analytical Engines of 1834 and 1856.


This 53-page pamphlet defends Babbage and is critical of the British government and the Royal Society for not supporting his work with engines.


This details the life of Lady Lovelace and her work with Babbage on analytical engines and a gambling scheme.


This is a survey of mathematical tables and of the Difference Engine.

This is an obituary notice for Charles Babbage with portrait. He was recognized as a major mathematician in his own day, resulting in numerous obituary articles.

558 "The Late Mr. Babbage," The Times, October 23 and 30, 1871, p. 5.

This obituary notice is particularly detailed on his early years.

559 Lewis, T.C. Heroes of Science: Mechanicians. London: Society for Promoting Christian Knowledge, 1884.

Pages 302-340 contain a biography of Babbage drawn from his own writings. There is nothing on the Analytical Engine.


This has many papers previously unpublished by Babbage housed at the library of the Academy of Sciences of Turin. It includes police records on Babbage's activities and those of his friend Fortunato Prandi.


He surveys Babbage's ideas regarding program control of machinery.


These are reproductions of eighteenth century French articles on calculating machines such as the adding device of Perrault and calculators of Lepine, Pascal, Hillerin de Boistissandeau by an expert on Charles Babbage.


This has a significant paper on Babbage's Analytical Engine, reflecting a clear view of the device.


Pages 71-83 contains a chapter on Babbage's life and
includes a good description of his ideas for an analytical engine.


This describes how the Difference Engine was intended to function.


The epilogue was written by May, Countess of Lovelace and contains a short biography of her husband's mother, Ada Augusta, also the Countess of Lovelace.


This is general, short account.


This was written by a friend of Babbage and may perhaps be the first account published of the analytical engine's concept on the European continent. It is well illustrated.


This includes a letter to the author from Babbage on the subject of the Analytical Engine.

570 Merrifield, C.W. "Report of the Committee, Consisting of Professor Cayley, Dr. Farr, Mr. J.W.L. Glaisher, Dr. Pole, Professor Fuller, Professor A.B.W. Kennedy, Professor Clifford and Mr. C.W. Merrifield, Appointed to Consider the Advisability and to Estimate the Expense of Constructing Mr. Babbage's Analytical Machine, and of Printing Tables by Its Means," *Report of the British Association for the Advancement of Science, Dublin, August 1878*. (London: John Murray, 1879): 92-102.

This reviews Babbage and his ideas. It concluded that his machine was not sufficiently designed yet to be built at that time.


This is a collection of 13 microfiche cards with the
papers of Charles Babbage for use by researchers on his life and work.


This is an excellent biography which has material on her work with mathematics and her relations with Charles Babbage.


This contains 400 pages of material on his engines. It is a convenient collection of primary source materials.


This is a biography with some description of his engines.


For many years this was the standard biography on Babbage.


Pages 19-20 recount a visit to Charles Babbage by the author and has some sad comments about the unfinished analytical engine.

577 "Mr. Babbage and His Calculating Engines," Mechanics Magazine 21, No. 578 (September 6, 1834): 391-392.

This was a report on the current status of the Difference Engine and of its problems. The article suggests that the British government investigate what is going on so that the work could be completed.


Like the previous article, it reviews the status of the project.


This reviews calculators made before Babbage's and
then surveys the status of work on the Difference Engine.


This is an obituary notice that contains some details on how he built the Difference Engine (or parts of it).


He argues that modern designers did not know of Babbage or of his work when they developed the digital computer.


This biography has a good overview of Babbage's work.

583 "Our Obituary Record," The Graphic, November 18, 1871, p. 495.

This is an obituary notice on Charles Babbage.


This was written by a friend of Babbage and has material on the inventor.


This article is somewhat critical of Babbage's efforts in regard to the Difference Engine.


This is a letter to the editor regarding Babbage's book, On the Economy of Machinery and Manufacturing, published in 1832, asking why the inventor has not finished building his calculating machine instead.


The author describes memoirs of meetings and letters with Babbage, a close friend of the author.

Pages 90-102 discuss a self-regulating heating system installed at Babbage's home in 1837. Plate 16 has a layout of the house while Plate 17 the machine to control water flow in four circulation loops. The machine was devised by Babbage.


He reviews the Society's relations with Babbage and the inventor's attempts to bid for government contracts in the early 1850s.


This was the 191-page sale catalog with sections on pure mathematics, astronomy, mechanics, optics, electricity, pneumatics, mathematical tables for a total of over 2,000 items.


Babbage was closely associated with this organization.


There are some references to Babbage and his calculating machines.


This book has passing comments on Babbage and his role relative to other scientists of his time in industrial England. Such books are important to appreciate the relative impact of people who later were seen as giants of as yet an unborn industry, such as data processing.


He describes the role played by Babbage in acquiring a calculator for the Albany, NY observatory in the nineteenth century.


This lists the papers and discusses them in detail. The article is very thorough and complete.

First published in 1863, this has a chapter on Joseph Clement who did some work for Charles Babbage. An appendix written by Babbage explains their relationship.


This is based on a letter written by Babbage on his own work in 1840.


This is a full biography of Ada Lovelace, Charles Babbage's companion. The author focuses a great deal of attention on how he worked with her to promote his various projects.


This publishes a letter defending Babbage's plans for calculating and printing mathematical tables automatically.


While minor, a connection existed with interest in his engines covering many years in duration. Work on early digital computers also took place in New Zealand.


Pages 134-135 discuss Babbage's work mentioning that, in addition to his engines and automatic speaking machines by others, there is a review of work by Morland and Jacquard.


This is a short biography and review of Babbage's work, and about his visit to Turin in 1840, based on manuscripts in the collection of the Academy of Sciences in Turin.

603 Tucker, R. *Mathematical and Scientific Library of the
Origins of Modern Computing


As part of the effort to liquidate Babbage's estate, this catalog of some 2,000 items on science in general was published.


This is a light account of Babbage's Analytical Engine and has some comments on American computers, including on the method of programming the ENIAC.


This is a short account of Babbage's machines with a quote from him in a letter dated December, 1839 to an associate on the use of the Jacquard card technique.


This reprints the letter with analysis, on the concept of the Analytical Engine.


He discusses Babbage and the implications of his work.


This booklet has two articles concerning Babbage's arguments with the British government over his difference engine. The argument is critical of the government's lack of support. The pamphlet may have been edited by Babbage himself.


Chapter nine reviews Babbage's relations with the Royal Society and the government regarding his engines. He uses primary materials housed at the Society's library.


This is a detailed view of Babbage's Analytical Engine by a leading computer scientist.

He relies extensively on Babbage's notebooks for material with which to write this article on his Analytical Engine.


This is a short biography that also explains his significance to the general field of computing's history; illustrated.


Wilkes focuses on why Babbage wrote little about a control system for the Analytical Engine. He offers details as well from the notebooks.


Babbage wrote a letter on August 2, 1835, which is reprinted here, describing his thoughts concerning the Analytical Engine.


This is a short biography.


The author describes the contents of Babbage's library of some 2,000 items, suggesting possible intellectual influences on him.


This contains a bibliography, photographs and notes.

This is a letter supporting Babbage's plans for an analytical engine to prepare mathematical tables.

Leon Bolée


This is a short description of his machine with a good explanation of how it works to do direct multiplication.


He describes Bolée's direct multiplier first built in 1887. Some biographical data is also included.


This surveys Bolée's machines and provides a very useful of his life and work.

George Boole


This is insightful, well-written, and offers a good review of the life and work of George Boole.


This is a reprint of his famous book, An Investigation of the Laws of Thought, on Which Are Founded the Mathematical Theories of Logic and Probabilities, first published in 1854. This is the book in which he presents what came to be the basis for Boolean mathematics.


This contains a good survey of his thinking in original source material.


This is a good introduction to the nineteenth century
mathematician who applied arithmetic (mathematical) principles to logical thought, hence the term Boolean logic. His work was essential to the mathematics underpinning the development of computer technology in the following century.


This is an illustrated, technical discourse on the evolution of Boolean logic and how it applies to compilers.


This is a useful biography that also explains his significance to computer scientists.

Dorr E. Felt


This provides a description of the machine he invented and that became the basis of Felt & Tarrant Manufacturing Company of Chicago; illustrated.


This is on one of the more popular calculators of the turn-of-the-century. It is a description of its use in performing basic arithmetic functions and offers a comparison to the functions of slide rules and arithmometers.


He describes his comptometer and comments on developments by other vendors. It offers useful information on the history of Felt & Tarrant Manufacturing Company.


This is a very important publication not only on Felt & Tarrant's products and history of the company, but on calculators in general; their technology and use. The 1920 edition is over 600 pages in length and has many illustrations.
Herman Hollerith


This is the definitive biography of Hollerith, covering his life and work, while providing considerable information on punch card technology and the industry it fostered from the 1880s to World War I.


This consists of excerpts from his book cited above.


This deals with Hollerith's efforts to sell his devices to commercial users from 1900 to 1910.


This is a short biography.


This is a short version of the M.A. thesis and, like it, relies on research done in the Hollerith family papers.


This is a short biography.


This is a good analysis of his business career and on his personality. Emphasis is on the years after 1890, ending in 1911 when his firm became part of C-T-R.


This is a textbook on how to use contemporary gear developed by Hollerith. It is over 400 pages in length and well illustrated, suggesting what Hollerith accomplished.

While primarily a survey of Hollerith's equipment, it is a useful, if short, introduction to his work.


This is an obituary.


This illustrated article reviews his first tabulating system and use in the census of 1890. There are passing comments on the origins of IBM.


This is Hollerith's own description of his punch card equipment and how it could be used for the census.


The article was written by his daughter. She focuses on how he developed his tabulating system and about his trips to Europe to find users.


While primarily an application brief on the use of his devices, along with photographs of these as installed at Southern Pacific Railroad, Carnegie Steel, Cleveland Electric Illuminating Co., it is suggestive of what he sold and to whom.


This biography also defines his historical significance to the data processing industry.


There are passing references to Walker's relations to Hollerith.

This is a well documented biography and of his work up to about 1914.


This is a brief review of his life and work, complete with a useful bibliography.


This is a translation of an article in English and good evidence of the publicity Hollerith was receiving in many parts of the world.


It pays particular attention to the evolution of his punch card devices.


This has a short passage on Billing's relations with Hollerith.

Percy E. Ludgate


While the focus of this piece is on Babbage and his work, it offers a rare glimpse into Ludgate's own thoughts.


Written by a lesser-known pioneer of computing of the first decade of the 1900s, this article describes a tape drive calculator.


This is the only serious article to appear on Ludgate's career and work on an analytical machine.

656 Riches, D. An Analysis of Ludgate's Machine Leading to
a Design of a Digital Logarithmic Multiplier.

This 94-page monograph analyzes Ludgate's ideas and has designs and other illustrations included.

Otto Schaffler


This is an illustrated review of Schaffler's life and work by a computer scientist.


This illustrated and well-documented biography illustrates how early machines could be programmed using a telephone-like switchboard.


This is on the life and work of Schaffler who patented a plugboard in 1895 for controlling punch card equipment.

Georg and Edvard Scheutz


This reviews the work of Georg Scheutz and of his interest in Babbage's machine between 1833 and 1853. It covers work done the workshop of J.W.Bergström in Stockholm during those years on improved versions of Babbage's designs.


This is a short biography of the father and son team. It is well done and fully annotated with bibliography.


Austrian astronomer Edmund Weiss (1837-1917) saw the...
Scheutz machine at the Dudley Observatory in 1872 at Albany, New York. His observations are published in English.

This focuses on two Scheutz machines and in their use to calculate and print English life tables. This article has bibliographic references on difference engines in general.

It has a great deal on difference engines, on Scheutz and about Wiberg and Torres y Quevedo.

These three machine builders of the 19th century are well reviewed both in terms of the social context in which they worked and their actual technical achievements. It is a major source of material that uses new primary sources for a very well documented study.

This is a serious study that is well documented.

This is an illustrated account of four European contributors to computers involving the work of Leibniz, Pascal, Scheutz and Zuse, with passing commentary on Babbage. The most useful portion covers Scheutz.

This series of articles on Scheutz includes translations of original documents on his difference engine. Included is an extensive bibliography by C.F. Bergstedt.

This contains excerpts of meetings held at the
Institution of Civil Engineers during 1855-1856 at which Babbage talked about his own device and that of Scheutz.


This is a thorough and competent study of the 19th century project complete with illustrations and bibliography.


This was one of the first "application briefs" ever published describing the use of a difference engine. It details the use of their machine of the 1850s.


This observatory, located in Albany, NY, used a Scheutz difference engine for the bulk of the second half of the 19th century which is described here.


He describes a Scheutz difference engine and its printing of logarithms completed in 1874.


Leonardo Torres y Quevedo


This obituary notice reviews his work on all manner of scientific research, including on computation devices and automata. It is substantive, written by a technically competent writer.


Although an obituary, this is a detailed review of his work, including on analog and digital devices.

677 Homenaje a D. Leonardo Torres Quevedo (1852-1936).

This has a 1951 article on Torres by G. Torres Quevedo Polanca and a 1953 catalog of an exhibition of the inventor's machines; illustrated.


This is a short, illustrated account growing out of an exhibition of Torres' work. It includes a biography and a bibliography.


This is a biography containing a great deal of information, including illustrations and photographs of the inventor and his machines.


This is a fuller treatment of Torres and his work than the 1974 publication.


This is the most detailed, best biography of Torres y Quevedo and of his work. For a review in English, see Annals of the History of Computing 3, No. 4 (October 1981): 416-417.


This is an illustrated account of his scientific work and especially about his chess machine.


He describes the machine invented by his father for playing chess and for remote control of a boat.


This is on the life and work of Torres y Quevedo prior to World War I, and particularly regarding an electro-mechanical analytical engine.

685 Torres y Quevedo, L. "Arithmomètre Électromécanique,"
He describes his electromechanical arithmometer. It was an important development of the time for arithmetic calculations, controlled by a typewriter.


He discusses digital methods for automatic process control and then describes how a program controlled calculator might work, years ahead of many other designs.


This is the original version of the material presented in citation No. 686.


This is an illustrated article describing the inventor's typewriter-controlled arithmometer.


This is a short survey done, especially concerning a chess-playing machine.


This is a short, illustrated article on the inventor and about his electro-mechanical devices and, in particular, about the chess machine and arithmometer.

Martin Wiberg


This is a short biography of Martin Wiberg (1826-1905) which also describes his difference machine. The article is based on primary source material.

While a biography, and a survey of his work, its focus is primarily on his contributions within the field of mathematics. It does review his efforts to make calculating devices.


This details the method of finite differences and of Wiberg's device. There are comparisons to those of Babbage and Scheutz.

Census


This mentions the introduction of data processing technology to help counting in Europe and in the United States. This is a standard history of census taking.


This is an illustrated description of Hollerith devices used in the 1890 U.S. census. It also has a review of its use in Canada, Austria, Italy, France and Germany.


The author argues that he first suggested the use of punch card technology for the 1880 census and that Hollerith took up the idea and implemented it for the subsequent U.S. census.


He reviews Hollerith type devices constructed by Schaffler, used in the census taken by Austria. Over 24 million cards were processed in this census alone.


This reviews U.S. census practices with tabulating equipment as employed for the 1920 count and in use for that of 1930.

104 Bibliographic Guide


This is an explanation of Hollerith's equipment, particularly the tabulator and sorter, and how they were used in the U.S. census of 1890.


This is a review of the use of tabulating machines in the U.S. census of 1910.


A great number of facts about card punch technology at the U.S. Bureau of the Census is presented, especially concerning performance rates, configurations, and features of the hardware.


The book recounts the introduction of Hollerith's punch card system for use in the census of 1890 as part of an overall history of the Bureau.


This was written by a U.S. official at the Census Bureau. It is an important contemporary publication on the role Hollerith's technology played in the census of 1890.


This is an illustrated account of James Powers' card punch and tabulators made at the U.S. Bureau of the Census as an effort to improve Hollerith's equipment.


The authors survey the use of computers at the U.S. Bureau of the Census of the 1950s, providing a balanced, detailed view of their experience with this new technology.

706 Hollerith, Herman. "The Electrical Tabulating Machine,"
This is one of the earliest statements by Hollerith in print on how to use his equipment to conduct an analysis of a census.


A biography of a key official in the U.S. Bureau of the Census, it is useful for appreciating the early use of punch card technology at the agency.


The author describes how Hollerith's equipment was used to tabulate the U.S. census of 1890; illustrated.

709 "Mechanical Tabulation," Engineering 74 (August 8, 1902): 165.

This is a short review of Hollerith's devices and use in the U.S. census of 1890, and later in the U.S. agricultural census taken in 1900. His equipment is compared to those employed in looms and in railroad signal interlocking mechanisms.


An illustrated article, this describes various adding devices used in the U.S. census of 1880 and of the equipment employed in 1900.


This is a biography of the superintendent of the U.S. Bureau of the Census in 1880 and contains some details on his introduction of technology into the Bureau.


This is an excellent and very early complete history of Hollerith devices and their role in the U.S. census, 1890-1910.

Walker was the superintendent of the U.S. Bureau of the Census responsible for the 1880 count.


The article describes the use of tabulating equipment for the U.S. census of 1920.


He details the devices and programs of the 1890 census in the U.S. This is an informative report of the mechanics of collecting and analyzing data from an official of the Census Bureau.


This is a detailed review of Schaffler's tabulators and their role in the Austrian census of the time.


Stewart describes the use of tabulating equipment for the U.S. census of 1920.


This is a translation of Cheysson's article of 1892 (No. 697 above).


This is the most complete study of the subject and the major source on the use of Hollerith and Powers equipment in this U.S. agency, by an employee.


The Superintendent of the U.S. Bureau of the Census and also a well-known economist, reports that he would gather data on 215 items (as opposed to 5 in 1870) and that to carry out this task encourages the use of card tabulating equipment for the first time in the taking of a U.S. census.

There is a great deal of contemporary information on Hollerith's technology as used in U.S. census-taking.

Punch Card Applications (1880s-1930s)


This is a user guide over over 600-pages for the application of Duplex-Key-Controlled Comptometers in business. It also has illustrations and makes this volume a good source on both applications in general and on Felt's equipment for the early years of the 1900s.


He describes an early use of such algebra with a logic-truth calculator approach, suggestive of how far the use of punch card technology had come by the mid-1930s.


He discusses punch card layout conventions using Hollerith's equipment. It is one of the first articles to appear on the use of such technology. The author was a highly regarded statistician.


This describes 18 ways of using the Logobox bookkeeping machine, drawn primarily from accounting and banking applications. Some simultaneous linear equations are also illustrated along with harmonic analysis applications.


He reviews various calculating methods, such as "short-cutting," that used machine available in the British office-appliance market.

The author managed the British agency that used the National Accounting Machine to do mechanical forms of scientific calculations, most importantly, in doing calculations associated with the movements of the moon.


In the early decades of the 20th century, quantitative methods were applied to all manner of business activity. In part, punch card machines and calculators made that possible.


This is a major application brief for punch card applications in science, written by an expert who was supported by IBM. He describes the technology and then gives special emphasis to astronomical uses.


This is a short account using examples of uses of punch card technology from IBM at Columbia University in the period 1928-1950.


This illustrated article surveys the development and use of an interlocking mechanism to control sequences of railroad signal settings.


Using Hollerith's key punch and tabulator, this is an early example of cost accounting done by mechanical means at a time when cost accounting was becoming a normal accounting process in American industry.

While this volume surveys the use of bookkeeping machinery and not punch card equipment, the applications it describes were also being implemented on Hollerith and Powers products. This volume is massive in detail, over 1,100 pages in length.


In the first two decades of the 20th century, this became an important application of punch card devices and, by the end of the 1930s, standard in most large corporations.


The author describes the use of tabulating equipment to do payroll and gives a very early explanation of the justification for such automation.


This is an obituary of an IBM engineer of the 1920s and 1930s who had developed a series of inventions for mechanical accounting.


This is a history of punch card equipment from 1880 to 1950 with particular emphasis on the period 1930-1940. It is a major source on applications and bibliography.


It reviews, in part, the development of punch card devices since 1890 down to the 1920s.


This is a short, early brief on accounting applications in the United States and their justification.


This early publication describes tabulating machines and their use in calculating and managing statistics.

Tauschek was an engineer who built punch card equipment for both European and American firms in the 1920s and 1930s, including for IBM.

742 The Pierce Automatic Accounting Machines. Woonsocket, R.I.: Pierce Accounting Machine Co., 1910 (?).

This is a sales brochure describing card perforators, cash registers, and other office appliances capable of printing and punching simultaneously.


He argues that Jacquard mechanisms can help automate manufacturing applications, e.g., in cutting out cloth. The use of such technology was a rival to punch cards and even in the late 1980s was still the basis of much machine instructed activities.


This was typical of many such publications that began to appear at the turn of the century on the use of office equipment to do accounting or manufacturing (shop floor) applications.


Accounting practices were undergoing many significant changes in the first two decades of the 20th century. This book surveys some of those and how managers were responding to these.


This is a short review of sorters and calculators in use for statistical work.


This short article describes how Hollerith equipment was used by the Portland Railway, Light and Power Company to do accounting and statistical work. This represented one of the earliest commercial users of Hollerith's equipment.

This describes a bookkeeping system employing punch-
es, sorters, collators and tabulators during the
1920s.

749 Thompson, H.A. Joint Man/Machine Decisions: The Phase
Beyond Data Processing and Operations Research.

Pages 103-105 discuss a railway signal machine called
the Saxby and Farmer Machine, first made in the
1850s. The author refers to it as "non-numeric,
symbolic logic simulator" device employing Boolean
logic.

750 U.S. War Department. The Medical Department of the
United States Army in the World War, 15: Statistics,
War Department, 1921.

This surveys activities during World War I, including
the use of Hollerith devices to establish the sizes
of men for sewing uniforms, along with other appli-
cations.

751 "Wanted: An Electric Nerve-Saver," Literary Digest 48
(June 20, 1914): 1484-1485.

This describes developments and uses of card punch
equipment.

752 Williams, N. "Les Machines à Calculer et à Classer
Hollerith et leur Emploi dans la Comptabilité des
Chemins de Fer," Genie Civil 61 (May 18, 1912): 57.

The author describes the use of Hollerith equipment
by American railroads.

753 Woodruff, L.F. "A System of Electric Remote-Control
Accounting," Transactions of the IEEE 57 (February
1938): 78-87.

This provides a description of a system in a depart-
ment store using terminals, telephone lines, and
tabulators in the 1930s. Perhaps this was the first
use of on-line applications.

Research and Development

(July 1, 1909): 14, 15.

This surveys Ludgate's proposal for a tape driven
calculator.

755 Church, R. Review of L.E. Sadovskii, "Topics From The
History of the Development of Mechanical Mathematics
in Russia," Mathematical Reviews 12, No. 2 (1951): 69.

This concentrates on the efforts of Tchebichef on a.
device having automatic multiplication and division developed in 1881. It also reviews an Odhner wheel of about 1878. Other machines are mentioned intended for analogue work developed during the same period.


This is the discussion of a device that composes Latin hexameter verses made by John Clark (1785-1852) and shown in London in 1845 called "The Eureka." Babbage said of the man: "He was as great a curiosity as his machine." It has a photograph of the device.


This is one of the earliest papers to discuss a relay system driven by electrical impulses causing "great changes ... in its electrical equilibrium, and then remains in the new condition until re-set." That became the basis of the use of electrical impulses in computers decades later.


This illustrated article is on a difference engine based on a Burroughs adding machine prototype.


This offers details on a mechanical device to evaluate Boolean logic up to four forms.


While the case is overstated on computer design, the article does provide useful material on two important scientists working on logic machines.


Marquand was an important 19th century designer of logic machines; this was one of his more important articles on the subject.

This book describes a logic machine the author invented in 1903 which could represent 256 syllogisms expressed on the machine.


This was an important article by a designer of logic machines in 19th century America.


He focuses on music boxes, pianolas, looms, etc., involving a way of recording actions that need to be recreated. He suggests how this can be done using one master record.


This surveys the research of Babbage, Hollerith, Comrie, about analog devices, Zuse, cryptology, Turing, Colossus, ENIAC, and EDVAC.


This technical description is of a device to solve differential equations; it was designed, not built.

**Slide Rule**


This is a reliable history of the conventional slide rule with details on many of its late 19th century variants.


This carrier on the same theme explored in his book.


This biography is of a proponent of the slide rule.

The period of the 1870s and 1880s saw many new slide rules introduced. This documents one of hundreds that were built.


This is a very brief history of the subject; almost useless.


This is a user's guide for the slide rule, one of the most popular aids to computations in the U.S. and Europe from the 1880s to the 1970s.

Typewriter


This is a general, useful history of the typewriter. It came into use during the 1870s and was a common feature of major offices by World War I.


This article begins with pre-IBM typewriters then focuses on post-1933 developments down to 1980. A clear discussion of the technology that went into the IBM Selectric is presented with illustrations. This machine was frequently used as a console by various computer manufacturers in the 1960s, including IBM and Honeywell.


Like Adler's book, this is a good introductory history of the typewriter.


This is a very detailed, highly illustrated compendium of early typewriters and their technology, from the 1860s down to 1925. It reproduces many advertisements and marketing brochure-text of the period.

This has some material on pre-electronic typewriters not found in Adler or Beeching.


This is a short history that also includes some material on other typewriter supplies in passing.


This is the only full study of the subject. Essentially an economic analysis covering the period from the 1870s to the 1960s in the U.S., it surveys the major suppliers and analyzes market conditions.


This is a brief overview of the types of machines made from the late 1870s to the early 1920s.


This is a history of the company from the 1920s to 1950 and contains comments on early typewriters.


Pages 487-509 reproduce tables of salaries for manufacturing jobs across the U.S. in typewriter companies, for adding machines and cash registers, for male and female workers.


This covers the period 1933-1963 and IBM's most popular typewriter.


This offers considerable coverage of the role played by Remington Rand; the author was a vice president of that company.
Wizard of Oz


This is a reproduction of the original 1900 book with a biography of the author and historical essays on his work.


This is a biography of L. Frank Baum; one of the co-authors was his eldest son.


This is a beautifully illustrated history of OZ: plays, stories, and movies.


This is a serious study of the literature and movies of OZ.


This details the iconography of OZ and Ozian artifacts; well illustrated.


Denslow was the original illustrator of the OZ books.


This is the only extensive bibliography on the subject and includes material on Baum's successors.


This reproduces early drawings by W.W. Denslow and includes a biography of L. Frank Baum with bibliography.


Reviews more than 630 Ozian characters in 39 books; includes biographies of OZ authors and illustrators.
The period between the two world wars was marked by two fundamental events in the history of computing and data processing. First, there was wide acceptance and use of punch cards and other office equipment by government agencies and commercial enterprises on both sides of the Atlantic. That development, in turn, led to continued expansion of the office appliance industry. Second, differential analyzers and other analog devices were constructed, which encouraged additional work on mechanical computing. Concurrently, mathematicians and engineers worked out the theoretical underpinnings of information theory to a point where projects could be started leading to the construction of the first digital computers during World War II.

This chapter organizes materials around those themes. Headings include key scientists, punch card applications, types of equipment and technologies, and institutional histories. As in the previous chapter, both contemporaneous and monographic materials are listed when they contribute to an understanding of the history of both the technology and its nascent industries. For the first time, a particular technology was widely used enough to make it necessary to have sections on its applications. Punch cards, in effect, gave thousands of users their first exposure to the kind of information processing that later evolved into computer systems. Thus considerable attention has been paid to including contemporary articles and books dealing with what those devices were used for on both sides of the Atlantic. Although this chapter focuses on the interwar period, materials on punch cards during the late 1940s and early 1950s were also included to round out the subject.

Serious historical attention has focused more on particular scientists and their machines, such as on Vannevar Bush (1890-1974) and Douglas R. Hartree (1897-1958), than on a particular class of machines. Yet to be examined fully are the uses of punch card equipment, network analyzers, calculating and adding machines (particularly in business), and company histories. Exceptions include John V. Atanasoff (1903--), Bush, and cryptoanalysis. If we know little of American developments during the interwar period, that is even truer for Europe, Japan, and Latin America.
Analog Calculators


This describes the use of an analog type device first perfected during World War II based on a planimeter mechanism. The second machine he describes had a digital counter.


The author describes an analog calculating machine used to do algebraic calculations at Bell Laboratories in the 1930s.


Duncan surveys an analog computing machine used in Europe and in the U.S. to do algebraic calculations in the 1930s.


Frame reviews analog devices built in the early 1940s and growing out of projects from the 1930s.


This technical paper reviews how an analog calculator could be used in the 1930s to do algebra just before the dawn of the digital computer.


The decade of the 1930s saw considerable work done with analog computers, particularly in their application to higher mathematics. This article reflects that activity.


Mallock's detailed technical description of an analog calculator showed how his machine could solve 10 linear simultaneous equations in 10 unknowns.

This device, an analog calculator, was used for research at Bell Labs. The article is a useful description of an isograph, a device used to do algebra mechanically.


This giant of early computing at Bell Labs discusses his use of an analog computer (really a calculator) in the 1940s to do algebraic functions.


This is a history of a German machine built in 1941, based on Hoelzer's earlier work, and was used with the A-4 rocket; illustrated.


This is an illustrated spoof on computing in the late 1930s.


He shows how to use an analog calculator to solve up to 9 simultaneous equations in the 1930s.

John V. Atanasoff


This is his most detailed account of his own work during the 1930s especially; illustrated.


This has the same theme as the previous citation; it defends his claim to being the earliest developer of the digital computer.


This is an illustrated description of his machine and about the research that went into it. It accounts for the use of binary registers, add/subtract mechanism, and the decimal/binary converter.


This is a 28-minute film; his anecdotes and views about the role he played in the development of the digital computer.

Berry, Clifford E. "Design of Electrical Data Recording and Reading Mechanism" (Unpublished M.S. thesis, Iowa State College, 1941).

Berry was Atanasoff's graduate student when he was working on the ABC machine in the late 1930s and early 1940s. The thesis was a byproduct of some of that work.


This is a major review of Atanasoff that argues in favor of his significant contribution to the development of the digital computer.


This contains several papers which discuss the use of data processing technologies there from the 1930s to the present.


This is an interview with Atanasoff which focuses on his role in the development of the digital computer.


This was written by a student of Atanasoff at the exact time he was working on the design of the ABC machine. This paper influenced the logic design of the device.

Kern, J.L. The Development of Computer Science at Iowa
Between Two World Wars


This contains data on the early use of punch card technology, then on the beginnings of computer research by Atanasoff and others as far back as the 1920s, then carries the story into the period of the electronic computer.


This is a brief, but competent survey of the subject.


He argues that Atanasoff was the first, not the ENIAC team.


The author (journalist/lawyer) argues that Atanasoff developed the initial ideas for the digital computer. This is a well-rounded biography, not just a history of a computer.


This is an illustrated biography of the computer scientists that also defines the historical significance of his work.


This is an account of his life and work based on interviews with the computer scientist.


This was published by the Iowa State Historical and unhesitatingly takes Atanasoff’s side in the debate over who developed the digital computer.


Says it was junked in 1948 by the author who, at that time, did not realize its historical significance.

823 Stern, Nancy. "Who Invented the First Electronic

She argues that Atanasoff did not and that the team that put together the ENIAC did.


This includes an interview. The DP industry also noted the celebration; see Robert M. Stewart, "John Vincent Atanasoff Celebration." *Annals of the History of Computing* 6, No. 3 (1984): 313-315.


This brief article is one of the first to recognize that Atanasoff had played an important role in the development of the computer.

Vannevar Bush

826 "All the Answers at Your Fingertips; In the Laboratory of M.I.T.," *Popular Mechanics* 85 (March 1946): 164-167.

This has a description of the second differential analyzer built at MIT by Bush.


This is a major statement by Bush on his work at MIT in the late 1920s to develop an analog device to solve problems in electrical engineering.


He surveys available calculating devices, some digital and others analogue. He suggests a control unit attached to a conventional punch card device to address some of the function proposed by Babbage.


These are his memoirs, the man who built significant differential analyzers in the 1930s and served as an important advisor to the U.S. Government in subsequent decades.

830 Bush, Vannevar and Caldwell, S.H. "A New Type of

This is about a faster machine for programming a differential analyzer available at MIT in 1942 than was previously in operation there.


This is one of the earliest papers by Bush on research done at MIT on the Difference Analyzer, an early analogue calculator.


They describe a device that could solve second order differential analyzers they were building.


He describes work on a device at MIT that could solve integral equation problems. It was, like all his other machines, an analogue creation.


This describes the second differential analyzer at MIT that he and Bush worked on together.


The article describes the second differential analyzer then at MIT and which grew out of Bush's work of the 1930s.


This is a light biography of Bush and review of his work; includes four photographs.


The public was exposed to a number of "computers" in 1945-1946 of which this was one of the more famous. This is a non-technical description of Bush's machine.


He reviews the machine and possible uses in mathematics.

This important computer scientist wrote one of the first application briefs for an analog device, in this case, for MIT's differential analyzer of the 1930s.


This is a brief description of the second differential analyzer at MIT.


This is a brief description of MIT's second differential analyzer. Like many other computer/calculator projects not publicized during the Second World War, this one received considerable attention.


The author presents a well-researched account of early analog computing, in particular Bush's, covering the period of the 1920s-1930s.


This reports on one year's work funded by NCR to work on a machine proposed by Bush. This 98-page report offers a highly detailed and illustrated account of the work done by him.


This offers a non-technical description of MIT's analog machine, as designed and built by Bush.


This is a good survey of Bush's work during the 1930s and the results of it.

Calculators

846 Apraxine, N. "Machine à Calculer mue Électriquement,"

This briefly reviews of an accumulator with multiple decimal digits, using electromechanical relays.


This is a useful survey of office applications for "office appliances" as of the late 1920s with emphasis on their benefits.


This 97-page catalog of sales items includes descriptions of abaci, adding machines, typewriters, subtracting devices, etc. of all types. These were on exhibit at the Société d'Encouragement pour l'Industrie Nationale show in 1920 which was then purchased from Malassis and expanded by Chauvin to a total size of 442 items. The devices date from 1914 to 1939. Forty-one illustrations and 15 photographs support the detailed descriptions of these items.


This offers a history of desk calculators and current models of this company's products. It also describes the Trinks-Brunsviga Museum.


This describes, with illustrations, the collection of the Trinks-Brunsviga Museum. That contains devices from the 19th and early 20th centuries; includes a bibliography.


A German lawyer, Emil Schilling, patented a machine in Germany in 1926 which was program-controlled as a calculator. It used punch tape and pneumatics. This is also a biography of Schilling.


The article reviews sales for various firms in 1933 and 1934, forecasting a strong 1935. It is well informed.

This surveys widely available machines of the 1930s, their features and functions, operational characteristics, and their uses.


This is a short discussion of the Odhner wheel type of calculator and some uses it can be applied to in science.


This 29-page booklet deals with difference engines and methods. While he surveys machines by Babbage, Scheutz, Wiberg, Grant and Hamann, he also spends considerable effort and space on more contemporary devices such as the Brunsviga-Dupla, the Nova-Brunsviga Iva, Burroughs bookkeeping machines, and on NCR's.


The discussion centers around card punch devices of the 1930s and of their possible linkage together to solve problems raised by Babbage relating to program control.


This book was first published in the 1890s; the translation is of the 1928 edition and has an introduction. It is a good source for the subject covering the period from the late 1800s down through the 1920s.


This is a useful introduction to existing calculating machines of the 1940s and their possible uses.


This is a description of a 1916 device built by Charles Foster using punch card tabulating equipment.


This discusses the use of calculators in business.
Between Two World Wars

861 French, W.F. "Don't Tell Me It Can't Be Done," Illustrated World 36 (February 1922): 836-838.

This describes what calculators could be useful for as of the early 1920s, a period of enormous expansion in the use of such devices by all offices.


He argues that with the availability of data capturing on the plant floor possible by the early 1900s, cost accounting was now a practical thing to do. Especially useful is Chapter Five.


This 32-page booklet describes various devices, such as multipliers, sorters, calculators and other tabulating equipment.


He surveys differential analyzers, their use in mathematics, digital equipment, Babbage's engine, and the general question of program control; excellent technical bibliography.


Although the original publication was of a then state-of-the-art device, the Thomas machine was still in use a century later, mainly at under-budgeted university laboratories.


He describes an electric calculator using numbers read from paper tape. It was a special purpose calculator.


This is a catalog of calculators and other related equipment in the collection; illustrated.

868 Last, J.. "Digital Calculating Machines," Chartered

Last describes many of the pre-1900 calculators, along with early card mechanisms (such as Hollerith and Powers). It is useful and well organized.


This surveys current adding machines and their principles of operation; illustrated.


He describes currently available calculators capable of performing multiplication; illustrated.


The process of quality control of production depended on the collection and analysis of a great deal of shop floor data made possible only by the introduction of data processing technologies of the late 1800s.


This is useful for explaining the state of the technology commonly available in the 1920s in calculators.


This volume of 640 pages is detailed and very complete for devices from the last quarter of the 1800s to the early 1920s of all types. This is the best source available for used market conditions as well.


This is a technical description of a device to do repetitive applications such as payroll, cost accounting among others.


Pages 53-122 describe how contemporary calculators and adding machines work. A quick review of computer developments may be found in an appendix.

This is a sales catalog for contemporary adding machines and calculators; illustrated.


This the second annual edition. It lists devices by vendors by the hundreds, and provides some information on the suppliers themselves. It is an excellent source for information on the office appliance world of the early to mid-1920s.


This contains massive quantities of information on current adding and calculating devices, tabulators, bookkeeping machines, etc., how they work, design, applications; illustrated. Historical backgrounds of some machines is also presented. It is an exceptional review of British and American devices of the 1930s.


This is one of the first articles to argue that some machines designed in the 1930s were made to handle data handling requirements of New Deal programs.


This is not to be confused with Baxandall's 1926 publication issued by the same museum. The newer catalog is twice the length of the first one and contains devices from after 1926 but with the same useful information about them.


This was published just on the verge of a massive injection of office appliances into American and European offices in the 1920s. It argues in favor of their use.


He was the first to write and lecture extensively on what would become known decades later as quality control and quality circles. It was possible to
focus on the issue because of the now existing capability of capturing necessary data in efficient and cost-effective ways that involved a continual process of data gathering, feedback, and response to events in a factory.


This is another example of a growing body of literature, beginning in the 1920s, on the use of continuous data gathering in process and manufacturing operations to control quality of production and hence lowering of unit costs. The data gathering effort involved the use of hardware from the office appliance industry.


This surveys the life and work of Leslie John Comrie (1893-1950) and Alexander Craig Aitken (1895-1967). Comrie encouraged the use of calculating equipment in the 1920s and 1930s, particularly by mathematicians while Aitken did the same for numerical analysis.


This was a mobile totalisator at the Thirsk race course in 1930.


Toulon describes a variety of devices in the possession of this society which includes a Thomas arithmometer, Millionaire, Comptometer and such other equipment as adding machines from Burroughs to devices by Torres y Quevedo. All were 19th century and early 20th century vintage.


This nearly 200-page monograph is a detailed review, primarily of early 20th century technology.

888 U.S. Bureau of the Census. *Census of Manufactures, 1933: Cash Registers and Adding, Calculating, and

This 8-page census was published for various years in the entire 20th century. These are especially useful for sizing American volumes of manufacture of such devices. This one reflects the impact of the Great Depression on the industry.


Wright describes the use of a calculator in higher mathematics. All during the 1920s mathematicians would stress the limits of existing calculator technologies which would force additional enhancements to adding and calculating machines, to bookkeeping and punch card devices too.

Company Events


The article reports on some of the early legal battles between the U.S. Government and both IBM and Remington Rand concerning dominance of the tabulating machine market.

891 "Rand Reshuffle," Time 27 (June 22, 1936): 70, 74.

This describes a strike at Remington Rand, one of the office appliance industry's largest vendors.


Both Remington Rand and IBM were involved in litigation over the issue with the U.S. Justice Department during the 1930s.


In addition to some sales training, it offers insight into the company of the 1930s and 1940s.

Leslie J. Comrie


He reviews the history of special purpose difference machines and then this particular one and its application.

895 Comrie, Leslie J. "On the Application of the Brunsvig

Offers a quick survey of difference machines, then the features of this device and its use in differencing applications.

896 Comrie, Leslie J. (Untitled article). The Observatory 51 (April 1928): 105-108.

This is a summation of the paper referred to in entry No. 895.


This is an obituary. For a biography see entry No. 884.


In addition to describing its services, this has a review of Comrie's career and a bibliography of his publications.

Cryptology


This description of a German cipher machine of the World War II period covers a class of devices called Sturgeon, Tunny and Thrasher (British) machines. The descriptions are accurate and are illustrated.


This is an illustrated account of a machine built in 1926 which is described as "two modified typewriters connected by a pneumatic rotor mechanism" with 5 moving cylinders. It was judged to be ineffective.


This offers a review of devices used between 1920 and 1945 which they author call machines from "the golden age of machine cryptography." The book is an important source on the subject.
Between Two World Wars


This is a lecture delivered by the author on December 13, 1927 dealing with work done during World War I in breaking German codes for the Allies. He worked on the Zimmerman Telegram for the British.


This is a useful survey of British activities, with details on the Typex Enigma and the Rockex machine.


This is an excerpt from her 1983 thesis done at the Naval Postgraduate School, in which she argues that little data exists on activities prior to 1940 but then explains in detail the French role.


This describes a search for a World War I paper by Herbert O. Yardly, then head of MI-8, the U.S. Army's cryptologic agency.


He reproduces two letters, dated 1924, by Churchill.


This is an obituary notice for a World War I cryptoanalyst. It provides details of his role.


Among the topics is a discussion of how he came to write The Codebreakers (1967), he also discusses Enigma, Polish cryptoanalysis and World War II. It is a collection of many articles published elsewhere.


It contains a discussion on two flaws in a cipher hidden in a group photograph of a World War I
cryptographic class (1918) in Geneva, Illinois.


He describes a mechanical unit of the 1950s; it is a technical discussion.


He describes the M-94, a U.S. Army device of 1922. A similar machine had been invented by Thomas Jefferson between 1790 and 1793 and also by Babbage in 1854. In 1891 Etienne Bazeries also conceived one which stimulated later the development of the M-94, M-138, M-138A. This is illustrated and contains an extensive bibliography.


The first piece is on World War I, the second assesses various World War II efforts of the British and Americans and concludes that American efforts yielded the greatest results.


This very large book reflects thinking of the 1970s and early 1980s, including lines of development within IBM to provide protection to messages sent across telecommunication lines.


He reviews the role, in the 1940s and 1950s, of various agencies, such as NSA (1948-1962). He has a technical discussion with chronology and some memoir material of his own role.


Some of the computers discussed include the Atlas, ERA 1101, UNIVAC 1103, and other machines from the 1930s through the 1950s.

The device described was designed by Horst Feistel in the early 1970s to provide a secure cipher that had both diffusion and confusion features to confuse any statistical analysis.


The A-22 was the first device used in a commercial telegraph system. It was a hand-held unit for mechanical cryptography. The article is illustrated and offers a good description of how the A-22 worked.


This is an illustrated description of the B class electromechanical cipher machine, first developed in 1925 and used against Enigma during World War II.


Solomon Kullback was one of 3 mathematicians hired in 1930 for the Signal Intelligence Service in the U.S. Army. This article describes a 1935 test he devised.


This describes the museum's holdings and is located in Washington, D.C. The collection ranges from 1900 to the 1950s. This also has material on the role Wenger played from 1924 to 1958.


This is the fullest, contemporary account in print of the role played by U.S. Army cryptologists in World War I. It was written by a participant of the period who also continued his activities into the 1920s.

Differential Analyzers


This is a description of a small British differential analyzer of the early 1940s.

923 Berry, T.M. "Polarized-Light Servo System,"
This describes a differential analyzer built at GE, a device that followed motion by using polarized light.


This 25-page document is on a differential analyzer built at U.C.L.A. in the 1940s.


This was one of the earliest computing projects that Wilkes was involved with.


Comrie reviews difference devices and their applications and history. It is useful for devices of the 1920s and 1930s.


This is a description of GE's differential analyzer. See also entry No. 923.


The article discusses briefly GE's differential analyzer.


This was one of nearly a half dozen such machines constructed in Great Britain during the 1930s.


This reflected research done by a graduate student of Douglas R. Hartree. Porter helped him build the
first differential analyzer in Great Britain. It was modeled after Bush’s machine at MIT. The thesis is an early description of the analyzer.


This is a description of a German differential analyzer.


Trvis describes an analog differential analyzer built at the Moore School of Electrical Engineering, nearly a decade before the same institution constructed the ENIAC, the first fully operational electronic digital computer.

Harmonic Analyzers and Synthesizers


Archer details work done with harmonic analyzers which were early analog computational equipment.


Brown provides one of the first descriptions of this kind of analog device which he used to study wave motions and various other physical or mathematical functions.


These two scientists discussed how they used a harmonic analyzer.


This article reflected a growing interest within the U.S. scientific community of the 1920s-1940s in using ever increasingly complex devices to do the work of research in mathematics.

This is an example of British research done using a harmonic analyzer in the 1930s and 1940s.

The use of analog devices to do tide predicting had been underway since the 19th century and served as an important motivator for harmonic analyzers and synthesizers in the early decades of the 20th century.

This is an early description of an analog computer-like device of the 1920s.

Marble describes work done at Bell Labs on analog devices, suggestive that there was more computer-like activity there at the time than simply Stibitz's.

The method described is one that relied on the use of a harmonic analyzer.

This discusses, in part, problems of current calculations using mechanical calculators and what was needed. The authors were two great physicists.

Miller's work took place at the high point of early 20th century development of harmonic analyzers.

Miller worked at the dawn of electrical computational devices and at the same time as Ludgate and Torres y Quevedo.

This British harmonic analyzer was one of the first described in print built in Europe.


A great deal of work was done at Bell Labs in the 1920s and 1930s with a variety of analog computational machines. This was one of the projects of the 1930s.


This is a technical description. Raymond was one of the first scientists to design harmonic analyzers.


This is a technical piece on a British harmonic analyzer, one of many built in the 1920s and 1930s.


This is a study of tidal waves, providing additional motivation for the construction of harmonic analyzers during the first half of the 20th century.


Although a technical piece, it describes some of the most advanced work being done on harmonic analyzers in the late 1930s and early 1940s.


Bell Labs was one of the premier centers for U.S. computational research in the 1920s. These two authors were part of a staff of hundreds doing research at Bell.

He describes an early British differential analyzer built in the 1930s at Manchester University.


This was one of his earliest papers on the Hartree-Fock method of using a differential analyzer.


He describes an early differential analyzer built at the Manchester University with comments on the experience of construction. Most accounts of such devices only reviewed how they were used.


They discuss mathematical applications of a differential analyzer.


The article reviews Hartree's work during the 1920s and 1930s on mathematical solutions for problems in quantum mechanics. This led him to realize the need for analog and digital computational aids to help do the necessary calculations.


This analog device was used to model the flow of electricity—a major application area since World War I.

Hazen and his associates describe one of the most famous of the early analog computational devices.


Network analyzers provided much information on how such analog devices could be used. One use is described here.


This describes how Kron used a network analyzer for a non-traditional application.


Kron, a leading figure in the use of network analyzers, explains his study of electrical circuits.


This was one of the author's most detailed publications involving the use of network analyzers to study electrical circuits.


This continues the discussion begun in earlier articles and late in the history of network analyzers of the 1930s.


This was one of the last of Kron's papers in a series begun in the early 1940s involving the use of a network analyzer.


This is a technical description of an electric network modeling exercise, which came in a period of extensive work with such analog devices.

This describes the GE network analyzer used to model electrical circuits in upstate New York in the mid-1940s. The effort, however, had been going on for nearly two decades with various types of analog devices.


This description illustrates how network analyzers were built in the late 1930s to help electrical companies manage their large networks of electrical circuits by modelling their behavior.


The article describes GE's network analyzer installed in Schenectady, NY, called the A.C. Network Analyzer.


The two scientists prepared a useful overview of how network analyzers were being used in the 1940s.


Varney describes a network analyzer to solve problems in electrical networking.

Punch Card Applications: Commercial, 1920s-1930s


U.S. railroad companies were some of the first, extensive users of such technology, along with the U.S. Government.


The Polish National Alliance of the United States of North America, an insurance company, saved on clerical expenses by using punch card methods and machines.

During the 1920s one of the fastest growing areas for the use of punch card equipment was inventory control. The logic for such an application is explained.


The notion of cost accounting was a relatively new one at the end of World War I. It is explained here along how it can be implemented with punch cards.


Automobile factories were some of the largest in the U.S. and they quickly became major users of office appliances in manufacturing.


This was a major work, at the time, on the use of cards, primarily in scientific applications but also in administration.


Pages 157-179 has an illustrated description of office equipment of the late 1920s, with comments on their use, cost justification and impact.


The installed Powers equipment managed 550,000 accounts. This was probably Powers' first account outside of the U.S. Bureau of the Census, dating back to 1911.


Old Colony Trust Company and the First National Bank of Boston employed punch card equipment to cut nearly in half all duplicated existing data in the 1930s in the area of trust accounting.


Although on mathematics for scientists, the article concerns issues relevant to the business community involving the use of punch cards.

981 Briggs, G.B. "Economies in Trust Accounting,"
This illustrates benefits experienced in the 1930s as banks moved rapidly to tabulating equipment to cut operating costs and improve efficiencies.

982 Butz, R.H. "Punched Cards Speed Stock Control," Food Industries 8 (December 1936): 631.

Punch card equipment at the Luden Corporation did perpetual inventory, stock control and production accounting.


Tabulating machine applications frequently required either pre-printed or pre-punched cards. This article is a rare account of this topic.


Production control at the Model Laundry Company in the early 1930s is described.


The hardware is described along with its most famous and first use.


During the 1920s railroad companies continued to find more uses for tabulating equipment and its trade press continuously published articles on the subject.


It not only reportedly favorably on tabulating equipment but describes as well a series of applications already in place within the industry.


This is a text on how to use punched cards in accounting and why as of the 1930s. The journal was a highly regarded publication.

Utilities early became users of punched cards for billing and accounting management. The article is a survey of common uses as of the 1920s and early 1930s.


This is a relatively early article on the logic of using tabulating equipment for this application.


The focus is on inventory control with punch cards but it also discusses stock control, billing, and sales analysis in 10 warehouses.


This company's tabulating equipment was used to compare expenses to budget by doing detailed sales analysis.


The application was at the American Rolling Mill Company.


This represents an early description of the use of tabulating equipment for accounting at a railway company.


By the end of World War I engineering applications were becoming more common, using punch card equipment.


This was a variant of inventory control accounting applied to railroads and fuel management.

This tells of how the Schenley Distillery Corporation used punch card equipment to manage the large volume of orders it received after the repeal of prohibition.


This describes accounts receivable and billing applications.


This is a study of the Boston and Maine Railroad's approach to information management systems begun in the 1920s. It led to the installation of a Powers system in 1932 for a variety of statistical applications.


This is a detailed description of office applications and in particular about cost accounting, using both punch card and bookkeeping methods.


Manual versus semi-automated methods are compared with specific examples; a very useful piece for the late 1920s/early 1930s.


This was one of the earliest uses railroads put punch cards to in the United States.


This reviews billing and gas consumption data capture and management using punch card equipment.


This describes IBM's tabulating products of 1925, what applications they were useful for, and gives details on use and justification.

1005 International Business Machine Corporation. A

This contains descriptions of IBM punch card products of the 1930s, how to use them, and offers a series of descriptions of applications. It ends with hints on better methods of using such equipment.


This is very much a collection of application briefs using punch card technology.


As with most of IBM's punch card publications, this one focuses on applications of such technology: what, how, and why.


Chemical applications called for calculations and were a major set of uses for such equipment in industry.


The authors describe the use of tabulating equipment at the East Bay Municipal Utility District of California (1916-1931).


This is a valuable source for early 1900s office management issues, including the use of office appliances in the United States.


This is on the use of punched cards at the New England Gas and Electric Association. Data taken from meter readers was analyzed by an IBM tabulating service bureau during the 1930s.

The Excelsior Insurance Company used punch card equipment to manage data on premiums and quotas.


The article describes the use of punch card equipment at Kaufmann's Department Store to do inventory management in the 1930s.


Large employers saw the benefits of managing payroll through a punch card system; this is an early application brief on the topic.


The article explains the logic for using a punch card system for inventory control and the issues involved in the implementation and management of such a system. This was published at a time when large department stores were implementing new systems for this application.


The Frank H. Fleer Corporation used punch cards to control stocks in 28 warehouses during the 1930s.


Appendix A (pages 157-163) surveys business machines available as of the mid-1930s, suitable for use by accountants.


This lengthy book is a wealth of material on what uses people could put business machines to, including punch card systems. It has application descriptions along with a survey of existing hardware and some bibliography.

"New Methods to Order and Inventory Control in Rubber Footwear," *Rubber Age* 25 (September 25, 1929): 671-672.

This is a postive story on inventory control and of its methods, using punch card equipment.

This accounting brief discusses the use of punch cards in financial applications as they apply to a railroad.


The author describes how to use punch card equipment to help manage the library book circulation process.


This describes the use of punch cards for payroll management at a time when this application was spreading widely among large organizations.


The industry's trade publications continued to publicize installations of tabulating equipment even though by the 1920s the use of such technology had been evident in the railroad business for over 30 years.


The Union Switch and Signal Company installed IBM punch card equipment in the 1930s to manage information on routing, tooling and materials.


Articles on railroad accounting applications, published before the 1920s, are few. This one describes work begun several years earlier on the use of tabulating equipment.


Like the previous entry, this is a positive account of the use of punch card applications.


This continues a type of publication popular in the 1920s within this industry.

1028 "Rock Island Goes Modern in Material Accounting," Railway Age 106 (June 10, 1939): 976-984.
The application described here is accounting with statistical analysis. Card punch equipment was first used in January, 1939, in material handling. It was a huge application of such equipment, employing 66 IBM machines.


This is the earliest, or one of the first, articles published on the use of punch cards in this industry.


Shop floor automation became increasingly important during the 1920s. This article describes how punch cards can play a role in such automation.


This continues the theme first developed in the previous bibliographic entry.


This is a 563-page "how to" book on equipment and applications of the 1920s; an important source for the period.


Railroads were, along with insurance companies, the leading commercial users of punch card equipment by 1920. In this article disbursement accounting is described.


The Cleveland Trust Company installed punch card equipment to handle large volumes of data and to produce reports on trust accounts, lists of securities, income and analysis sheets.


The topic is obvious; it relied on punch card equipment doing a new application.

This was one of the first departments within a rail-
road to use punch card equipment (1890s), the arti-
cle one of the last to appear on the subject.

1711.

The Bureau of Water Works and Supply at Los Angeles used punch card equipment first to do customer billing, bookkeeping, and accounting before finding other uses for such hardware.


Materials control, particularly in manufacturing facilities, early became a logical inventory management application suitable for automation with punch card equipment. A case is described of the benefits of such an implementation.


At McKesson and Robbins, Inc., the central tabulating center offered a wide variety of services much like computer data centers did more than 20 years later. The services are described.


This is a major review of the subject in which the author explains how best to create audit trails in punch card systems and then how to audit these in comparison to manual accounting applications. The principles developed by accountants in the punch card era were applied almost directly for over two decades in the post mid-1950s era of computer-based applications.


Merchants National Bank of Boston used punch card equipment for trust accounting in the 1930s, using IBM products. The article describes this application and includes the cost justification for it.


The Guaranty Trust Company of New York installed
this application. The firm used IBM products from the earliest days of the punch card company's marketing to banks.


Kaufmann's Department Store used punch card equipment for inventory control at the store level, which is described here.


This is an early description of how to do cost accounting with punch card equipment. It was to be during the 1920s that cost accounting became a widespread accounting application, in part because of the convenience of punch card equipment.

Punch Card Applications: Commercial, 1940s


This is a self-congratulatory account of the system.


This is on tracking charges and inventory for goods and rolling stock used by multiple railroad companies.


This describes the use of a new Remington Rand machine that had a 10 key calculator introduced in 1939 doing automatic multiplication of constants.


This describes order processing for the sale of Buick automobiles.


This is like the previous article, except this is about Chrysler automobiles.

This surveys parts control and inventory management using punch cards within the automotive industry.


The use of punch cards in statistical work is described. It is interesting to note the use of the word Hollerith so many years after the term had lost currency and had been replaced with e.g., IBM.


By the 1940s some punch card machines were becoming calculator-like, even computer-like in function, leading to more complex uses. This is a good reflection of that process at work.


As punch card products became more sophisticated, with enhanced calculating capability, such applications became more possible. This describes such a use.


One way they cooperated was through punch card based accounting systems that included inventory control.


Although implemented initially in the 1930s, this use of punch cards became increasingly widespread in the late 1940s with the post-World War II housing boom.


As with the previous bibliographic citation, this one is concerned with how to manage customer account information and billing through the use of punch card equipment.

Census taking, by the 1940s, had been done with punch cards for half a century in North America. Each time it took place, however, articles such as these would marvel at the extensive use of punch cards and explain why.


This is a typical description of the benefits of payroll management using punch cards.


This is almost like an inventory control application in which punch cards are used in a mining business.


This is an inventory application for managing the location and allocation of rolling stock. This use of punch cards was not new in the 1940s but had been applied since the turn of the century.


Each time a census was taken, articles such as these appeared, explaining the benefits of accounting equipment. The term "census machine", although very old fashioned in the 1940s, was the original name of Hollerith's equipment in the 1880s/1890s within U.S. Government circles.


The author published some widely-distributed books in the 1950s on the management of data processing. This early article recounts experiences with both installation and initial use of punch card systems with recommendations on how best to do that.


While the application described is a technical one, the use of tables was increasingly an issue in punch card tabulation in the 1940s within businesses.


The use of punch cards here is not a technical or
scientific application but rather a records keeping function.


Although not a new application for punch cards, it continued to experience new users all through the 1940s.


Banking applications of punch card technology were often on the leading edge of new uses. Check handling was continuously automated and standardized all during the 1940s and 1950s as the volume of checks increased. This is an early explanation of one case of the process at work.


This describes the use of punch card technology in a primitive "data base" application.


This reviews the use of machine and hand punched card record keeping to list references at Socony Vacuum Laboratories. The benefits of each approach are explained and the conclusion is drawn that a combination of the two is most efficient.


The aircraft industry has always been a major user of mechanical aids to computing, particularly in design engineering. This punch card-based application is an early example of that kind of use.


Punch cards are used to log customer information.


Inventory control for raw materials and work-in-process (WIP) became a major application area for manufacturing companies, as illustrated here.

This does not describe a purely scientific research and development application but rather a more common industrial one.


Mark sensing experiments had been going on since the 1920s as a method of data collection by the use of electronics. This describes such a use but based on a punch card system.


This is simply another application brief on a well-established use of punch cards in banking.


This may be the most detailed study of punch errors published. In the case of card verification, its samples showed that errors varied from 0.5 to 5.0 percent. This is important information since so much was spent on data verification.


This bulletin describes one application that requires calculating worth of insured items for purposes of establishing loss values.


This is an application brief on accounts payable using punch card files and technology.


This outlines a system employed in computing power network performance, listing advantages and disadvantages of the described methods.

1079 Egan, D.J. "It's All in the Cards," Business Transportation 23 (November 1944): 48-51.
This is a short description of a scheduling application.


Beginning in the 1930s, utilities automated billing and this case study of a New York utility, was simply the latest in process.


This is a description of data manipulated and studied by using punch card equipment within the U.S. Government to analyze the American workforce.


The use of punch cards in mining had been limited to normal administrative processing. This describes a unique use of punch cards.


By the 1950s decision-making reports and "what if" analysis generated by computational devices became very normal. This is an early description of such an application, based on the use of punch card files and equipment.


Printing policies with the injection of appropriate data specific to a policy was tried using punch card systems.


Chrysler invested $100,000 in Remington Rand products which are described and their use explained.


This describes a personnel record system in an automotive plant.

Accounts receivable applications were a logic use of punch cards. This article describes a case of its application.


While productivity gains were usually experienced when manual operations were put on punch card systems, few articles were specific on quantification of time saved, speed gained. This article offers evidence of productivity.


Gallagher describes a punch card system in which efficiency and productivity justified the investment.


One June 8, 1943 the Wage Labor Board was established by the U.S. Government to stabilize salaries. The article describes salary levels and ways of measuring data relevant to these.


Punch cards were used in this case to document cash splits at Consolidated Edison of New York, employing IBM mark sensing equipment.


This describes material inventory control in a factory environment using punch cards.


This is a sophisticated article on mathematics but for applications relevant to business.


This application became increasingly evident in the 1940s although some U.S. cities had begun working with it in the 1920s.

1095 Hood, T.A. "Punched Cards for Field of Metal Finishing," Metal Progress 56 (July 1949): 75-78.
Between Two World Wars 159

Complex manufacturing processes adopted punch card systems for record keeping and job performance analysis in the 1930s and 1940s; one is described here.


This manufacturer of lights uses punch card technology in the 1950s to produce its bills and to manage accounts receivables.


The use of tabulating equipment that had computer-like processing capabilities after World War II made such applications easier to develop.


The rise in amount of information, caused by expanded business and increased government requirements, made it imperative that insurance companies manage data more efficiently and use to greater effect. Punch card technology was a way of helping that process.


This is an application brief that describes how to perform the various war-related accounting functions required by the U.S. government using punch card equipment.


By the late 1940s this application of punch card technology was a well-established one with a proven track record of success. This article is simply a very late description of such a use.


More than a description of hardware, the article also surveys new uses for such technology as of the late 1930s/early 1940s.

1102 "It's All in the Cards," Bus Transportation 27 (April 1948): 66-68.
This describes the use of punch cards in such typical applications in transportation as scheduling.


While reflecting experiences with 1930s' vintage technology, it is a useful description of how to manage such equipment and not merely an application brief.


This describes an application that had not received much publicity prior to the 1960s using information handling equipment.


During the 1930s and 1940s many shop floor applications for punch card equipment came into existence. This article reflects that process by describing one case.


While a description of hardware, the article describes sorting. Sorting was a fundamental feature of all punch card applications: shuffling data into different piles that made sense to a user.


By the 1940s punch card equipment was being used to produce summary reports for management based on substantial amounts of information in punch card form. It is the most important justification for the use of such technology.


This describes a well-known application using punch card equipment of the late 1940s.


Billing applications in this industry was a basic function made complicated by this industry's early efforts to tie many of its activities to billing, managing the process with punch card equipment.

This is a general overview of a series of applications in the coal mining business employing punch card equipment.


This is a description of a common use of punch card equipment within a coal mining company, however,


This is a well written description of available machines and uses, circa 1940/41, with statements about their capabilities.


This is more of a description of accounting with punch cards by a city than a general review of the subject.


This was a common application of punch cards, in effect, to do inventory management and job scheduling.


This describes the application in one bank. The benefits of such a system are also touted.


IBM products are described being used for parts and material control, payroll and other accounting applications. It also lists the equipment used and their capacities; circa early 1940s.


The check is a punch card technology output document.

The better methods involved manufacturing accounting using punch card methods.


The article offers the argument that not only large insurance companies can benefit from punch card applications.


The system is a punch card based one and involved rolling stock inventory and scheduling control.


Utilities increasingly went to punch card accounting systems during the 1930s and 1940s. This is yet another, of a series of reports, of such companies migrating to more automated methods of controlling operations.


This is one of the earliest articles to address the issue of data processing in the movie making business. The applications described are routine accounting ones.


This is an inventory control application description.


Punch card payroll systems were still being reported on since many businesses had not yet installed them. It was still new news in the 1940s and 1950s in mid-sized companies.


This is more of an academic or library data management application found in American industry.

This is one of a series of articles published by the journal in the 1940s on the value and use of punch card technology in accountancy.


After describing the problem of loss of control, the author discusses the response made to it by using punch card equipment to handle more data, faster, and less expensively than before.


This report argues that existing punch card technology restricted use of cards to only a small number of possible permutations of combinations in chemical research and applications but that changes in the technology should change that, offering greater flexibility.


This offers various opinions concerning the value of punched cards in chemical research and applications. The general consensus was that it is a time and cost saving tool.


This discusses price tags for products in retail business being managed by punch card methods.


This essentially describes production control and manufacturing applications.


This details the experience of one company installing punch card equipment.

This describes modelling with punch cards in the design of aircraft.


This describes punch card applications in the insurance industry with specific reference to underwriting.


This is an early publication on the use of punch cards in the petroleum industry.


The answer was yes with an explanation of why.


This describes a novel inventory control system using tabulating equipment and punch card files.


This is an excellent description of the application and of the costs and benefits of the same.

1147 Root, W.J. "Block Rate Computations," American Gas Association Monthly 25 (February 1943): 75-77.

Root describes analysis of product costs and accounting using punch cards, for a single utility.

1148 Rostler, K.S. "Applications of Punched Cards to Indexing Rubber Compounds," India Rubber World No. 120 (September 1949): 698-701.

This is essentially a description of a process control/manufacturing data base management system using punch card files.


This is a short piece on the acquisition of cards and data rather than on a specific application.

One of a very few articles on the use of punch card technology to manage personnel. It became an important application, however, during the computer age.


This is probably the first article published in the U.S. dedicated to this application for punch card equipment. It is a detailed, useful description.


This is similar in subject to No. 1150 above.


This is a case study of one organization's experience and rationale for such a system.


The application and its benefits are described. This was an important application by the mid-1950s in the United States.


Errors and audibility are important issues. Advice on these are offered here.

1156 Sparks, C.C. "Fitting the Audit Program to Punched Card Accounting Systems," *Journal of Accounting* 86 (September 1948): 196-200.

This was a major issue with accountants throughout the era of punched cards. Some advice on dealing with it is offered in this article.


This is one of many such articles to describe inventory control in the railway industry.


This was a widely used application, particularly in the retail business. This is more a brief announcement of its use in one organization rather than a description.

This is a typical testimonial of the period to the benefits of punch card technology's use in managing organizations.


He describes how the National Roster of Scientific and Specialized Personnel performed important work in the U.S. during World War II in locating people with specific skills, using punch card equipment.


This is a short description of punch card applications in manufacturing.


This is a description of a U.S. tax application, one that would be described later in many articles when it was computerized.


By the late 1940s major organizations had automated billing applications using punch cards. This is a description of one such case.


The work describes is an example of management information systems in the utility industry. This uses punch card equipment to do the work.


Punch cards are part of the technological base used in the case study described here.


The equipment was a tabulator system.

This represents a brief, but useful, description of punch cards in inventory management.


He describes summary accounting reporting using punch card equipment.


The case is specific and deals with consumer loans, an application area hardly touched on by other articles on banking applications of the 1930s and 1940s.


This is a public utility application.


Most punch card installations were controlled by accounting or financial departments. This article addresses the responsibilities and tasks involved.


Productivity continues as a theme of this, the latest of a series of articles published in this journal on the use of punch cards in the late 1940s.


This is specifically a warehouse management and inventory control application.


This is a useful article on the "how" of this application.


Most banking articles deal with their products and services; this concerns overhead.
Railroads often shared goods being transported which called for a sharing as well of fees for that service. The general application is described with a specific case study.

Punch Card Applications: Scientific, 1930s-1940s

Alt, Franz L. "Multiplication of Matrices," Mathematical Tables and Other Aids to Computation 2, No. 13

He describes the use of card punch calculators in mathematics.


They detail the use of a tabulator with a "cross-connecting board" to store numerical values.


Punch cards were used in scientific research in the 1940s both in physics and mathematics. This is a description of such a use.


He reviews desk calculators, adding machines and punch card devices for applications in science.


This describes a famous piece of work done with punch card equipment in 1929 at the Nautical Almanac Office by the author.


This is a detailed review of how punch card equipment from IBM was used in one application, involving the entire range of gear: tabulators, sorters, and multiplying punches. This was a complex use of such technology.

This is an early description of a mechanized bibliography in the sciences. By the 1960s, all scientific literature in English, for example, was being abstracted by some mechanical means.


This describes how the work was done using punch card equipment.


This is a description of the use of punch cards in solving sampling problems in the late 1930s and early 1940s in a precursor to an operations research project.


This reflected work encouraged by IBM in mathematics using its products.


This was written by an expert in the use of punch card equipment for statistical analysis. Here he reviews work done by himself in the late 1930s.


In the 1930s pre-punched cards with mathematical data on them could be bought from IBM for use by customers in accounting and scientific applications. These are described.

Two authorities on the subject of how to use punch cards in scientific and statistical computing in the 1930s comment on the use of such technology in statistical analysis.


The work was done using IBM punch card calculating equipment.


This laboratory at Columbia University was funded by IBM and supplied with punch card equipment by the same firm. Its purpose was to expand the use of such technology in scientific research. Eckert describes the equipment there, its mission, and recent work.


This was a very important publication on the subject. It also contains descriptions of tabulators, sorters, and multiplying punches.


He describes applications such as quality control, structural vibration, stress, and other forms of analysis using punch card equipment from IBM.


Eckert taught at Columbia University where he found many ways to use card equipment in scientific applications. This describes one of his projects.


This is a very technical period piece in mathematics.

This is an illustrated history of the office equipment industry with details on the influence of the New Deal on it and new application areas, including scientific.


These new methods involve the use of punch card calculating machines.


This is a collection of papers dealing with the use of punch card applications, primarily in education but also in science.


This collection of papers focused on applications using punch card equipment, primarily in science and mathematics.


This was one of the first papers published on the general subject of mathematical-statistical problems and punch card equipment. There is a commentary on the evolution of mechanical key punches, electrical key punches and of other devices.


King did considerable work employing punch card equipment in mathematics, some of which is described here.


King states that current technology is limited to addition, subtraction, and multiplication but that the machines which can divide would soon appear. He ends the article with a list of applications possible with punch card technology in science.
Between Two World Wars


Beginning in the 1920s, and considerably by the 1930s, scientists and mathematicians were using punch card equipment to do their work. This examines one such application.


This is an early article on the scientific uses of punch card equipment from IBM; it uses a specialized piece of equipment developed in the 1930s.


Although focused on library applications, the problem of scientific publications had to be solved as part of the solution of getting materials into the hands of researchers fast.


This describes the use of punch card equipment in complex mathematics problems at the height of experimentation with punch card equipment for such applications.


This is an early piece on the use of punch card equipment in complex mathematics.


This is a convenient survey of the subject as of the late 1920s.


This is an extremely useful publication and contains material on IBM's calculators at the dawn of the age of computers.

This is the first bibliography to appear on the subject. This 25-page publication was essentially an earlier edition of the previous citation (No. 1209).

Punch Card Equipment


While this has material on the Alden product line, it contains material on applications and equipment in general for offices, including data processing products.


This is one of many such guides to existing hardware available during the 1930s.


This is a short review of the development of punch card technology with an illustrated account of IBM equipment of the 1930s.


The volume of articles is filled with comments on punch card equipment of the 1930s.


This is a 112-page, illustrated description of features and uses of various accounting and bookkeeping equipment of the 1930s.


This is a review of the evolution of punch card technology, discussing both Hollerith and Powers equipment, with illustrations. There are comments about attaching such technology to typewriters and calculating machines.

This is a general overview of punch card equipment and applications, late in the era of the technology. It is useful for late punch card hardware.


This is a 48-page review of how to operate such devices, their features, and applications; illustrated.


This 143-page book is a guide to contemporary hardware and applications. It includes comments on products from Brunsviga, National, Underwood, Remington, Hollerith, Campos and others.


This is on contemporary calculating devices, their features and functions, with material on both Hollerith and Powers equipment; illustrated.


This is similar to citation No. 1217.


The author, a plant manager, describes the use of tabulating equipment in factory applications.


This is the first publication from this organization on mechanical/tabulating computing. It would be followed by dozens in the decades to come.


This is a compendium of early uses of tabulating equipment in the U.S., complete with descriptions.

This pamphlet concerns the use of computing devices to do thinking and data manipulation.


This is an early "how to" users guide to mechanical aids to calculation. Emphasis is on systems, not single machines but groups of machines working in concert.


While focusing more on accounting practises than on hardware, there is considerable material on the use of tabulating machines in accounting applications.


The author taught statistical analysis employing IBM tabulating equipment. There is no discussion of collators or multiplying punch equipment, only other tabulating gear.


This is a "how to" for configuring, installing and managing hardware systems of the early 1930s.


This is a 20-page survey and general reference work.


While an application brief, it contains descriptive material on IBM products.


This is an illustrated description of nearly 20 punch card machines, vintage 1945.

1233 International Business Machines Corporation. *Machine

This is a group of 28 pamphlets providing details on how to use IBM's punch card machinery, complete with descriptions of the hardware. The intended audiences were IBMers and users of the products.


This was issued by the Tabulating Machine Division (the old Hollerith company), and it was a salesman's Bible, their sales manual. It lists all products, prices, features, terms and conditions, and contracts under which customers could acquire the machines and supplies. Other than for product updates, this was the salesman's manual for the years of the Great Depression.


This is an illustrated, 80-page description of IBM's products intended as a sales document, circa 1938. The majority of the devices presented are tabulating and accounting machines and peripherals.


This brochure describes IBM's products in both stock and pre-punched cards.


This is a series of booklets describing IBM's punch card equipment of the 1940s, and how to use them. By the 1930s all IBM products were accompanied with a principles of operation publication, a publishing program that continues down to the 1990s.


This is limited acknowledgement of the role of played by hardware in accounting. It does, however, provide background on accounting as of the late 1930s.

This is a massive compendium of hardware as of the early 1920s. It is an outstanding publication on devices, companies, marketing, and industry information.


This is a brief survey of computing devices, such as those of Babbage, Hollerith and calculators down to the 1940s.


This particular show had many new devices on exhibit which are briefly described here.


This is the same show, different year, just cited above and which exhibited many products designed during the 1920s.


This reflects the wide use of punch card technology in scientific and engineering applications with some discussion of the equipment used.


The volume covers both hardware installations and the design of information flows in accounting.

1245 Parsons, Carl C. Machinery of the Office. Chicago: La Salle Extension University Press, 1921.

The focus is on a broad range of equipment, not just tabulators or calculators.


This is a good exposure to the company's products.


This is an illustrated survey of its products.
Between Two World Wars


This is a 53-page description of how to use punch card equipment of the 1930s in commercial applications.


This is a popularized description of card punch equipment of the 1940s and then as they were being used at *Life* magazine.


This is a sales manual issued to marketing representatives of Hollerith's company. It describes all the punch card products, features, services, and prices as of the 1920s or late teens.


This offers a short history and description of tabulating equipment at that technology's pinnacle of development.


This is a text accounting book but with some acknowledgment of mechanization.


This includes the use and explanation of punch card equipment.


This described IBM's punch card calculating devices and how to use them.

Research and Development


This is about a small, special-purpose calculator containing 16 electromechanical counters.
1256 Berry, C.E. "Design of Electrical Data Recording and Reading Mechanism" (M.S. thesis, Iowa State College, 1941).

This describes card reading and punching devices worked on for Dr. Atanasoff.


Various automatic totalisator systems being developed for race courses in Great Britain are described. Essentially three systems are involved in which the total bets on each course are recorded and calculated.


This is a good overview of R&D activities and gives insight into the thinking of scientists and engineers over this considerable period of time, by an historian.


He argues the case in favor of presenting numbers in binary form for computers and reviews the design of electrical calculators of the day.


This thesis is on how an electro-mechanical program controlled binary calculator might work.


He discusses the electrical evaluation of logical expressions and is part of a series of articles he wrote growing out of his thesis on programmable calculators.


This is on a machine that could perform four
function and chain the events in sequence. This article is an outgrowth of his graduate work.


Pages 60-65 has a design for "an automatically controlled calculating machine" to do matrix calculations. It has a means for scanning digital data represented on punched tape for the four mathematical functions, and for storing and printing or punching out data.


Davis reviews Turing's work and influence on the development of computers.


Fry headed Bell Lab's mathematical consulting program in the interwar period. This article was an important review of the subject as of the 1930s. His thoughts and work influenced the developers of computers in the late 1930s.


It has a section on Turing's work during World War II.


This is a description of an early analog computational machine developed in the 1920s.


This surveys work done in the 1930s at MIT on evaluating integrals by analog means.


This is on work involving Bush's ideas as applied to electrical power networks.

This collection of 28 papers, on the occasion of the 50th anniversary of the publication of Alan Turing's famous 1937 paper, deal with Turing, 23 with contemporary events in logic and theoretical computer science.


This surveys a device called the Automatic Control Analyzer for analog process control. It is an illustrated, technical presentation.


This surveys mathematics in the 1930s and focuses on Turing computability; a highly technical paper.


A patent of Bernard Weiner, 1923, for electrical computer and typewriter, is discussed in which relays are used with fixed built-in programs. It also includes a short biography of Weiner. Work on this project came to an end when the Germans occupied the Vitkovice Iron Works where he had his ship. Weiner died in 1942.


This is on early work done with analog computing at the Riverbank Laboratories, Geneva, Illinois, during the 1920s.


This is an illustrated account by a participant in the development of machines to solve specific sieve mathematical problems during the 1930s and 1940s.


This reviews technical developments during the 1930s.
1278 "Letter-Printing Cathode-Ray Tube," Electronics 22
No. 6 (June 1949): 160-162.

Work with CRTs (terminals) had begun in the 1930s and intensified after World War II. Here is an expose on their use with digital electronic computers.


This surveys technical developments in Great Britain in the 1930s.

1280 Lewis, W.B. Electrical Counting: With Special Reference to Alpha and Beta Particles. London: Cambridge University Press, 1942.

Covers the same material as his previous publication except in more detail.


The authors discuss a binary counter they developed during the 1930s.


This describes a device developed to solve problems in physics.


This is an obituary on Veblen (1880-1960), an American mathematician who did research on ballistics during World War I and later built up the mathematics department at Princeton University and at the Institute of Advanced Studies.


This is on his research on ballistics and mathematics.


Myers describes an analog device, perhaps could even be called an analog calculator, which he worked on during the 1930s.

1286 Nicoladze, C. "Arithmomètre à Multiplication Directe Purement Electrique," Comptes Rendus de la Academie

This is a short review of a device based on Genaille's numbering rods and compares it to the work done by Torres y Quevedo.


This describes their work with an analog device in the 1930s and early 1940s.


The author acknowledges that he was aware of Babbage's work while doing his own on computing in 1936.


He suggests actuarial data files be kept in octal and doing calculations in binary notation. He then argued how this might be done by mechanical means.


He says he was always interested in Babbage. Further, it first occurred to him that a binary computer should be developed in 1934.


Post describes problem solving that mirrored programming from logic to machine-like "primitive acts" thus joining with Turing and Shannon in the 1930s in describing programming a computer as one of logics not of mathematics. This was a seminal paper.


Originally published in 1938, this was his masters thesis project at MIT in which Shannon applied propositional calculus to the design of electrical circuits. This paper made possible scientific methods of circuit design, helping to make information subject to manipulation by electronic digital machines.

1293 Shannon, Claude E. "A Symbolic Analysis of Relay and
Switching Circuits,"  Transactions of the AIEE 57 (1938): 712-713.

This is an illustrated account of how symbolic logic can be applied to the design of circuits as, for example, in adding two binary numbers.


This is an illustrated history of microfiche from 1839 to 1986.


The emphasis is on components from the years between 1927 and 1937, a period during which rapid developments came in tube technology.


This describes a machine which was a takeoff of an IBM test scoring device, used to help in the multiplication of matrices.


This paper discusses work done on Colossus and is a contribution to the early development of computer science in Great Britain.


This is one of the most famous, influential papers ever written on computer science. In it Turing describes the theoretical design of a computer and how such a device might solve complex problems.


The author proposes a calculator that transforms input into binary and then performs calculation. He argued the case for representing binary digits by mechanical and electrical means.

This short description of a device foreshadowed the differential analyzer common in the 1930s.


The paper is a description for evaluating 3 x 3 determinants using electromagnetic relays.


This technical piece describes a machine by the same name built by this MIT professor in the late 1920s and early 1930s. It represented one of the earliest calculators constructed at MIT.


This interview discusses the Turing Machine.


He presents five articles on various mathematical devices with illustrations and bibliography.


This was written by an important British computing scientist. He reviews his work of the 1930s on the design of electronic counting circuits, electronic counters, printing, and decimal-to-binary conversion.


He reviews his work at the Cavendish Laboratory, and later, at the Imperial College on Thyraton-based counters. He made his first counter in 1930s. The article carries the story down to World War II.


This summarizes his work with counters at the start of the 1930s.


He discusses various methods using thyratrons as
recorders and suggests how an electronic counting device might be made.

Tide Predictors


He describes a machine made by E.G. Fischer and R.A. Harris, of the U.S. Coast and Geodetic Survey, to predict waves, using gears and pulleys. The machine became operational in 1914 after 15 years of development.


The co-inventor of the machine describes how it could take 37 different tides to calculate tide forecast and produce a plot which worked. The device was used during World War I to help Allied ships avoid German U-boats.


He describes a machine used to predict tides built in Germany in 1916 at the Imperial Observatory. It was a German version of the U.S.'s Great Brass Brain.
Hardware, 1939–1960s

The quantity of material in this chapter, which exceeds that in any earlier one, reflects the period when the digital computer and its associated data processing industry came into their own. In the decades between the start of World War II and the mid-1960s, computers were built, used, and distributed widely. The major concepts behind the von Neumann machine were worked out and significant progress made in its associated technologies. These ranged from the initial use of vacuum tubes to the creation of the transistor, and finally to multiple generations of semiconductor components. Almost all the major computing projects that historians have studied so far come from this period, as do the bulk of the memoirs associated with computing. The majority of the subheadings are by machine type with some notable exceptions when the volume of literature warranted separate headings for individuals such as Grace Hopper, John von Neumann, and Konrad Zuse. The body of literature on activities during World War II alone is rapidly rivaling that on Babbage. Since robots first emerged during this period, a section on robots is included here, although it covers their role through the 1980s.

Much of the material in this chapter is contemporary. Careful attention has been paid to collecting descriptive publications, contemporary coverage of events to provide a perspective on expectations, technical literature on base technologies, memoirs of scientists and engineers, and available historical monographs. Early computers from the period 1940–1965 have received the most focus from historians, archivists, and museum curators, and they continue, as of this writing, to draw the greatest amount of attention. Yet almost nothing has been devoted to the customers’ uses of these technologies or to the vendors who worked with them. What little available literature exists is listed in the final chapter on the information-processing industry as a whole. Because of the considerable success of IBM’s processors during the 1950s, especially its 650 system, this chapter includes a number of contemporary materials on them. Left out were nearly two hundred one- or two-page descriptions from American newspapers, newsletters, and periodicals, since these did not contribute substantially to one’s understanding of the subject.
The body of available materials on European developments is better for the 1940s and 1950s than for any earlier period, with the possible exception of the seventeenth century. It is particularly good for British computing projects. French, Italian, German, Russian, and East European developments are not well represented. Existing publications on the industry in these nations are included in the final chapter.

**ACE and Alan M. Turing**


This is a brief description of the computer at the National Physical Laboratory, home of much computer development during the 1940s.


This reviews British computers of the period 1945-1951 and in particular, Turing's work on ACE at the National Physical Laboratory.


This is a quick survey of recent work done at the NPL, including on ACE.


This historian of British computing provides an illustrated and well documented technical review of a variety of computers, including the EDSAC at Cambridge University, Manchester's Mark I, NPL's Pilot ACE, and discusses the impact of these devices on stored-program computing.


This is a more detailed survey of the same theme published in the previous entry (No. 1315).


He provides an illustrated history of the design of the British ACE between 1945 and 1952. It is a technical history of the computer and on its programming. It is well documented and clear.

This is a collection of his papers from the 1940s and 1950s, and includes a short, illustrated biography of this important British scientist.


They review the design and features of Turing's ACE in the mid-1940s and compare this to the work being done by von Neumann. The article concludes that Turing's perspectives on the characteristics of a computer were more complete than von Neumann's. It is a highly technical discussion.


See previous citation.


The author reviews Turing's work on computers and cryptoanalysis in the 1940s. This should be used with caution, it has errors of facts.


This is an excellent, full biography of Turing. For a detailed review of the book see Annals of the History of Computing 6, No. 2 (April 1984): 176-178.


His focus is on Bletchley Park and World War II, Turing and the ACE, work done at Cambridge University with an EDSAC, and research at both Manchester University and at the University of London in the 1940s.


He discusses Turing's ideas and the author's role in early computing, including memoirs of the Bendix G-15; illustrated.

He talks of Turing's visit to Bell Labs during World War II to look at a telegraph scrambler to secure telephone calls; illustrated.


This assesses British computing projects of 1945-47 and has a discussion of people, projects, places and, in particular, about the ACE. Turing receives considerable attention and the ACE's progress is presented down to the late 1950s.


This obituary notice includes material on his work with ACE at the NPL in 1943.


The time was 1949, the event is documented with a description of the mathematics involved, and the original paper by Turing reprinted.


This is an obituary/biography of a British computer pioneer and mathematician with material on his work with computer science.


He discusses work done toward the design of ACE in January 1943 and then about Turing's involvement in the project in the autumn of 1945.


This is a good analysis of his contributions to the field of computer science from the mid-1930s to the early 1950s. It is also useful for information on Colossus.


He argues that Babbage's work was known to him and
to other developers of computers of the 1940s, thus adding fuel to the fire of controversy about how much influence he had on computer scientists of the 1930s and 1940s.


This is a good source of material on Turing's work of the 1940s.


In his own words Turing offers the design of the ACE and an analysis of the work being done on it during the 1940s.


His 62-page booklet contains lectures he gave with others on the ACE and he shares his views on the general design of computers.


This 125-page book reprints key papers published between 1945 and 1958 on the British ACE computer.


This is a biography written by his mother. It is not limited to his personal life but also includes discussion of his work on computers.


This is a short, useful biography that defines his historical significance; it offers a good bibliography and is illustrated.


He focuses on the nature of optimum code as a means of reducing delays from delay-line storage.

He compares order codes of both the Manchester and NPL ACE computers.


This reviews the development of an important early British digital computer in the 1940s, and with the role of Alan Turing explained.


It contains a good survey of the work done on both hardware and software from 1946 to 1948; highly technical.


This was the A.M. Turing Lecture for 1970 in which the author commented on the life and work of the British mathematician who developed the Turing Machine and worked on the ACE Computer.


This is Wilkinson's most complete report on the ACE project and the important role played by Turing in its development during the 1940s.


This is a progress report on the ACE computer at the NPL.


1347 Woodger, M. "The History and Present Use of Digital Computers at the National Physical Laboratory,"

This reviews the construction of the final ACE at the NPL between 1953 and 1957. It also mentions the DEUCE.

American Computers


This was one of the first published reports for users of computers in business surveying existing computers and peripherals as of 1955 in the U.S.


This brief article is an excellent survey of the period 1947/1948 of U.S. equipment, their features and functions.


This is an 8-page description of digital computational devices.


This is a light statement that digital computers existed and how they worked. Alt worked at Bell Labs where much research had been done on computers since the 1920s.


He describes the Elecon 100, an early digital device.

This reviews work done between 1946 and 1953 on early American computers.


This is on digital computers, very early in their development in the United States.


This describes an early U.S. government computer.


This describes a computer built by Bell Labs for the U.S. Air Force, and was one of the earliest, if not first, to be built with transistors.


These are technical papers, including some by Warren S. Loud, Robert R. Everett and David R. Brown, covering a broad range of topics by people knowledgeable about computers of the 1940s.


Besides being a formal description of the features of this early digital computer, there are comments about American computers in general.


This is the only known formal description of this device.


This is a short survey of the device, primarily of number formatting. The machine was installed in the fall, 1949, at the U.S. Ordnance Department, and became operational in March 1952.

This is a description of an early U.S. digital computer project.

1371 Gridley, D.H. and Sarahan, B.L. "Design of the Naval Research Laboratory Computer," Electrical Engineering 70 (February 1951): 111.

This is a technical description of the NAREC, an early digital computer for the U.S. Navy.


The subject is computing in Los Angeles between 1942 and 1957. It is a light account with the names of many participants and specific dates of events related.


This is the author recollections about activities in the general subject area of automata theory during the 1950s and 1960s.


Hoberg describes Burroughs' first digital computer.


These are his recollections of early computer work dating from 1947 to 1954. It contains very few details.


He describes the technical features and functions of an early computer housed at the University of California at Los Angeles for the National Bureau of Standards (1948-1949).

Hardware, 1939-1960s


The papers focus on computer projects of the 1940s and 1950s, such as the ENIAC and EDVAC.


He surveys major projects such as IBM's electronic calculator, ENIAC, BINAC, Harvard Mark III, and the EDVAC.


This is a brief, technical description of an early digital computer in the U.S. called the JAINCOMP-B1.


This is a detailed account of some early U.S. digital computers, including the ENIAC, EDVAC, ORDVAC, BRLESC, and about the role played by the Corps in their development.


While a news article, it is an early, non-technical description of the DYSEAC computer, a member of the SEAC series built by the U.S. Government in the 1950s.


The DYSEAC was an early "portable" computer, built under the auspices of the National Bureau of Standards, following the design of the SEAC, and was installed at the U.S. Army Signal Corps in 1954.


This was NBS's third computer project, built between 1952 and 1954, and described by its builders and is a formal technical description of its features and functions.

1384 Maynard, M.M. "Livermore Automatic Research Computer (LARC)," in A. Ralston and C.L. Meek (eds),
This is a short, illustrated history of one of the earliest electronic digital computers, developed by Sperry UNIVAC (1959-1960).


This is a technical description of the features and functions of the ORDVAC, an early U.S. Government electronic digital computer.


This describes one of a series of computers built at MIT (TX-0, TX-1, TX-2, etc.), which were very advanced in the 1950s and grew out of work done on Whirlwind.


Morton describes the CALDIC as a user but also gives details on its design and function.


This is a technical description of an important digital computer, the ERA 1101.


The article reflects the infatuation with digital computers evident on the part of the U.S. press which began in the late 1940s and remained firm down to the present. He also describes various projects then underway.


This 28-page survey of government projects is relatively complete as a catalog of government computers of the late 1940s.

In addition to its focus on programming, the article addresses hardware issues since programming in the early 1950s involved close interaction with machines.


This may be the only published description of the MONROBOT computer.


This is a positive outlook on the future of computing and offers a good look back on recent developments, including on the work of Eckert and Mauchly on the ENIAC and subsequent machines.


Rigby was, in the mid-1950s, head of the Logistic Branch, Mathematical Science Division, Office of Naval Research. He reviews computing projects at ONR, its technology and their applications.


This is a technical description of the CEC Model 30-201 digital computer of the early 1950s.


The ALWAC digital computer arrived at Southwestern Computing Services in July, 1956. This describes the system and is illustrated.


This is written by a participant in the use of these early U.S. digital computers, covering the period 1949-1952. This is an illustrated, technical survey of these two systems.

1398 Sharpless, T.K. "Mercury Delay Lines As a Memory Unit," Proceedings of a Symposium on Large Scale Digital Calculating Machinery, 7-10 January 1947. Annals of the Computation Laboratory of Harvard University 16

Scanned OCR with permission of Greenwood Press [19 June 2009]
He argues that the Moore School intended to apply this technology to its next computer. It was at the Moore School that the ENIAC was built during World War II.


This is an illustrated account of his work (1953-75) and about a Westinghouse computer system called SOLOMON. It also comments on the University of Illinois ILLIAC IV.


This is a review of the logical aspects of a computer at the design level, surveying architectural changes over the past four decades.


The CADAC was a very early digital computer which Sprague describes in this article.


This Bell Labs scientist reviews the current developments in the design of digital computers in the United States.


This is an excellent overview of the kind of computers being built at Bell Labs in the mid-1940s and has comments on the general development of computers in the United States.


The Atlas was a 1950's digital computer project supported by the U.S. Government and which is partially described here.

This 109-page publication is an early, detailed analysis of existing computer systems and about how they were being used, covering U.S. processors.


This describes storage for the Univac-Larc (also called the LARC in some publications) computing system. It was a system characterized by relatively inexpensive but slow memory.


Wolff described a computer under construction through funding from ONR in the late 1940s and early 1950s. It was one of several being sponsored by the ONR at the time.

Analog Computers


This is a brief survey of existing analog computers and their advantages, circa mid-1950s.


Black described his 1937 invention of a feedback amplifier which made the potential for accurate analog computers possible.


This Bell Labs scientist developed amplifiers of tolerances needed for analog computers of the 1930s. This book, although a technical treatise, summarizes his work.


GPAC, also called Gypsy, was an early post World War II analog computer built at Bell Labs for complex mathematical applications. Currie describes the system in this article.

This is an early publication on the use of analog computers in post-World War II USA.


This briefly describes analog computers.


This is a detailed study of the device which was used for centuries to predict movement of the stars and planets in Europe as an aid to navigation. The concepts of analog computing and feedback are described in this book as part of the effort to explain the astrolabe.


This is a technical treatise with some history. It is best used to understand early electronic analog computers of the late 1940s and early 1950s.


This is a good technical snapshot of existing technologies in analog computing as of the early 1960s and late 1950s.


This second edition (first published in 1952) was a standard technical survey of the subject in the 1950s. The first chapter (pp. 1-29) has a useful summary of 1950s' analog machines. It also has an extensive bibliography (1950-1955) on analog devices and their uses.


This is a very recent publication on the analog device used to help predict the movement of stars and planets since ancient times down to at least the 1600s in the West.


This 270-page book is a collection of reprinted papers and articles on the features and applications of analog computers, mainly during the 1950s.

He reviews many analog devices used for navigation and the prediction of the movements of stars in general.


He describes the Greek Antikythera device which was a mechanized astolabe found in a sunken ship. He discovered it at the Greek National Archaeological Museum and sees it as a very early analog computer.


The authors describe an analog construct of theirs which served as an early general purpose electronic computer.


Analog computers enjoyed a limited but useful period of popularity in the 1950s, particularly for military uses. This is a brief, and rare, look at such an early post-World War II use.


This is an early, useful introduction to the subject. It also contains material on the history of analog devices.


The author reviews the computer at the U.S. Naval Research Laboratory, an early military computer.


By 1961 there were many functioning analog computers some of which are described in this article. It is also a useful introduction to their technology.


This is an excellent, detailed, and technical description published when analog computers were enjoying a great deal of popularity and just before the digital came to dominate.

Travis reviews briefly calculating methods that are both analog and digital.

**BINAC**


The authors describe the BINAC and include circuit diagrams. They called this computer the "first CPU of its type to be completed successfully in the United States." They include a sample program run on the processor.


This is a review of a demonstration of the BINAC held at the Eckert-Mauchly Computer Corporation. It includes some technical details on the machine.


This is a brief, but competent, overview of the military "portable" computer called the BINAC.


This details the purchase and plans for the BINAC. It was one of the first commercial transactions for a digital computer in the United States.


Shaw offers a description of how to perform addition, subtraction, multiplication and division on the BINAC in the most formative period in the development of what would later be called programming.


This is a well-researched and written history of the machine built by Eckert and Mauchly between 1947 and 1949.

This is an illustrated survey of machines Booth worked on, starting in the early 1940s, from mechanical counters to analog machines, and relay calculators. Some of the machines were the APEX, ARC, MAC and M3. A few were developed for the British Tabulating Machine Company.


This was a computer developed, in part, at the University of London with Andrew Booth's early involvement.


This describes the TREAC, an early British computer which was very advanced in design for its day.


Clarke discusses the development of British commercial electronic digital computers of the 1950s.


He reviews calculating devices and their applicability for scientific work. He discusses difference analyzers, the National Accounting Machine, various electrical and desk calculators, and commonly used punch card devices.


The authors describe work they did on an early transistor computer at the United Kingdom Atomic Energy Research Establishment, Harwell, called the CADET computer.

He describes MOSAIC, a British processor built between 1947 and 1954, a machine for military radar users.


The computer is described and was used for aircraft tracking experiments in the mid-1950s.


They review adding, multiplication and other functions on machines in detail. It is, however, very much a theoretical discourse, circa mid-1940s.


This was a high-speed transistor, British computer.


This is a status report on various computer projects in Great Britain as of 1947-1948.


He offers a quick review of modern devices (nearly 25) and then surveys work done at Birkbeck College. About half of the 152-page report is historical in content.


The report is based on an RRDE research survey of January 1945, on a machine using 2 paper tape readers and 1 multiplier built out of relays and uniselectors.


This is a reprint, with introduction, of technical papers on computers from conferences held at
Cambridge University (June 22-25, 1949), Manchester University (July 9-12, 1951), and at the National Physical Laboratory (March 1953).

Colossus


Chandler worked at Bletchley Park during World War II and with this secret computer. These are his recollections of the period and about the machine.


Coombs reviews conference discussions on Colossus held at the Los Alamos Conference on the History of Computing, June, 1976.


The author participated in the creation of computers at Bletchley Park during World War II and had a good knowledge of the Colossus system which he describes here.


This is an illustrated account by an engineer at Bletchley Park during World War II.


These are four 90-minute videocassettes with developers of Colossus. Speakers included Flowers, A.C. Lynch, A.W.M. Coombs, and H.H. Hinsley.


This is about a lecture made by T.H. Flowers on Colossus. Flowers argues that the British lost the lead in the race to develop computers because of the need to keep quiet about the Colossus rather than share knowledge of the machine with other scientists.

Randell, Brian. "The COLOSSUS," in N. Metropolis et al. (eds), A History of Computing in the Twentieth Century: A Collection of Essays (New York: Academic...
This is a detailed review of the British processor of World War II vintage. It is a technical piece, illustrated and by an author with hands-on experience with the machine.

This is a short history of the early British computer.

This is discussion of various British computers and scientists, including the COLOSSUS and about Turing.

Computer Design Automation Technology

The authors describe packaging in the pre-LSI era. They relate the example of the transistorized IBM 1400 and 7000.

This includes a detailed bibliography on recent trends in design automation.

They discuss the use of interactive processing, using graphics and alphanumeric terminals, in automated design applications not limited just to the design of high technology hardware.

IBM used techniques described in this article in the 1950s to generate design documentation for parts.

The authors describe how they did design automation at IBM in the early 1960s.

The language was used for FET-based technology of the 1960s.


This is a description of a tool to design FET technology for the IBM 1620 and 1130 class computers.


The subject is a computer design simulator of the 1960s to help detect and handle logic circuit hazards and race conditions.


This important figure in the history of programming languages discusses how only computers can deal effectively with finite numbers.


This scientist, from Bell Labs, describes an SLT packaging technique used in the late 1950s by some designers of computers.


The author describes a language used to help design FET-based computers of the mid-1960s.


This is a description of testing methods for computer components, using software, during the 1960s.


This is the only bibliography in the subject.
DEUCE


This is a detailed, technical review of the DEUCE, an early British computer of the 1950s and about which there is little information.


The DEUCE was an early commercial British computer (circa 1955), which used mercury delay lines. The author provides a technical description of the system.

Digital Computer Technology


In the 1950s Alt worked for the U.S. National Bureau of Standards and was a recognized expert on computers. In this article he provides a management overview of computer technology as it existed in 1955-1956.


The author was a major developer of the S/360 at IBM and the founder of a company after his name, that sold computers in the 1970s and 1980s.


This is a textbook introduction to data processing technology, its equipment, applications and management as of the early to mid-1960s. It includes a short history of computing equipment (pp.15-31).


This overview from the abacus to integrated chips includes a photograph of "Dirty Gerty," the first transistorized computer made in Canada, and perhaps the only published photograph on the device. Other useful illustrations are included.

This offers a short review of the history of computer technology in addition to a much longer description of contemporary devices of the mid-1950s. The authors were active participants in the development of computer technology in Great Britain during the 1940s and early 1950s.


They review the state of the art as of the late 1940s, a period of much activity in the field both in Great Britain and in the United States.


Burks played a key role in the design of electronic digital computers, making any comments by him of significance to historians. In this brief piece he reflects thoughts at the very dawn of the computer.


This is a technical treatise on the characteristics and performance of large computers as of the mid-1950s.


This is a balanced and useful history written by an historian. It surveys the ENIAC, ASCC (Mark I), Zuse machines and work done at Bell Laboratories.


The book briefly covers the evolution of calculators and, in considerable detail, the development of computer technology during the 1940s and 1950s.


This very large supplement has a section on the history of computers and many short articles by such historically important individuals as Berkeley, Noyce, Bell others on Babbage, Hollerith, Atanasoff, Mauchly, Eckert, von Neumann, Watson and Hopper.

This short DPMA publication reflected its role in educating the public, and many within the new data processing industry, about the subject and on how best to use this technology.


This fit into a genre of articles which appeared in the late 1940s introducing the new technology of computers to the American public.


Two well known computer scientists describe the technology and its features as of the mid-1950s.


This is a major encyclopedic work on technology of computers as of the late 1940s.


This is one example of many such articles typical of the 1950s describing digital computers and their use in general, non-technical terms.


This MIT engineer, at the time of publication, was involved in leading the development of Whirlwind, and thus was particularly well informed on trends which he describes, particularly those in the United States.


This is an introduction to computer technology as of late second generation computers.


Although not a thorough survey, this 705-page book nonetheless represents a detailed snapshot of data processing of the 1950s from many perspectives. It is particularly useful for British views and developments.

The focus is on parallelism in large computers and how that is accomplished. Chapter One has an historical survey of computers from Babbage to the ILLIAC IV. The book also comments on machines of the 1950s.


This is a general introduction to computers. It is also useful for appreciating machines of the late 1950s and very early 1960s.


Hamilton frequently wrote on computers in their early years. This article is typical of his work of describing this new technology for the general reader.


This emphasis is on the development of computer technology.


This describes digital computing for the general public in the United States.


This is a brief, contemporaneous overview of second generation computers.


This is a popularized description of digital computing of the late 1940s: technology and applications.


Lubkin's paper was a technical discourse concerning digital electronic computers.


Focus is on digital computers and upon how they could be used.

He reviews some of the mechanical monsters of the 1940s and 1950s. The author was a European journalist specializing in the data processing industry.


The "brain" was the digital computer which is described for the first time by this magazine. It would publish many more articles on computers in the next 30 years. This article appeared at about the same time as other similar pieces were being published by other widely read American periodicals.


This was a well written yet early article on the subject and is narrative in form.


This is an important, early publication on all kinds of computer equipment, both processors and peripherals as of the late 1950s.


This is the second and full edition of his survey on computer technology of the late 1940s.


The author reviews how this could be done with digital computers, using the I/O equipment available to him in the late 1940s.


This is a short report of the "Historical Session" at the 1967 session of the National ACM Conference in which a number of early computer pioneers participated.

These are 20 lectures covering all aspects of digital computers, delivered at the home of ENIAC. These sessions were influential on many early computer builders.


This article provides details on the ENIAC and EDVAC projects.


This reviews quickly existing computer projects in summary fashion.


This is a serious, 384-page book on data processing technology of the early to mid-1950s. It describes how computers operated at that time and thus is a useful period piece for second generation equipment.


Chapter 1 reviews the history of electronic components and circuits.


This continues the theme of his previous books; this time it is a reflection of technology of the 1960s.


The author was a frequent commentator on computers in their earliest period. This was one of many he wrote introducing the technology to the American public. This article carried out that objective primarily for business people.


The focus is on computers built from the 1940s through the 1960s.

The short article is concerned with digital devices made by the inventor, primarily relay computers, at Bell Labs in the late 1930s and 1940s.


Stibitz was the father of a series of Bell Labs computers in the 1930s and 1940s. This book is on applied mathematics and contains a brief history of computers, with a survey of the technology as of the mid-1950s. It has a detailed bibliography particularly useful on publications of the mid-1950s.


This focuses on the design of computers and related devices. It is a good review of technology circa 1949 and contains a detailed bibliography on the subject.


Besides being a series of technical comments on the CDC 6600 processor, it reflects leading edge computer design of the early 1960s.


This is a brief discussion of digital computational devices of the 1940s.


These are the proceedings of one of the more famous DP conferences of the 1950s of an international type. It contains dozens of technical papers by both American and European scientists and engineers.


This distinguished computer science reviews computer technology and software of the 1950s.

He focuses attention on developments of the 1940s with an illustrated account of the Mark I, Bell Labs' Model V, and the ENIAC.


This is a general history of computers of the 1930s and 1940s.


This is a history of the five generations of computers, along with a discussion of their economic worth over the previous 30 years.


This is the transcript of a discussion regarding the origins of the concept of the stored program.


This is a history for the general reader, taking the story from the ENIAC of the 1940s to the early 1950s with the IBM 701.

Digital Computers


They describe the Australian CSIRO Mark I computer.


This is the story of an early vacuum tube stored program computer. Both authors worked on this Australian machine which they describe.


This reviews the work of Svooboda in the 1950s and about Czechoslovakian computing.

This is a useful, very early survey of Soviet computing projects, along with a description of data centers and computer scientists.


This describes the TX-2 computer, built in the 1950s. The TX project helped train a generation of engineers who later went on to build mini-computers, especially at DEC.


This description of LINC was one of the early narratives of a project involving the use of 12-bit computers. It was done at the Lincoln Laboratory at MIT, beginning in 1960. The machine's functions were first demonstrated in 1962.

1535 "Fast Student; ORDVAC," *Time* 59 (January 28, 1952): 42.

This was an early, non-technical, public announcement of the existence and functions of ORDVAC.


This is a description of the features and functions of the system. It was used, for example, to help develop the St. Lawrence Seaway, and was housed at the University of Toronto.


This is the most complete review available on the U.S. Army Signal Corps project of the 1950s. It is an illustrated and highly detailed account.


They discuss computer projects at Osaka University undertaken after 1946.


The University of Toronto built an early digital computer, described here; it was one of many such projects at this school.

This is a general introduction to the subject for non technical audiences. It contains references to the history of the subject.


This describes a computer built in 1950 at the Royal Institute of Technology at Stockholm.


The author describes his role in building this computer, which he started in 1952 and had completed in March, 1956.


He describes the CSIRAC (also known as the CSIRO Mark I), the first stored program computer built in Australia and done between 1947 and 1951. Only one copy of the machine was ever built.


A typical period piece in that it surveys the status of computer technology and describes its uses for the general reader.


He describes the workings of a digital computer and speculates on that technology's potential.


This is a brief comment on the Oracle about which little was published.


He describes an all transistor computer in the process of being built—the first in Austria called MAILÜFTERL.

The authors describe a device which attached to a digital computer, vintage 1948.

**EDSAC**


They focus on EDSAC's programming capabilities of the 1950s, in an era when programming was done without benefit of higher level languages.


This is a short description of the architecture of the EDSAC.


In addition to reviewing various projects then underway in Great Britain, it contains comments on the EDSAC.


This is an illustrated biography of one of the most important of the early British computer scientists.


He focuses on the EDSAC's technical features.


He includes a description of his use of the EDSAC.


Naur relates his experience in learning how to use the EDSAC at Cambridge University and about his work in astronomical research with the machine.

This is a key paper because it details the first and second forms of program representation and loading for the EDSAC.


This is a short survey from 1946, when the Moore School conducted a class in computing, forward.


He describes plans for the construction of the EDSAC.


He surveys the origins of the Mathematical Laboratory at Cambridge, of his taking classes at the Moore School in 1946, the development of the EDSAC and about programming that computer. He includes a large number of photographs of the EDSAC taken in 1951.


This short, yet informative, article covers his role in the design of the EDSAC at the Mathematical Laboratory at Cambridge University, 1946-1950.


Its architect describes the features, functions and history of the EDSAC.


He describes what it was like working with the EDSAC and discusses such issues as servicing it and running diagnostics.

This is an illustrated narrative of the EDSAC and about its use in solving differential equations during the late 1940s.


These are important memoirs on the early history of digital computing. Wilkes recounts his work, first with radios, then later with computers, from the 1930s down to the 1980s. It is an essential source on British computing.


He reviews computers and programming techniques of the 1940s with special reference to the EDSAC experience.


One of Wilkes' concerns with the EDSAC was to make it easier to use than previous or contemporary digital computers. This article focuses on some of his concerns and experiences with the use of EDSAC.


This is a technical description of the memory components in the EDSAC and hence a snapshot of such technology as of the late 1940s.


This is a formal description of its features and use.


This reviews the design and programming characteristics of the EDSAC.


This describes a demonstration made by W. Renwick of EDSAC. It includes flow diagram and programs used.


This includes two photographs of the EDSAC with a short description of the system.

EDVAC


This is a discussion of plans for the EDVAC and offers an explanation of how decisions were made regarding its design.


This non-technical piece briefly describes the EDVAC.


This is a 19-page technical treatise, making it one of the first programming manuals.


This is a short description and history of the EDVAC by a major figure in the history of early computing.


They describe work done on the EDVAC at the Moore
1982 4 MARCH 1964, 26-27.' DATA SYSTEM DESIGN.' "AN HISTORICAL EVENT—BNAC: A" ALL READERS.
techniques used for setting up programs on function
that's work done with the BNAC and also about
(1972) 69-69.' COMMUNICATIONS OF THE ACM 15, No. 7
1979 12 MAY 1947! 168, 172, 176.' "MEMORY MEMORY" FROM THE NEW BNAC, COMPUTER, "EDAC-" FOR those who have had to retrieve patient con-
counsels to the doctor. To also discuss the current experiences in detail and a review of the prices and costs in options
the important articles reflected the general concerns
The discussion concerns the patent debate over the ENIAC.

1584 "Answers by ENY; Electronic Numerical Integrator and Computer, ENIAC," *Newsweek* 27 (February 18, 1946): 76.

This was one of the first widely published accounts of the ENIAC available to the American public.


This was written by the project leader on ENIAC. He reviews carefully the Moore School project, how it got organized and started, taking the story from the 1930s through the 1940s.


They discuss both how the system worked and review some details of its history.


He describes the electronic characteristics and design features of the ENIAC.


This is an excellent article covering the ENIAC, EDVAC, IAS, Whirlwind, EDSAC, UNIVAC I and other processors during the 1940s and 1950s. The author was involved in the development of computers during those decades.


This is an early account of programming instructions for digital computers; particular emphasis is on the ENIAC.


He describes programs of and a demonstration of the ENIAC; illustrated with photographs and diagrams, including some on programming instructions.

This is a major review of the ENIAC's functions, history, and historical significance. The article is also well illustrated.


This is on the evolution of digital systems and, in particular, on the ENIAC and IAS system for a non-technical audience.


This describes von Neumann's efforts to do weather forecasting on the ENIAC.


This 48-page document describes how the ENIAC could be used in the 1940s by describing its coding conventions.


This is on John W. Mauchly, containing many personal details, such as about his high school days in Chevy Chase (suburb of Washington, D.C.), and his first wife (Mary Walel).


These are memoirs of Mauchly, Eckert and the development of the ENIAC.


This is a profusely illustrated history of computing since the 1890s which also contains a great deal of material on the ENIAC and other machines of its era.


This briefly describes the functions of the ENIAC.

This was written by one of the main architects of the ENIAC, offering a general overview of his role.


He provides a history of the ENIAC, how he and John Mauchly developed the concept of the stored program and applied it to both the ENIAC and EDVAC.


This is a rambling discussion over a variety of data processing issues, including stories of experiences with ENIAC and disputes with von Neumann.


This document was written by four giants in the history of computer technology. It contains a large number of details and issues concerning reliability, availability, and service. The paper is very technical but does reflect the nature of their thinking as of late 1945 on the subject of general purpose digital computers.


This is a description of the ENIAC for the serious general reader in the United States.


This a short review of the ENIAC, complete with one photograph.

1605 "ENIAC: At the University of Pennsylvania," Time 47 (February 25, 1946): 90.

This major publicity came on the occasion of the ENIAC's public debut as a digital computer.


This detailed obituary is about the scientist best known for heading up the team that built the ENIAC at the University of Pennsylvania in the 1940s.

This article was written as a result of Judge Larson's ruling on the ENIAC patent suit. It discusses Atanasoff and includes an interview with him.


The ENIAC, EDVAC, and IAS computers are described in considerable detail with reliance on the author's records. It includes comments on his personal role and that played by von Neumann.


This is a good description of the ENIAC and about its programming.


It has a chapter on the ENIAC and EDVAC, how they worked, and comments about von Neumann.


This is a lecture, primarily focusing on the ENIAC.


He briefly describes the ENIAC.


This is a comparison between IBM's relay calculator, the ENIAC, and Bell Laboratory's computer in terms of actual performance, an early such article that would, in years to come, be a frequent publication for each generation of machine.


This is based on primary materials to tell the story of the ENIAC. It begins in July, 1944 and continues.
it down through the patent lawsuit of the 1960s. It is detailed and balanced.


This is a short, illustrated history of the ENIAC.


The first half of the book is devoted to digital equipment and to their history. This publication is also one of the earliest Japanese accounts of the ENIAC.


This is a formal obituary notice of one of the key developers of the ENIAC.


This book contains many details about the EDVAC and ENIAC, circa 1945-1955.


This is the Judge's findings concerning the validity of the ENIAC patent. He concludes that Eckert and Mauchly did not invent the automatic digital computer. The 319-page document, like the lawsuit, generated vast quantities of information on the ENIAC and on the early history of computing.


This is a narrative history of the ENIAC with over-statements about the significance of the project.


This is a letter to the editor in which he offers background material on the evolution of the ENIAC and argues that his ideas were developed long before
von Neumann first visited the Moore School of Electrical Engineering in late 1944.


The historical survey is more important by the fact that Mauchly was one of ENIAC's developers. He also defends the development of the stored program notion.


These are his recollections of work done on ENIAC.


This consists of letters and comments on his work in the 1930s and 1940s.


This covers the period while he was at Ursinus College (1933-41), about his dealings with John V. Atanasoff, and later at the Moore School. The author was Mauchly's wife.


This is a short biography of the co-developer of the ENIAC.


Like other widely-read periodicals of the 1940s, this one provided brief, but important, coverage of the public unveiling of the ENIAC.


This is a non-technical description of the first fully operational electronic digital computer in the United States.


She focuses on the role of Eckert and Mauchly as businessmen moving a high technology product from
lab to market and across multiple projects from the mid-1940s to early 1950s.


This is a very complete, and well-researched, study of the various computer projects of Eckert and Mauchly. It is a major monograph on early computing history.


This is an illustrated biography/obituary.


She reviewed the controversy and voted for Eckert and Mauchly over Atanasoff as the developers of the first such machine.


Tabor provides a technical and contemporary explanation of the design of the ENIAC, reasons for the EDVAC, and problems associated with the earlier system.


This is an obituary/biography with photograph. He worked for the Eckert-Mauchly team on the UNIVAC.


This is a biography of a co-developer of the ENIAC and UNIVAC.


This is an important paper in the history of computing because it was the basis of much computer design.
1943

Akien, H.H. and Hopper, G.M. "The Automatic Sequence Controlled Calculator Function." This is a short history of the automatic machine built by Akien at Harvard.

1944

According to Mark 17, "Time 64 (August 9, 1944), 69-69."

1945

Aiken, H.H. "Proposed automatic calculating machine."

1946

Aiken, H.H. "The Mark 1: General Specification (August 1946); 62-69."

1947

Harvard Mark Series IV

1948

Wikipedia, Harry, breath and to the computer age. This book contains material of the evolution of the UNIVAC. This is an early history of the UNIVAC with partition. This review of the UNIVAC, the application to ballistic. The BINAC ELECTRONIC 19 (April 1946); 308, 310. 312.

1949


1951

War Department, U.S. "The BINAC and other uses. This review of the BINAC the application to ballistic. This book contains material of the evolution of the BINAC. The BINAC ELECTRONIC 19 (April 1946); 308, 310, 312.

1952

One of Aiken's students is the author of this article. Auerbach describes how Aiken treated him and reviews the professor's views on Eckert and Mauchly.


This is a description of the Mark I and the uses it was put to during the mid-1940s.


This describes the Mark II at Harvard, a paper tape controlled calculator, with comments on its various functions.


Cohen explores the extent of Aiken's knowledge of and inspiration from, Charles Babbage for his own work. He includes an inventory of models of Babbage's machines. Cohen concludes that Babbage had a minor influence on Aiken's ideas on computers.


This is a description of the Mark II relay calculator at Harvard.


The founder of Wang Laboratories worked on static magnetic memories in the 1940s at Harvard for Aiken.


This briefly describes the Harvard Mark I calculator built by Aiken and IBM.


This features the Mark I and Aiken's work.

This describes how to operate the Harvard Mark I calculator.


This 6-page functional description of IBM's first important computer product grew out of the Mark I at Harvard.


This was one of the first widely distributed articles on computers to appear in the U.S. for the general public. It describes the Mark I, and IBM's involvement.


The machine used to do the work was the Harvard Mark II, a relay calculator.


This is a short biography of the creator of the Mark series of calculators at Harvard in the 1940s and early 1950s.


This describes works and features of the Harvard Mark I.


This surveys Aiken's 16 Ph.D. students (1948-58), some of whom became major figures in the history of computing. It was written by one of Aiken's 16.

This is on one of Aiken's latest Mark calculators; a technical description.


This is a short, competent and illustrated history of the Harvard Mark I.


This celebrated the existence of the Harvard Mark I.

1662 Torrey, V. "Robot Mathematician Knows All the Answers," Popular Science 145 (October 1944): 86-89.

This provides a non-technical description of the Mark I.


This is a short, illustrated biography of the builder of the Harvard Mark series of machines, with special reference to the Mark I.


This was the subject of a 1983 Pioneer Day session at AFIPS; contains stories of the 1930s and 1940s.


This is on the Mark I, a narrative with a great deal of hyperbole.

Grace M. Hopper


This is an interview with Hopper who recounts her work with COBOL.

This is a biography of the first female programmer in the U.S. and a major force in the development of COBOL. Pages 7-24 are her memoirs of those experiences.


This includes an interview with Hopper (pp. 59-64). She comments on her days with the Harvard Computation Laboratory and at Univak (1940s-50s).


This illustrated biography focuses on her naval career and includes quotes of a talk she gave in the spring of 1982.


In addition to being a short biography, this has comments on her work at the Harvard Computation Laboratory and at Univac.


This is a biography by a computer scientist on her work with particular emphasis on the Mark I and on COBOL.


They offer a biography of Hopper which is well illustrated on all aspects of her long career.

IAS Computers


Aspray looks at the relationship between mathematics and computing (1945-55) by looking at von Neumann's efforts at building the IAS computer.


He surveys the period from the late 1940s through the
early 1950s and includes material on von Neumann's role and computer developments. The author worked at the IAS in the late 1940s.


They focus on von Neumann's approach to programming languages.


This is a survey of IAS hardware systems.


This is a detailed analysis and description of how to code for the IAS computer and offers design considerations for the system.


This is an illustrated, thorough history of the Rand JOHNNIAC computer by a user. It was used from 1950 to 1966.

Input/Output and Telecommunications


The author reviews remote data input via telephone lines, circa 1955. It was a very early and comprehensive article on the subject.


He describes Sylvania's DP communication system of
the mid-1950s for data transmission. The applications involved payroll and customer order entry.


In addition to reviewing existing devices, the author concludes that they are fast enough for current systems although expensive.


This describes peripherals used on the SEAC, SWAC, DYSEAC and other processors (8 in total).

IBM Devices


This describes IBM's transistorized version of the 709.


This describes the first system from any vendor that used magnetic disk files commercially in the 1950s. It includes a photograph of an IBM 305.


The authors describe the features and functions of the IBM 702 system of the mid-1950s.


This covers all computers and system architectures for the period 1949 to 1964 up to S/360. It includes the 701, 702, 709, 7090, 704, TPM, 650, 7070, 1401, 1440, 1460 and STRETCH.


This device used binary coded decimal and alphabetic symbols for commercial applications.

1688 Bender, R.R. et al. "A Description of the IBM 7074
This is a technical description of the features and functions of the IBM 7074 system.


This is intended for a non-technical audience with a description of the possible uses of this system.


The author reviews the physical installation problems experienced in the installation of an IBM 705 at the Southern Railway Company in Atlanta, Georgia.


Grosch was the president of the Association for Computing Machinery and of the Institute of Aeronautics and Astronautics. He worked for IBM, GE and the U.S. Government. He describes the acquisition and use of an IBM 704 at GE in the 1950s.


The authors survey the features of all of the IBM calculating equipment available at the time. Their review includes both electronic and mechanical devices.


This illustrated account is by an IBM scientist and covers the years 1947 through 1957, from the IBM 701 through STRETCH. It is excellent for both technical details and on decision making in computer development.


He essentially covers the same ground as in the previous citation. Since he participated in the development of many IBM systems of the period, his comments are also memoirs; illustrated.

Hurd describes IBM CPC and applications for which it could be used.


It reviews quickly the Harvard Mark I, SSE, 603 Multiplier, CPC, 628, Tape Processing Machine and others.


This is a public announcement of the RAMAC system.


Klass describes work done at Northrop Aviation leading to the IBM CPC and on its use at this aviation firm. He also comments on the BINAC.


This is a technical overview of the first disk storage system available in the data processing industry.


This is a formal description of the IBM 305 system by two of its developers.


The author describes the connection of two pluggable Sequence Relay Calculators together into a system.


This was an important technological improvement over earlier processors that went far to propel IBM to a leadership position within the computer industry in the early to mid-1950s. The system's history is recounted.

Reviews early RAMAC installations of the 1950s and the history of this IBM disk storage system.


This is one of a number of articles that appeared in the late 1940s and early 1950s of users lashing IBM calculating and peripheral devices together to make computer-like systems to do continuous and faster work.


The author describes equipment used as part of the IBM 701 system.


This is one of a number of articles that appeared on early IBM processors in the 700 line. The 702 was a major entry into the computer market for IBM.


He describes work at IBM on calculators and computers in the 1940s. He describes the work of R. Seeber on the Harvard Mark I and later at IBM in the 1940s and 1950s.


This is an important, technical description of the IBM CPC.


He describes the combined functioning of an IBM 603, 405, and one 517 punch.
IBM 650


This short technical publication describes how to operate a very early IBM processor, but one of IBM's most popular of the 1950s. It contains materials on using IT and For TRANSIT programming.


Carnegie was one of the first universities to install a 650; its use there is described.


The author used a 650 at Lockheed Aircraft Corporation in the mid-1950s. His illustrated account offers details on usage and early programming done at IBM for the 650's system.


He describes the availability and use of IBM 650s at American universities in the 1950s. There were 21 situations. He also explains IBM's policies of the period toward educational institutions.


While a technical article on system balancing (a topic of concern to computer designers for decades) it does review the performance of the IBM 650.


The author explains how memory for the IBM 650 evolved in the early 1950s. Woodenwheel referred to a type of machine design.


This is a reprint of a 1955 paper, along with the author's recollections of his work with the IBM 650 in the 1950s. His focus is largely on the machine's development.

He describes the use of the 2nd 650 shipped by IBM, to the DuPont Savannah River Laboratory, to do simultaneous equations in the 1950s for various scientific projects.


This is a description of an early magnetic drum memory of the 1950s, as it was for the IBM 650. The article was reprinted in Annals of the History of Computing 8, No. 1 (January 1986): 14-19.


The author's paper is a history of data processing at Stanford University during the 1950s with primary attention on the use of an IBM 650.


This is a very early description of how the IBM 650 was conceived and thus contributes to our understanding of early commercial computer development.


He argues that the SSEC reinforced the need for stored program computers and more advanced components, both of which appeared in the IBM 650 processor of 1953.


This describes applications run on the IBM 650 in the mid-1950s.


The author helped create the IBM 650 and other IBM computers of the 1950s. He describes the significance of the 650.

Business Machines Corporation, 1957). Multiple editions throughout late 1950s.

This is the "official" operations guide and description for the IBM 650, IBM's first disk-driven computer.


This is IBM's earliest description of the 650 system.


The author reminisces about using a 650 as a student at Case Institute of Technology in the 1950s. He includes material on how the processor worked and its relationship to early software.


This reproduces the announcement materials on the IBM 650, dated July 1953. This is a good example of the kind of publications coming from IBM on new products from the 1940s forward. Learson was a senior marketing executive, Hurd a senior engineering executive.


This 510-page book is a detailed study, based on the IBM 650 computer.


The author describes Carnegie's experience with a 650 in the 1950s. It is both autobiographical and illustrated.


This is a reprint of lists of topics and attendants at a computational class taught by IBM in August, 1955 on the 650.


The article is a survey of the IBM 650 as the company's first major business applications computer.

This is a description of how the 650 evolved, written by one of its designers. It is an excellent overview of the device and concerning its technology.

IBM 701


These are the recollections of a project leader of the 1950s working on the IBM 701; illustrated.


They describe the 701's design. Both helped to design the system for IBM, a product first announced in April 1953.


Backus, who later became a major figure in the early history of programming, describes the 701's programming capabilities.


This is an illustrated description of how the 701 was used at Douglas Aircraft in the early 1950s.


This offers a useful insight into how computers were developed in the early 1950s and is fairly typical of IBM's experience throughout that decade.


This is a formal description of the IBM 701 for a technical audience.

This is a description of equipment configured with the IBM 701 system.


This is an early, useful description of scientific uses put to this IBM system by a user.


This is a technical description of IBM's electronic computer: design, features and functions.


His focus is on the uses of an IBM 701 in the early 1950s.


An ex-GE employee describes how the 701 was used at his company in the early 1980s. GE was a heavy user of many computer systems in the 1950s for both commercial and scientific applications.


Haddad was a computer developer at IBM in the 1950s and beyond. The article is one of several published by the Annals describing the uses of this system.


This is the operating instructions which came with the IBM 701 system. Such books were used by users to operate and program computer systems, processor and peripheral equipment.


The national laboratories were early users of scientific computers; this article describes one example of such usage.

The authors used the 701 for scientific applications in the 1950s which they describe.


This is a description of work done in the design and development of the IBM 701.

IBM continued its tradition of running service bureaus, from tabulating days, with scientific computing services with the 701 processor in the early to mid-1950s.


This computer received considerable attention from engineers and scientists using computers, some of their interest is described here.


He describes software/applications on the 701.


He describes software development for the IBM 701.


He continues the theme of the previous citation, circa 1953.


Like many similar articles on other processors, this one reflected early interest in installation and performance of early computers.

McCool, Thomas E. "NSA's Defense Calculator (701),"
The author was a user of the IBM 701 and relates his experiences with it.


This continues the series of user views of early scientific processors from IBM, the 701 of the early 1950s.


The emphasis is on IBM developments up to the announcement of the 701.


He describes his role and that of a 701 at the Boeing Airplane Company in the early 1950s.


This is useful for gaining perspective on the significance of the 701 development effort for the industry and IBM.


Such early experiences with a computer were always watched with great interest by both vendor and possible users alike as they learned what to do better the next time.


This describes a major component of the IBM 701 in highly technical terms.


His focus is on applications for the processor.

Schlieser, Walter C. "The 701 at Douglas, El Segundo,"
This reflects the experiences of a technical end user of the 701 in the 1950s.


Lockheed was an early user of not only the IBM 701 but other processors as well. The 701, however, made many large-scale modeling and design applications possible due to its increased capacity and speed over earlier machines.


This is a rare article since little has been published on IBM's computer marketing programs of the 1950s and a great deal on its technology, however.


This is a description of how IBM organized I/O gear in a 701 configuration.


Although short, it does the same for North American as, for example, No. 1764 above.


This is yet another application survey involving the IBM 701.


Diagnostics on early computers were crude at best. Designers of the 701 attempted to enhance them with programming tools for this and subsequent machines.

IBM 1401

This is a technical guide that discusses the use of one of IBM's most popular early computers. It is also the one least studied by historians.

IBM SSEC


This is an illustrated history of the SSEC. He argues that this represented the first use of electrical computation and a stored program design (late 1940s).


This is an illustrated account of the features and functions of the IBM Selective Sequence Electronic Calculator, and about its possible uses.


This does the same as his previous article. The machine encouraged IBM to increase its R&D in computational equipment.


This reports on IBM's dedication of the SSEC on January 27-28, 1948.


This is a 16-page description and user guide. It includes some history of the device and a photograph of 23 people involved in its development.


Originally this was written in 1948 but published now for the first time. It describes the machine.

This is a brief description of the SSEC and its past intended for a general audience.


IBM early-on sought out publicity for its major products; this one on the SSEC is typical.

**IBM STRETCH**


This is a book-length account of STRETCH.


This is a brief, illustrated account of the IBM 7030 computer.


This is an early description of how one team attempted to manage real storage in the 1950s.


One of IBM's engineers describes the thinking that went on behind the development of this important computer.


This is an assessment of the system and on its use.


He discusses the IBM STRETCH computer, its evolution, technical innovations and importance to IBM, and finally, its demise.

**Institute Blaise Pascal Computer**

This is a detailed technical description of the Institute's computer and in particular, about the parallel arithmetic unit then being developed for the system.


This is a progress report on the same machine, now completed.


This covers such obvious machines as the Mark I, Bush differential analyzer, ENIAC and the Institut machine with comments on how it differed from American machines.

LEO


Gibbs described the first commercially available British computer, 1949-1951.


This was one of a series of articles on LEO; this one describes the input/output for the LEO computer.


This is one of three articles on LEO written by its developers. This one focuses on the use and care of the British system.


This provides a useful perspective on LEO I by a user.


This is written by two of its developers. They describe one of the earliest British commercial computers.

This book is on business management of data processing that relies heavily on the use of British devices of the late 1950s and early 1960s.

**MANIAC**


He reviews early computing at the Los Alamos National Laboratory (1950s) and comments on the work of Nicholas Metropolis. The author also worked there.


He describes the MANIAC, the first computer used at the Los Alamos National Laboratory (1950s).


This contains some discussion of the MANIAC machine of the early 1950s.


This publishes an interview with N. Metropolis about the MANIAC and on the evolution of the stored program concept of the 1940s.


This is written by an early user/developer of the MANIAC at Los Alamos, 1948-1960, and includes comments on the ENIAC and is illustrated.


This paper analyzes the extent to which the developers of early digital computers and relay calculators were aware of Babbage's work, discusses the development of the stored program concept, and offers an early history of the MANIAC.

**Memory Technologies**

This is a technical description of the memory on an IBM 7070 (7301) processor and for the STRETCH project (7302 memory), later also used on the 7080 and 7090 in 1958.


This reviews work done on bubble memories at Bell Laboratories in the late 1960s.


This surveys the use of such technologies on a processor at International Computers and Tabulators, Ltd. in 1958, making this one of the first applications of such memory.


The author, working at IBM, describes his creation, a load-sharing matrix used to reduce pulse-shape distortion in early memory technologies.


Forrester describes the development of magnetic core for RAM at MIT in 1950, the first such memory.


This describes memory on National Bureau of Standards computers of the early 1950s and is a technical discussion.


This technical piece discusses 4096 by 36-bit memory used on the IBM 704 beginning in December, 1955.


Merwin describes memory on the IBM 705 in 1956, early core memory.

1808 Proebster, W.E. "The Design of High-Speed Thin Magnetic

Proebster describes an 18,432-bit memory developed at IBM's Zurich Laboratory in 1961-1962.


This surveys the first thin-film memory to be used. It was developed at MIT's Lincoln Laboratory and, very quickly, became a standard type of memory for computers of the 1960s.


At RCA work was done leading to a two-dimensional matrix of transformers reducing the need for vacuum tubes in early memory units (1952-1953).


This article offers a summary of early work done at RCA by the author on early computer memories and, more specifically, on magnetic core for RAM in the early 1950s.


This ultimately 2048-bit chip technology from IBM became available for use in 1971 although it was developed in the late 1960s; that effort is described here.


This technical article describes IBM's memory for the HARVEST super computer of the early 1960s.


This important American scientist summarizes existing technology and methods for storing data in computers as of the early to mid-1950s.


Shaw and his research associates at IBM developed a core plane using hollow steel needles described here.
The authors detail how to program the NORC and their experience with automatic code.

"NORC! What Goes Into An Automatic Product?" Automatic


NORC: What Goes Into An Automatic Product?" Automatic


1970s, used on the IBM 7090 machine. As one of the first large-scale programmable computers, the NORC was a significant development in computer memory cell technology.


This technical discussion is a good reflection of how to use the Ferranti Pegasus computer.

The Ferranti Pegasus was a successful British machine of the late 1950s. This is a technical description of the computer. It was also called the PEGASUS.

This is as much a history of the PEGASUS as of the British company that made it in the 1950s and early 1960s.

RAYDAC

RAYDAC is described in detail by one of its developers.

The authors built computers for the Raytheon Manufacturing Corporation. The describe the RAYDAC, built for the U.S. Government and delivered in 1951.

This is a formal, technical description of Raytheon's first computer, built in the late 1940s and early 1950s, at Waltham, Massachusetts.

This positive analysis appeared two years after the machine went into operation.
This article was one of a series of contemporary pieces to appear on various aspects of the RAYDAC and describes some innovative work done on peripherals.


This is part of a series published on the computer and its features. Memory was of great concern to all developers in the early 1950s; the issues are described here.


They describe RAYDAC's design and functions.

Research and Development


This brief overview of the evolution of the transistor reflects the international interest in the topic for over three decades.


This is an anthology of 38 historically significant papers from the 1950s to the 1980s, and includes articles by Warren McCulloch, John von Neumann, down to others by David Rumelhart and Terrence Sejnowski. They deal with such themes as network structure, connectivist model, and network operation.


Berkeley was an early commentator on American computers. This was one of his earliest of many articles on the same theme.


Seventeen chapters cover the theory of computers, concepts, language and research on the subject, written by two leading British computer scientists of the period.

Brown, a professor at MIT, and Campbell, also of MIT, described research done on feedback mechanisms in the 1940s.


This is a reprint of lectures given in July/August, 1946 at the University of Pennsylvania. It reflects the state-of-the-art of the times. The lectures were heard by many engineers who later went on to build the major digital systems of the 1940s and 1950s.


This volume anthologizes papers on all major computer projects of the period 1959-1961. All are very technical and represent late second generation work.


He discusses how this particular unit works and also comments on the general state of R&D on the subject.


This set was an early, detailed collection of descriptions on all manner of computational equipment and technology, circa late 1950s. Updates to this set appeared into the 1960s.


This covers an important aspect of early computer systems research.

Dijkstra, E.W. "Invariance and Non-Determinancy," in

This is partially historical when discussing the proof of correctness for concurrent systems.


At the time of publication, Eckert was a leading authority on the use of punch card equipment for scientific applications. Here he describes recent uses of electronics in new calculators, primarily from IBM.


This is useful for an understanding of the scientific problems facing computer scientists of the 1940s and 1950s.


At 1093 pages, this was the largest of the early reference works on DP technology and uses, of the 1950s. It is a gold mine of details on all aspects of the subject.


Pages 215-233 is a history of the evolution of logic devices.


Alan Turing's ideas on computing significantly influenced the design of computers in the 1940s and 1950s with ideas originally developed in the late 1930s.


Lolli reviews briefly the history and philosophy of formalizations in logic; contains a chapter on the use of computers and formalization.


The author discusses a family of computing technology
supported by the U.S. Army in the 1950s and involving projects managed by IBM, Philco, Sylvania and Autonetics.


Although a technical piece, it is informative for the period of the 1940s about Wiener's views concerning mathematics and computing. It has various comments on his ideas.


He argues that computers should be electrical digital in design instead of mechanical differential analyzers and then offers suggestions on what the new type should look like.


They review work done at Westinghouse using an analog machine.


He describes how punch card devices were used for the synthesis and analysis of harmonic functions among other applications.


The author worked with Turing during World War II at Bletchley Park. This is a technical discussion of Turing's contributions and serves as a good introduction to the scientist.


Misa analyzes the role played by the U.S. Army Signal Corps in advancing the study of solid-state electronics.

The author's 42-page booklet reviews his work and that of others in mathematics with the Mark I at Harvard. It includes illustrated material on the use of DP with the Mark II and III, NORC, Stretch, CDC 6600 and the CDC Cybe 74, all between 1942 and 1972.


Much of the discussion is on how it differed between the SSEC and the ENIAC and is a technical discourse.


He surveys his most important computer-related project of his career, work on the Selectron. Due to manufacturing difficulties it was hardly used as a computer memory, a casualty of early computing.

1860 "Revolution in Robotland; Symposium on Calculating Machinery," *Newsweek* 34 (September 26, 1949): 58.

This describes a gathering of engineers interested in computing in the United States. Such meetings began receiving wide attention by the end of the 1940s.


Although a technical treatise, it is a good snapshot of second generation technology of the mid-1950s.


The article describes how the stored program computer evolved after ENIAC and includes a short description of that processor. The author attributes the idea of converter code to John von Neumann.


This short book takes the story of OCR from 1808 to the 1980s and is the only history published to date on the subject.

1864 Smith, C.E. and Gove, E.L. "An Electromechanical
Hardware, 1939-1960s


They describe a special purpose analog calculating device built in the early 1940s.


This is a detailed description of components used in computers and is a very hardware oriented book, circa second generation equipment.


He describes the concept of the bit and then its history.


This technical paper reflected a common area of research on input/output technologies, work which surface in such systems as Whirlwind and SAGE.


The focus is on technology of the 1940s with comments on the Colossus.


He is attributed as the developer of this notion. This publication reprints two articles by him published in 1951-52, along with a retrospective added for the Annals reprint.

Robots, Pre-1960


This was a very early article on the subject of a robotic device for commercial use.


This is one of the most famous books published on robots and in which he defines the "rights" and "duties" of robots. It helped publicize the term robotics.

This speculative piece discusses the use of robotic devices; it is a snapshot of thinking on the subject during the 1940s, particularly about their potential.


By the early 1950s many were commenting on the subject of automation, of which robotics was a major part, and the implications for society and the economy.


This is a piece of science fiction using a robot as a theme, written by an important sci-fi writer of the 1930s and 1940s.


This reflects typical thinking of the 1930s on the subject of robots, highly unrealistic and overly optimistic on capabilities versus technical realities of the time.


During the 1950s much work was done on basic research of robotics; this book reflects that effort.


By the late 1950s cybernetic and computing work was merging with electrical engineering; this work reflects significant research on robotics.


This was a Czech play that first introduced the word robot to English-reading audiences. The play was a great success in 1921 in London. It has been reprinted many times since then.


This expert on automata also surveys perceptions about robots.

This is a classic history of automata from ancient times to the early 1900s and is an excellent description of how they worked.


This is a more technical piece than his previously cited works above and covers more modern developments.


This is an early piece by Chapuis on automata and robots.


This describes well-known French automatons and automata of the eighteenth century.


This is a major work on all manner of automata from ancient times to the early 1900s; illustrated. It covers clocks, automata, mechanical toys, musical instruments and other devices.


This is a very detailed history of the subject and was the foundation for much of Chapuis' future work on the history of the topic.


This is a short history of automata; illustrated.


This describes an early automata device.

Kempelen's device of the nineteenth century was widely seen in both Europe and in North America.

1889 The Famous Chess-Player. London: H. Reynall, 1783 (?).
This is a description of von Kempelen's automaton.

Frankenstein was the most widely known fictional automata in history; this is a history of the subject.

This conference focuses on contemporary work in the field of automata and robotics.

This anthology of articles has pieces on robots in literature and legend, history, and other essays on their functions and role in movies.

The German philosopher conceived of a thinking automata called Homunculus, described here.

This is a good window into the technology of feedback systems/robots of the 1940s and 1950s.

This is a useful survey of the topic of literature's most famous robotic creature.

He describes a teoperator for handling radioactive materials—an early practical robot.

This is an early review of practical applications of automata and survey of the general subject of robots.

This is a description and philosophic look, at all kinds of automation of the 1920s.


This is a brief survey of old automata.


This surveys eighteenth century automata.


This surveys old automata from Europe.


This describes an automata device.


This is a non-technical discussion of robotics over time, mainly in fiction.


This is a serious review of robotic devices in American industry as of the late 1940s. Some were quasi-programmable.


This is a description of a set of automata with additional comments on pre-twentieth century robotic devices in general.


The focus is on the use of computers and robotic devices in American industry.

This is a general overview of automata over many centuries, with bibliography.


This is a history of early automata, mainly European.


This is a nineteenth century critic of spiritualism attacking robotic devices. Cooke also was a lesser known critic.

1911 Papp, Desiderius. Der Maschinenmensch. Wien: Stein, 1925.

This describes robotic devices and uses.


He covers post-World War II developments.


Pease discusses robotic devices and their potential use in defense.


In addition to reviewing the history and function of Jaquet-Droz automata, this discusses other devices of the 1700s.


This is a technical treatise on automata/robotic devices and uses.


This describes the device made by von Kempelen.


This is a monograph on the Golem automata and its role in literature, mainly Jewish legends in German.
New York: Oxford University Press, 1940.

This goes from images of mean robotic creatures, such as Frankenstein, to the potentials offered by modern technology of the 1930s as portrayed in literature.

1919  Sabliere, Jean (ed).  *De L'Automate a L'Automatisation,*  

This is an anthology of papers dealing with ancient and early modern period European automata.

1920  *Il Segreto del famoso automa che giucava a scacchi.*  
Florence: C. Benelli, 1841.

This describes well-known automata and how they worked.

1921  Shannon, Claude E.  *Programming a Computer for Playing Chess.*  

One of the important pioneers in artificial intelligence wrote of his early work on chess playing designs and how digital computers could be used to do the job often relegated to earlier automata.


While claimed by artificial intelligence experts as the origins of their field, these papers also concerned automata and robotic themes in general.

1923  Shelley, Mary W.  *Frankenstein.* (1818).

This is the famous horror story which has appeared in numerous editions. The most recent useful edition is *Frankenstein, or The Modern Prometheus,* ed. by M. K. Joseph (London: Oxford University Press, 1971).

1924  Silberer, Herbert.  "Der Homunculus,"  
*Imago* 3 (1914): 37-79.

This is a lengthy offering on the history of Homunculus, an early automa.


This is on the use of robotic devices in the U.S. and is a non-technical piece.

1926  Steiner, Hugo.  "Der Golem. Prager Phantasien,"  
This is on Golem, an automata in Jewish East European mythology.


The tradition of automata in German literature and mythology is great. This is an example.


This surveys Hommunkulus automata.

1929 Willis, Robert. *An Attempt to Analyze the Automation Chess Player of Mr. de Kempelen.* London: J. Booth, 1821.

This device circulated around Europe and North America at various fairs for decades.


The machine was suspected for years to be a hoax. This is an early expose on the subject.

Robots, Post-1960


A leading writer on science and science fiction, discusses the subject of robots in all its aspects.


The editors work at Bell Labs. Their book is a survey of current research on robotics but also includes material on the history of robotics in the 20th century. Research projects were all from the 1970s and 1980s.


Biological themes have been part of robotics since the 1950s.


Chess playing has been a recurring theme in automata and artificial intelligence for decades. This is useful for the period of the 1960s and 1970s but also for background in earlier years.

This short book has some historical material, but especially for the post 1950 period. It also covers the work of Joseph Engelberger, head of Unimation, and considered nationally as the father of the modern industrial robot.


The author received the first U.S. patent for a computer-controlled robot (1961). Work on that project is reflected in his dissertation.


Part of the discussion is about the modern use of robotics in industry.


By the 1960s robots were being developed using much the same methods and technologies found in computers. This is an example of that process typical of the period.


This is an early, technical piece on the modern automated machine. Many of the ideas expressed here influenced robotic developments in the 1960s.


Like the previous title, this one example of work done in which computing technology and robotics came together, borrowing from each other.


This is an outstanding review of developments in robotics, especially during the 1980s; includes a detailed bibliography.


This is a technical treatise on components and design of robotic functions.

This is a technical introduction, circa 1960s, to subjects that applied to both computers and robotics.


This publishes material developed earlier of a highly theoretical nature by two very important pioneers in the development of the modern computer and its technologies.


This is a detailed review of all aspects of the subject as known in the early 1980s. Its 77 chapters by 100 authors describe robots, their use, and offer case studies. It is an important piece for historians of robots.


Many of the images are robotic and intelligent.


This is a narrative survey of robots, their history, nature and use.


The author is a prolific writer on the mathematics of robotics. This was an early important work of his on the subject.


This was a widely distributed book for over twenty years and, at publication, was very realistic, providing a balanced account of the real possibilities and limits of contemporary robotics.

SAGE


This is a formal, well organized account on the SAGE.

This is an important, illustrated account of SAGE that also offers insight on how early computer systems were designed and built.


This was drafted originally in 1956 and is a description of programming the SAGE system.


This describes the SAGE system as understood in 1957. The authors all worked on the development of SAGE.


This is an illustrated account of the role of TP in SAGE and includes descriptions of the PST-1 and PST-2 radar data compression system.


It discusses guided missiles, weapons and air defense applications of the 1950s.


This is a brief, illustrated history of SAGE by one who helped to develop it.


Discussion was by builders of the SAGE system, held on October 26, 1982.


In this memoir the author discusses his role in the creation of the SAGE at MIT, a very personable account.

274 Bibliographic Guide


This is an illustrated description of the prototype for SAGE, 1951-53.

SEAC


This contains a description of work done at the Atomic Energy Commission (AEC) using computers, from the early 1950s to the 1960s, with passing comments on the SEAC.


The authors describe the computer built by the U.S. National Bureau of Standards between 1948 and 1950. This includes a technical description of the system.


Essentially covers the same material as the previous publication.


This describes the NBS computer, built in the late 1940s, and includes a description of its features.


This describes some work done on the SEAC late in its life.


This covers the same material as the previous citation and comes after publicity by NBS on the SEAC.


This is a highly technical analysis of the SEAC but useful in determining the quality of performance of early digital systems.

1967 Slutz, Ralph J. et al. "High-Speed Memory Development

He describes the memory that was put on the SEAC, SWAC and DYSEAC computers in the late 1940s and very early 1950s.


These are memoir comments by one of the developers but they are of limited value for the historian.


This volume discusses the technical features of computers installed with the help of NBS and include the SEAC, SWAC and DYSEAC. It was written by the builders of these machines.


This article shows that the use of diodes and resistors as logic elements, coupled with an effective maintenance program, made this a very reliable computer when compared to earlier machines.

Semiconductors and Chips


This technical paper described the first monolithic integrated circuit to come from IBM, circa mid-1960s.


This is a photographic history, beginning with point contact transistors from Bell Labs (1947 forward) to gallium arsenide chips and Josephson junctions.


These three Nobel laureates discuss how they developed the transistor and worked on other semiconductors.

1974 Bell, C.G. and Newell, A. Computer Structures: Readings

Although intended for students of computer science, it is an excellent reflection of existing technologies of the late 1960s. Issues are discussed by two very important computer scientists.


The technology discussed in this article appeared in IBM's computers in the late 1960s.


They argued that chip densities for large computers, would have over 1 million circuits by the year 2000.


This technical piece is based on research done at IBM on semiconductor technology in the mid-1960s.


This describes direct-coupled transistor logic circuits, the first to use switching properties of transistors instead of vacuum tubes in the 1950s.


This is a description of a tool to help speed up the design of bipolar transistors in switching circuits for computer chips.


This has a chapter on the work of John Noyce and Gordon Moore in their development of semiconductor chips.


They describe SLT in semi-conductors of the early 1960s as developed at IBM.

Very little material has appeared on Dummer's work; the article is a useful overview.


In this third edition Dummer includes a discussion about transistors, chips and computers in an historical context.


This article describes the monolithic systems technology (MST) that so improved the price/performance of S/370 computers of the 1970s.


This is a collection of 41 papers published between 1971 and 1983 on microprocessors. The earliest deals with the Intel 4004 (a computer on a chip) and continues through four generations of components.


This briefly describes the statistical design of diode-transistor circuits to reduce cost by better performance tolerances. The work was done in the late 1950s.


This is an early review of ICs, originally designed for the Stretch computer of the late 1950s and early 1960s at IBM.


This is an extra issue and was devoted entirely to the discussion of Josephson computer technology which, in the late 1970s, was once again seen as a new wave of semiconductor technology. By the late 1980s it was seen to be more of a 21st century opportunity.

1380-1409.
This is a history of semiconductors. The authors all did developmental work in the field, covering the 1950s through the 1970s.

This describes IBM's mechanized manufacturing of germanium disk sub-assemblies of the late 1950s and early 1960s.

This is not only a good snapshot of the technology of microprocessors of the early 1980s, but also is an important technical description of computers.

This good text reflects computer hardware technology of the late 1960s, particularly for mini-computers.

That problem appeared continuously in the 1960s and beyond at regular intervals. The process, and its effects, are first identified in this article.

This was the Bible on chips for many years. It also discusses the evolution of chip technology and production methods. It is a highly technical treatise, however.

This is on the history of the Intel processors during the decades of the 1960s and 1970s.

This is a popularized account of the development of the transistor and includes biographies of the key inventors.

1997 Nelson, R.R. "The Link Between Science and Invention: The Case of the Transistor," in *The Role and Direction of Inventive Activity—Economic and Social Factors*
The author describes how development problems were solved, making this technology practical to use.


The chairman of the board of Intel Corporation, and a major developer of the semiconductor IC, surveys the growth in capacity and cost changes since the 1950s.


This covers the period 1969-1970s and also discusses the origins of the company and its activities.


The author was part of Shockley's team in the 1950s and helped in the development of the chip. This is a useful survey from 1900 to the 1980s and offers a great deal of material on European developments not available in other publications.


This is a non-technical, popular history of the work of Jack Kilby and Robert Noyce.


This is a short memoir covering the period from the late 1950s.


This is a rare piece on European developments in the 1950s and 1960s.


This is a review of the nature of chips and includes an article by Robert Noyce.

2005 Sedore, S.R. "SCEPTRE: A Program for Automatic Network
The piece of software described here is of the mid-1960s and was used to shorten the development cycle for bipolar transistors in switching circuits. The use of software was a standard feature of semiconductor manufacturing throughout the 1960s and after.


This was the first book to appear on chip technology and was written by one of the inventors/developers of this technology. It is a seminal work in data processing.


This reports on the status of ICs as of 1964 with recent developments in a new generation in this technology.


Although a technical publication, it offers an excellent survey of semiconductors and solid-state physics of the 1970s. Thus it is useful for seeing the progression of significant developments that began in the early 1960s with new generations, for example, of ICs.


This includes a discussion of the invention of the transistor of the late 1940s and about its use in the 1950s.


The author expressed the opinion that by the year 2000 circuits per chips could exceed one million. It is a useful article for measuring expectations in the 1970s for this technology.


ASTAP was the best software tool available in the early to mid-1970s for use in designing bipolar transistors. It defined the characteristics of these components. The original notion of having such software tools first came up in the 1960s.

The author describes circuit improvements in computers of the late 1950s, all pre-ASLT, however.

Storage Equipment


This paper describes the logic technology of IBM's Stretch computer of the late 1950s, using new technology for circuit components and cards. Comments on storage are included.


This describes the technology of very early memories and, hence, storage for digital computers of the 1940s.


The size of memory and quantity of storage were always considerations in early machines. This article describes a leading-edge technological development of the late 1950s.


A great deal of controversy existed in the early to mid-1950s about whether it was better for data to be on tape or on some other magnetic or paper medium. This concludes that it was better and cheaper to keep data on tape as opposed to punch cards.


Forrester, father of Whirlwind and already at MIT, reports on early work done with the new computer's memory.

Considerable amounts of research was being done in the late 1940s on computer memories. This article reports on some of that work during a period when basic technological options were just beginning to be explored.


Henle reviews briefly transistorized storage being developed at IBM for Stretch in the mid-1950s.


It is a useful survey of the situation as of the early 1950s.


He reviews various off-line data storage devices and their associated technologies, circa 1947-48.


This is a first description of the IBM 305 RAMAC system. It is a detailed description of the first movable head disk drives commercially available. The introduction of the IBM 305 and 650 was a major technological event in the DP industry.


This line of research became important during the 1950s. This was an early paper on the subject.


Very little has been written on the history of computer products' manufacturing. This surveys the subject of IBM equipment, beginning with the 350 (1957) and goes to the 3370 of the early 1980s.

This is a formal description of the IBM 350 disk file, the first production model of a movable-head disk drive.


The author describes the first generalized indexing systems available for disk technology that made it possible to use disk drives as random access memory in the 1950s.


Today the author is recognized as one of the pioneers in developing computer memory technology while at RCA. This surveys his early work in the field.


Sharpless was one of the senior engineers on the ENIAC project at the Moore School of Electrical Engineering. She and others continued R&D there into the late 1940s, some of which is reviewed in this article.


The author was an engineer on the EDVAC in the 1940s and thus was on the leading edge of much computer development when he wrote the article. The material reviews work done on the EDVAC.


Walsh briefly discusses transistors made at IBM for use in Stretch and which would be used in IBM's computers of the late 1950s (7090 and 7094).


They describe the early use of metal tape for digital magnetic recording.

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The Williams Tube was a widely used form of memory in the period of the late 1940s and early 1950s. This historically important article describes the device.


The author describes the effort it took within IBM to get direct access products designed, built, and introduced in the late 1950s.


The switch was made originally for the IBM Stretch computer but was later also used in the IBM 7090 and 7094 processors.

Christopher Strachey


This 200-page book describes his extensive collection of papers housed at the Bodleian Library.


This is on the work of the British computer scientist with programming languages.


This is an illustrated biography of the man who worked on logic designs for computers and programming languages in the period 1950s-1970s, and especially on denotational semantics.


The Elliott 400 was a British computer of the 1950s and early 1960s with which Strachey was associated.

2039 Scott, D.S. "An Appreciation of Christopher Strachey and His Work," in J.E. Stoy (ed), Denotational Semantics: The Scott-Strachey Approach to Programming
Although often remembered for his work in programming languages, Strachey was active in other aspects of computer science, including the logic design of computer hardware in Great Britain.


He was already a highly regarded computer scientist before he wrote this article in which we see a good expression of his views.


This was published after Strachey's death, yet is a good summation of his work.


Two important British scientists, both with programming and hardware achievements to their credit, comment on a European-based programming language.

The article is useful in understanding the work of the NBS after World War II when it began to acquire and build computers, like SWAC and SEAC.

Huskey surveys the pre-1949 role of NBS, adds material on its work with UCLA on SWAC (1948-49). He was involved and offers an illustrated history based on primary material and includes bibliography.

This is a shorter version of the previous citation but with greater focus on the actual machine.


He covers work done in the period 1948-1954 with an illustrated account. It is particularly useful for a technical description of the system.


Unlike his other publications, this was contemporaneous with the project between NBS and UCLA.


The author describes the agency established by the NBS and was the brain child of John H. Curtiss. It was an early and important user of computers and advised various U.S. Government agencies on the topic.


This is a brief announcement of and description of SWAC.


Refers to the SWAC project with UCLA.


This is a technical piece that suggests what the levels of reliability and ease of use were for SWAC and, for that matter, of other machines of the early 1950s.

UNIVAC


This is a technical description of the first two Univac computers. They were the machines that received so much public attention in the early 1950s in the U.S.A.

Eckert and Mauchly were the creators of the modern electronic digital computer and the Univac in particular. They wrote this piece while designing the UNIVAC I.


This is an early description of the features of the Univac then under construction and about the BINAC too.


This was written at the end of the life of the early Univac machines as they were being retired.


He shares the experience had by the U.S. Bureau of the Census in managing the UNIVAC I installation from 1951 to 1956.


Originally published in 1952, this article reflects her thinking about computer design while she was involved with developing software for the UNIVAC series in the early 1950s.


Kopp reviews the creation of and experience with a maintenance staff responsible for a UNIVAC I. It is very useful for understanding how reliable this machine was.


His memoirs go from before ENIAC through Sperry Univac. It contains material on his student days at the Moore School and about EDVAC, BINAC, UNIVAC I and LARC.

This describes the UNIVAC I and tells its history very briefly.


This is a technical paper by an end user of the machine and written early in its history. The authors worked with the BINAC.

University of Manchester Mark Series


It includes photographs of the Manchester computer with some brief comments on the Mark I.


The Atlas was the third computer built at the University of Manchester (1960s).


This is an illustrated account covering the period 1946 to 1954 and is a very complete paper on the topic.


The author describes computers built by Ferranti and this university's electrical engineering department between 1945 and 1962. He includes a background chapter on British computing during World War II.


This is primarily on British computer developments and particularly, at Manchester and at Cambridge. It also comments on World War II and Colossus.


It describes work done just after World War II.

This was one of the first articles to appear in Great Britain on a British digital computer.


They discuss work done at Manchester on two transistor computers (1953-55).


This is an obituary/biography of a scientist involved in early computing at the University of Manchester in the 1940s and 1950s.


This is an illustrated account covering the period 1949-1959 and adds much to our understand of the roles played by Tom Kilburn and Frederick C. Williams with the Mark I.


This short book is an essential source on the subject covering the period 1930-1955 with discussions about Colossus, EDSAC, Pilot ACE, Mark I, Leo and other machines.


This is an illustrated history for the period 1945-1955 and covers the same material as his other publications.


He argues that such a period existed in British computing between 1945 and 1951.


This 44-page booklet summarizes the five computer projects at Manchester between 1946 and 1975. It
relies heavily on primary material and focuses on the roles played by Williams, Kilburn, M.H.A. Newman, A. Turing and others and is well illustrated.


He discusses the historical significance of these machines for British computing (1940s-1950s).


The author focuses on the University of Manchester digital computer of the late 1940s and work done in the early 1950s.


Robinson was an early user of British digital machines and thus his comments are useful for appreciating their effectiveness, particularly for the period of the late 1940s and early 1950s.


The author was a major force behind the development of much early technology, including the Williams Tube and MADAM machine. These are his memoirs of the late 1940s and early 1950s.


They describe the machine at the Royal Society Computing Machine Laboratory.


They discuss MADAM and its features. The paper was also published in Review of Electronic Digital Computers (February 1952): 57-61.

Aspray, at the time of this writing, was involved in researching the life and work of von Neumann for a full-length biography. Work on the IAS machine was a critical phase and the article an important overview of the subject.


The entire issue was devoted to von Neumann and was published as a result of his death.


This is a detailed obituary of von Neumann.


This is an obituary/biography and an analysis of his work.


This is one of the best known documents to be published on computers. It details the architecture of a computer, as essentially adopted by the computer industry at large for the next forty years. It was the basis for the design of a parallel binary device called the IAS Computer.


This is a biography and analysis of his work by two very enthusiastic admirers.


This is an excellent source on von Neumann's views on computer design as of 1946, particularly on the concept of the stored program.

In addition to being an important participant in the development of the modern computer, von Neumann was a very important mathematician of this century. This is a useful biography on him.


The author focuses on the issues of confronting responsibility by scientists and thus is not a biography. He is concerned with the arms race and atomic bombs. There is almost nothing here on computers; however, some biographical data is included.


He reviews the heated argument over who developed the concept of the stored program while analyzing the book.


This is a review of a sort program von Neumann wrote in 1945 for use in what eventually became the EDVAC. The article comments on both ENIAC and EDVAC as well.


Stern documents his role with ENIAC and EDVAC.


This is the most complete collection of his papers to be published and they include considerable amounts of material on computers, particularly volume 5.


This discusses mathematical work done by von Neumann using a calculating machine.


This is a short, illustrated biography.

This is a detailed biography and technical discourse on his work in mathematics, logic and computers on the occasion of his death. The paper was also reprinted in *Annals of the History of Computing*, 4, No. 2 (April 1982): 157-181.


It is also a dialogue on the ideas in the book. Both the book and the review were published shortly after von Neumann's death.


These were edited by A.H. Taub and represent a major source on von Neumann.


These were a series of lectures delivered late in his life in which he compares and contrasts computers to brains.


The IBM NORC calculator of the 1950s is the subject of this paper, originally written in 1954.


This very large book constitutes the best collection of von Neumann's papers on computing and includes a biography.


This is a seminal paper on computer architecture, originally dated May 15, 1946. This publication includes a forward by Nancy Stern (pp. 263-64). The *Annals* republished the paper in 10, No. 4 (1989): 243-256.


This has material on the logic of a computer.

This is one of the first modern papers to be published on numerical analysis and thus contributed to the solution of large groups of linear algebraic problems at the dawn of the age of computers.

2106 Von Neumann, Nicholas A. John von Neumann—As Seen By His Brother. Meadowbrook, Penn.: Privately printed, undated (late 1980s?).

He reviews von Neumann's childhood and young adulthood as background to his work and views. The author announced his intent to expand this publication at some future date.

WHIRLWIND


This is a short history of the MIT project of the 1940s and early 1950s.


Although brief, it was one of the first published accounts of this military project at MIT.


This interview with the creator of Whirlwind was held in 1972; illustrated.


This paper is on coding (programming) at an early stage of Whirlwind's design.


This covers the period 1945-1952 and is written by a participant in the MIT project; illustrated.


The memory developed for Whirlwind was the subject of
much interest in computer science circles. In this paper Forrester described memory that represented a significant improvement over older ones in reliability.


This discussed the very large expense of the Whirlwind project and adds details about its long history.


This is the most complete history of the Whirlwind project available. It is based on primary research and is illustrated.


The project was massive, involved hundreds of people and was very expensive. This is an overview of the project.

World War II: British Role


This is on the British use of deciphering methods to understand German coded messages. It discusses computers and Bletchley Park.


This describes how the British deciphered German coded messages during World War II.


This tells the story of Enigma and deciphering of German code.


This is a massive study of espionage operations by the Allies during World War II. This includes comments on A. Turing and British computers.

Bundy was an American working at Bletchley Park during the war. He offers little not available in other publications.

This discusses work done at Bletchley Park to translate German coded messages for the Allies. The author mentions the use of "prototype computers" to help in the process, offering new details not available before.

The answer involves the use of British computers and work done by Alan Turing.

These are excerpted papers of the author at Churchill College, Cambridge University, describing World War II experiences at the British Government Code and Cypher School. It was originally drafted in the 1950s.

They describe a relay computer derived from the designs of Shire and Runcorn; illustrated.

He reviews French cryptoanalysts' method for discovering ways to use Enigma, a tool of the Allies.

This has three sections: historical, mechanical and mathematical. It contains six articles on World War II.

This is an illustrated account of how the Enigma cipher machine worked. Others are described which were also used during World War II.

2128 Erskine, Ralph. "From the Archives: GC and CS Mobilizes 'Men of the Professor Type'," Cryptologia 10, No. 1 (January 1986): 50-59.
This contains three letters, written in 1939, by Alastair Denniston, of the British Government's Code and Cypher School, containing a list and short biographies of new hires for Bletchley Park. They went on to develop early computers in Britain.


This is a history of cryptography, primarily about how the Allies broke German codes. The author was involved in the process during this war.


This is the English edition of the book cited before.


This has material on work done at Bletchley Park.


He recalls work done during World War II and contains many thumbnail sketches of people involved.


This reprints 23 of his papers and his introduction adds much biographical data. Good was a cryptoanalyst at Bletchley Park during World War II. He later worked with Turing.


This is an excellent article on British work during World War II, particularly on decoding and computer developments.


It contains remarks about World War II developments (1943) and about Turing's involvement.

Much British intelligence work, involving the early use of computers, was under the control of the Post Office.


This is a major study on the subject. It is based on British archives and has much material on Bletchley Park, some on British computers, and considerable amounts of discussion concerning code breaking. For a detailed review of volume 2 (which has material on Enigma), see Annals of the History of Computing 7, No. 2 (April 1985): 187-189.

2138 "Intelligence Services During the Second World War," special issue of Journal of Contemporary History (April 1987).

It contains some discussion of activities at Bletchley Park.


This reviews British intelligence work at Bletchley Park.

2140 Jones, R.V. "The Secret War (Letter to the Editor)," New Scientist 73 (February 24, 1977): 480.

The author worked with Turing in 1939 on a code deciphering device.


This is a full treatment of the subject of British intelligence work at Bletchley Park during World War II.


The author, an expert on cryptoanalysis, offers a history of work done at Bletchley Park.


He discusses Ultra in World War II but also current issues involving cryptoanalysis.


This reviews a German conference held in November,
1978, on British and German cryptologists of World War II.


He reviews Wintherbotham's book (cited below) and criticizes his description of how Enigma was broken. Kahn also mentions that Colossus was built to solve machine ciphers.


He argues that the Allies did a better job on code breaking, using computers in the process.


Although intended to be a study of the role played by the Poles, it contains material on the British.


This is his view of how the Allies broke the German code in World War II.


He discusses British computers and intelligence activities during the war.


The code was used in 1944.


Its focus is on British intelligence during the war and on Bletchley Park. It is well done.


This describes German cipher devices and Bletchley
Park's code breaking efforts. This is well illustrated.


This describes the Heath Robinson and Colossus machines and the use of photo-electric paper tape readers for these computers.


This is an early account of Bletchley Park's activities.


This is a humorous review of Turing's work at Bletchley Park.


This is a brief review of Michie's World War II work at Bletchley Park, with comments on Turing.


This is a short account about minor digital and analog calculators in Britain during World War II and includes those for TRE for cryptoanalysis.


This is a short account of Bletchley Park and Enigma (sometimes called ENIGMA).


The author provides a first-hand account of how the Allies broke the Germany navy's hand ciphers during World War II.


Bletchley Park's machines are described; in particular Colossus.

This is on British intelligence with material on the work done at Bletchley Park.


The article is a summary of a paper, from July, 1944, on a range finder performance computer under development.


These memoirs are an important addition to the literature on British intelligence. He discusses Turing, Bletchley Park, computation processes, and describes many of the people involved.


Whiting describes Anglo-American intelligence and includes a short chapter on Enigma. He claims the British post office had a computer at Bletchley Park by February, 1940.


This is another narrative history of how the British broke German codes and ciphers in World War II. He too implies the British had a computer doing the job by 1940 at Bletchley Park.


The book is useful for understanding the use of Ultra intelligence data by the Allies at sea during World War II.


The article specifically deals with Colossus about which little is known. This piece adds little that is new but does explain how it was applied against the German Geheimschreiber codes during the war.

World War II: German Role


Atha describes how he maintained key-finding aids
for the German Enigma cipher machines in the possession of the U.S. Navy. He details the mechanics of the German device.


They describe briefly a tape controlled calculator destroyed by Allied bombs while being built in Darmstadt. Randell's reprint is in English.


Jensen describes various devices, all using photoelectric tape readers and electromagnetic relays for cryptographic activities in Germany during World War II.


He reprints an Allied interrogation report of April 1945 which describes various cryptographic devices used by the Germans. The article includes one photograph of a device.


It contains a short passage explaining the operation of the Geheimschreiber.


Pages 247-49 discuss German cryptoanalysis and devices used during World War II.


He uses an unpublished manuscript on Enigma and other devices.

2175 Rohrbach, Hans. "Report on the Decipherment of the American Strip Cipher 0-2 by the German Foreign
The author and his group were captured by the U.S. Army in April, 1945. The report is based on their interrogation of their efforts to decipher Allied codes during the war.


The author worked with electrical valves and applied them in switching circuits.


They describe Zuse's work on calculators but also projects at the Institute for Practical Mathematics at Darmstadt during World War II.


It contains a very short discourse on computers: Zuse's and Dreyer's.


The author reviews the Siemens and Halske T52 teleprinter online cipher machine and the Lorenz SZ40 and 42 cipher attachments used during World War II, particularly by the British at Bletchley Park.

World War II: Polish Role


This contains several articles that offer new material on Polish code breaking, about Enigma, and British intelligence during World War II.


This is a good review of the Enigma cipher machine.
used to break German codes during the war. Useful
details are provided on Polish devices that, by 1939,
could be characterized as "somewhat primitive, special
purpose, electromechanical, not electronic computer."

2182 Deavours, C.A. "The Black Chamber," Cryptologia 4,
No. 3 (July 1980): 129-132.

He surveys Polish devices from 1928 to 1940 and how
they worked.

2183 Dickson, D.A. "Enigma—The Ultra Secret," Journal of
the Royal Signals Institute 13, No. 4 (April 1978):
22-23.

This is on Polish efforts regarding Enigma when a
captured Enigma devise was given to the Royal
Signals Museum.

2184 Kasparek, Christopher and Woytak, Richard. "In Memo-
riam: Marian Rejewski," Cryptologia 6, No. 1 (Janua-

Rejewski worked with Enigma machines in the 1930s
and 1940s and it was he who was the first to break
German codes that made it possible for the Allies
to read confidential Axis messages throughout World
War II.

2185 Kozaczuk, Wladyslaw. Bitwa o Tajemnice. Warsaw:
Książka i Wiedza, 1967.

This is a history of Polish code breaking with
Enigma during World War II.

2186 Kozaczuk, Władysław. "Enigma Wie Der Code Faschisten

Reviews efforts by Polish cryptoanalysts in France
and in Poland to crack Enigma, the German system
for encoding secret messages.

2187 Kozaczuk, Władysław. W Kręgu Enigmy. Warsaw:
Książka i Wiedza, 1979.

This is an expanded edition of his 1967 book on
Polish code breaking and Enigma.

2188 Kozaczuk, Władysław. Wojna w Eterze. Warsaw: Wydawnic-

Yet another study on Enigma by Poland's leading
expert on World War II intelligence activities.

2189 Kozaczuk, Władysław. ŻYmamy Szyfer. Warsaw: Wydannic-
two MON, 1976.

This adds more material on Enigma and Polish efforts
during World War II.
This is a history of Polish code breaking and Enigma.

The author was the individual who actually broke the Enigma code for the Allies and, in this article, explains how.

These are the memoirs of the author's role and that of the Polish Cipher Bureau, 1932-39, working on Enigma military codes and machines. It is an illustrated and technical paper.

This covers similar material to the previous citation but with greater emphasis on the technical features of his early work on Enigma.

He critiques to clarify the Polish role in the Enigma story. See citation 2137 for Hinsley's publication.

This is a review of the use of computer-like devices in code breaking during World War II.

This is a narrative history of how the Poles broke German Enigma codes and learned to use the machine.

This surveys the joint Polish-British effort to break Enigma codes.

A Conversation with Marian

The discussion is on the role he played in breaking the Enigma code and that of other Poles during the 1930s and early 1940s.

World War II: U.S. Role


He explains the design for a calculating device for operating and controlling antiaircraft gun fire. MIT did a great deal of work on such feedback systems during the war that required computer-like devices.


This is a programming description of a device that was built originally during World War II for the Aberdeen Proving Ground and installed in December, 1944.


Farago surveys the work of the U.S. Navy’s cryptoanalysis organization in the 1930s and early 1940s relative to the Japanese and ultimately, to Pearl Harbor.


These are humorous memoirs that mention how punched card devices were used to help develop the atomic bomb.


The author provides considerable details on British and American cryptoanalysis during World War II.


The author describes a 1940 Bell Labs analog device, precursor of the M-9 gun director, which became the U.S. Army's main fire control mechanism for large antiaircraft guns in World War II.

They describe a special purpose machine for calculations in the use of Fourier Synthesis in crystallography.


Los Alamos National Laboratory worked on many war related problems, including the development of the atomic bomb, and were quick to rely on the use of advanced computational devices. Both authors worked there during World War II; many of their publications are cited in this article.


The war called forth the need to apply business applications of punch card equipment to manage war related controls.


The author announced that tentative designs had been completed. Similar work was also underway at MIT.


In addition to being a useful, 68-page account of R&D at RCA, it is also one of the earliest uses of the term "electronic computer".


Rees recruited mathematicians to work on war-related projects, which she describes, some of which were on computational projects such as von Neumann and the Moore School, ENIAC and so forth.


He offers a brief review of computer development activities during World War II.

This is the autobiography of an applied mathematician who worked on the atomic bomb at Los Alamos and with John von Neumann.

Zuse Computers


This is an illustrated account of Zuse's computers and software (Plankalkul) during the years of the 1930s-1950s.


Zuse developed this language for use on his computer and the article compares it to others.


This is a detailed, balanced account on Zuse and on his contributions; excellent introduction to the subject.


These publications cover the Z1, Z2, Z3 and includes memoir material by those who worked with him and illustrations.


This is a brief review of one of Zuse's later machines and on the man's overall contributions.

This surveys Zuse's programmable calculators and their uses from 1939 to 1945.


This 99-page book is a general collection of papers on German computing in the 1930s and 1940s.


This recounts how the Deutsches Museum in Munich rebuilt the Z3 computer; illustrated.


He surveys the Z4 computer which was then under construction.


Randell's version is in English. The paper does describe Zuse's work and potential applications.


This is a history of the Z4 machine of the late 1940s and early 1950s; illustrated.


Z4's performance capabilities are described.


This is a review of Zuse's efforts to develop program controlled computers in the 1930s and 1940s.


This is a short, illustrated biography of Zuse.

These are the memoirs of Germany's foremost computer scientist of the 1930s and 1940s. It includes many technical details about the various Z computers.


Zuse reviews his work on the Z3 and Z4 primarily.


This is an early report by Zuse on his machines and is especially useful in understanding his views on programming.


This is an important paper on Zuse's computer, particularly on the Z3, which was running in 1941, and the Z4, which was installed at the Zurich ETH in 1950. Randell has reproduced illustrations and diagrams in his English translation.


He concentrates on his work and on those of Schreyer and Dirks, fellow engineers who worked with him in the 1930s and 1940s.


There is in this article many personal memoirs. For another version of the installation of a Z computer see No. 2220 above.


Zuse wrote this originally in 1945 as an exposition.
on his idea for an algorithmic language. The 1976 publication includes material from 1972 by Zuse on his work of the 1930s and 1940s.


It is primarily a description of his computers.


He describes a number of Z computers.


This is an illustrated account covering mainly 1934 to 1948, and his Z computers, his role, and their features.


He describes an electromagnetic programmable calculator which used punched cards and floating point binary number representation. Randell's reprint is in English translation with diagrams.


This is a partial reprint and translation of his 1962 article. See No. 2230 above.
Hardware, 1960s-1980s

Computers developed since the early 1960s have been the least studied by scholars concerned with the history of computing, as the period when they first appeared has not yet taken on an historical definition. Contemporary materials generally describe devices and technologies and are less analytical or historical. As yet, this material adds little to our appreciation of computing's history. However, those important surveys that have been produced, and the historical/memoir materials that have been published, are cited below.

In this period there has been an extraordinary burst in the acquisition of hardware systems, which we have come to associate with the "computer revolution" or the "age of data processing." It is in this period that the computer has become ubiquitous. The era is better covered by application briefs (Chapter 8) and the numerous surveys of the industry at large (Chapter 9), and least of all by histories of hardware. The one exception is the subject of micro computers which is acquiring a literature of its own. The only publications included here are those that have an historical bent. There are hundreds of user manuals and some 150 PC magazines alone published worldwide, but none have been included in this bibliography.

The material in this chapter is organized by device types. IBM equipment has received the greatest amount of publicity and is, therefore, well represented in this chapter. Depending on who's statistics are cited, IBM mainframes, for example, populated anywhere from 65 to 80 percent of all medium to large data centers in the United States in the 1960s. That decreased to perhaps the 60th percentile by the late 1980s as computing was diffused across all parts of organizations. Historians should find the predominance of literature on IBM equipment useful. For all hardware announcements after 1969, an excellent contemporary source to consult is ComputerWorld, the industry's voluminous weekly newspaper. The periodicals section in Chapter 1 suggests other sources on the period as well.
Data Entry


Alrich compares prices and performance of data entry equipment from 22 vendors which were available in 1970, presenting a great deal of information.


He begins with key punches, goes to the Sperry-Rand Unityper, down to Mohawk Data Sciences Corporation's key-to-tape converter of 1965, and through key-to-disk devices available in 1970.


This reprints a group of papers on the subject from a conference held in January, 1986. It contains a great deal of illustrated material from the 1950s on but is devoid of any serious discussion of either of the most popular workstations of the 1980s: Apple and IBM micro computers.


This is a 24-page document that explains how to install punched card data entry equipment (EAM). The equipment described continued to be used all through the 1960s.


A 20-page description, it includes a short history of EAM equipment, current applications, how to code data, and uses of card input. A glossary is included.


Over 100 CRTs available in 1973 are surveyed, with descriptions of their functions, prices, and uses.


He discusses productivity of operators before (using keypunch equipment) and after (using key-to-disk). Productivity went up 40 percent in 6 weeks.
Bibliographic Guide


Bell helped to develop minis and real-time processors yet this article focuses on work stations only.


Reagan surveys existing OCR devices as of 1971, from 23 vendors.


This 91-page publication has sections on automatic typing equipment, transaction recording devices, optical scanners, punched tag/ticket and card punch machines, embossers and intercouplers. All of these items are of the period 1960-61.

Digital Computers


This computer science book appeared late in second generation computing. Some of the components described in this book appeared in machines of the 1960s.


The CDC 6600 was an important scientific/engineering processor of the 1960s, described in this article.


This is a functional description of an early super computer, the ILLIAC IV, built in the 1960s.


He describes research on reduced instruction set
computer (RISC) architectures of the 1970s and 1980s which appeared in commercial micro computers by the late 1980s. One widely used example was the IBM RT/PC.


This is a functional description of one of the most important, widely used mini computers of the early 1970s.


It contains material on the status and role of digital computers in 1964-65.


This contains a brief history of computer concepts since Babbage, then a review of contemporary technology, and finally describes the notion of a fifth generation of computers coming. It was an early publication to address the subject.


This is a serious, technical introduction to computers and their technology, circa fourth generation. It is a useful reflection of thinking in the mid-1970s.


Building on the success of earlier machines, such as the CDC 6600, for engineers and scientists, the firm produced the 7600. The event is noted here; it does not contain a technical description of the processor.


This is a popularized account of digital computing in the mid-1960s and how they were being employed in the United States.


Cashman offers a quick survey of DP product announcements over the period 1957-1982.

As did many articles of the 1960s and 1970s, this one recorded how the advances in hardware continued to surpass those in programming and in software in general.


This is essentially an announcement of the new PDP mini computer with some description of its features and functions.


Published under different, yet similar titles, this publication has continued to appear down to the present. It is a major source of information on devices available in the market and with such details as features, functions, costs, performance, comparisons, vendors' addresses and services.


The focus is on developments during the 1970s and anticipated changes in subsequent years in both hardware and software.


This is a description of fourth generation technology early in its development.


Contemporary technology is compared to what is appearing in fifth generation devices.


This funny book describes computers and includes some historical perspectives.


He describes various exchanges of ideas by computer scientists from 1938 to the mid-1970s on their work and technology.

Computers changed dramatically in the 1960s and those changes are reflected in this book.


The mini came into its own in the 1960s. This is a useful survey of activities leading to the introduction of more specialized, smaller processors, particularly in the second half of the 1960s.


Composition equipment early-on acquired computing capability, a trend that became increasingly evident in other industrial machines, particularly in the 1970s. This article describes early developments within the publishing industry.


The authors explain the nature of computer hardware late in second generation and early third. They also offer details on their use in the 1960s.


This is a technical description of the first large array processor. It was operational between 1975 and 1981. The book has little history and no index to its 350 pages.


It offers fundamental concepts and operational principles, citing various IBM machines for examples.


This is targeted at a reader with no knowledge of computers of the early 1960s and was used throughout the decade. It is a technical description with no history.


This very successful, widely-read book is a history of the development of the Data General MV/8000 mini.
It is particularly useful for appreciating how crash projects in the DP world are conducted.


Knight describes increases in capacity of processors versus declining costs for hardware in the 1960s. His work on the costs of computing has influenced significantly the work of economists looking at the data processing industry and its products.


This is a general description of the technology and its principles.


This technical description also provides background on the history of the VAX series, the outgrowth of DEC's PDP minis of the 1970s.


Already by the 1970s the impact of digital computers on people and society was receiving considerable attention. The relationship of technology to actions within modern society had become important.


The article is a description of the development and first use of a parametron-based computer which was built for the University of Tokyo in the mid-1950s but which continued in operation deep into the 1960s.


RISC technology was developed in the 1970s and came into its own during the 1980s. This is a description of RISC.


This is vintage 1960s views of hardware technology.

Hardware, 1960s-1980s

CRAY super computers were very popular in the late 1970s and throughout the 1980s. They were the most widely used of this kind of processor in the United States. This describes an early model.


This is much an application brief as it is a statement about the practicalness of digital computing and analog devices in laboratories by the mid-1960s.


Women writers on DP were rare in the early 1960s. Schultz offers a technical review of the subject of computers, circa early to mid-1960s, and on how to use that family of machines.


The author of many books on data processing provides a general overview of computers for the general reader. The material is based on technology of the early 1970s, circa fourth generation.


By this period many books were appearing in print on the nature and use of computer technology. This is a typical example of this type of publication.


This is system development history in a practical form. The CDC 6600, developed in 1964, was an important machine of the period. The author offers details on it and on design management; illustrated.


This reflects technological possibilities from the perspective of how computer scientists felt in the early 1970s.


This is a history of the system, 1964-1970.

This relates the results of a survey conducted in 1969-70 to measure error rates on over 1500 calls totalling 700 hours.


This is a history of methods of simulation and measurement, 1960s and 1970s.


The focus is on input/output equipment of the 1960s to perform this conversion.


This is as much a technical description of the system's components as it is of the ILLIAC IV.


This is a detailed, general introduction to the technology of computers, from basic principles to complex issues. The intended audience was the DP professional.


This technology was given high hopes as being significant in the early 1970s. It is described along with the basis of that hope.


This is a functional description of the super computer and of the technology with which it was made.


More than just a description of I/O equipment, it also discusses fundamental technologies involved.
H a r d w a r e ,  1 9 6 0 s - 1 9 8 0 s


NPL did considerable work on packet switching in data communications with computers. This offers insight on British telecommunications in the 1960s not available elsewhere.


This is a brief history of the Flexible Processor (FP) at Control Data Corporation in 1972 and on the Advanced Flexible Processor (AFP).


This was a line of technological R&D that enjoyed a momentary, if hardly successful attention.


Although a technical paper, it contains much material on the history of such devices.


This represents the first description of IBM's use of SLT, used to integrate semiconductor and resistor components, replacing the SMS printed circuit package cards of the early 1960s.


Since Diebold was such a highly regarded commentator on data processing in the U.S., his views on the future of such technology were important. He explains what new applications will be possible and the evolution of technology in positive terms.


This book, over 600 pages long, was written by an electrical engineer. Dorf presents a detailed technical survey of contemporary technology based on early fourth generation developments.

This describes methods for improving color video and their economic effects. There is included some discussion of computer video (1970s-80s).


Although intended for a technical audience, his overview provides historical perspective and details.


This is a collection of historical essays and includes contributions by Konrad Zuse, Helmut T. Schreyer and Wilfried de Beauclair on early computing in Central Europe (1930s-1960s).


By the end of the 1960s, the story of integrated circuits, compaction of components, and so forth was an important development in hardware packaging. Part of that story is narrated here.


The use of technology to accomplish the job is surveyed in this article intended for a business audience.


The author reviews the evolution of theoretical computer science, covering the genesis of over 500 research efforts.


This was one of a series of articles published in this magazine reporting on computer science in the 1960s.

They produced a series of volumes intended to cover all aspects of the subject. Four were published by the end of 1962, consisting of articles by experts on specific topics.


One of the creators of the computer chip argues that further miniaturization, capacity, and price performance would come and then described these prospects. In hindsight he was very correct.


Chip technology developments of the 1970s is reviewed by a leading figure in the industry with help from Hoff.


Integration of components was, by the 1980s, recognized as one of the major technological events of the twentieth century, and that made inexpensive and practical computers possible.


The article is on analog computing.


The strategy of building into computers redundant circuits and other functions was done as an effective way of reducing down time. That strategy is explained and illustrated.


This describes the application of computers, primarily analog, to various manufacturing and processing applications in the 1960s.


This is a history of the transistor and microchips with considerable focus on the physics of crystals and its current state-of-the-art. The author worked in Silicon Valley for a while. He also offers many details on German developments.

In reasonably lay terms he explains the process leading to the evolution of computer design as later seen in the 1970s.


Packet switching networks began to develop in the 1960s. This article has material on the role played by professors and engineers at MIT.


This is a book-length history of the subject with comments on its role in the 1980s.


This recounts the 1986 breakthrough achieved by Alex Muller and George Bednorz in creating a superconductive compound. The story is taken down through 1987 in which he reviews the work of other scientists all attempting to make superconductors that operated at increasingly higher temperatures.


Such circuits were common features of computers of the late 1950s and early 1960s with home-made devices using them throughout the 1960s. The technology of the period is explained.


This continues the discussion from the previous article.


The author describes the process of miniaturization of electrical circuits in computers.

The author argues that gold plating was used in computing, particularly SMS packaging, for reasons of reliability and performance, beginning in 1959. It was a way of controlling corrosion in components.


In addition to recommendations, this report has information on the number and value of peripherals used by the U.S. Government as of March 31, 1972.


This is a technical piece, vintage early 1970s, on computer architecture.


VLSI became standard fare in large computers in the late 1970s and throughout the 1980s. This is a technical paper with useful historical information.


This is a survey of computer design as of the mid-1960s.


This is one of seven SRI reports for the FCC on the subject. Surveys the cost of computers, software, terminals, and data communications. It contains a great deal of information and bibliography.

IBM Hardware and Technology


This is a 13-page pamphlet, originally an article in Think magazine in 1976. It covers developments from the 1950s to 1976; well illustrated.

This is a brief history of the DP industry's most widely used cathode ray terminal (CRT), from 1965 to 1985.


Hopkins describes work done at IBM on an experimental mini computer, begun in 1976, and its implications for the design of systems in the 1980s.


This is a history of RAS from 1956 to 1980 with a survey of design intentions, technologies, functions on IBM computers and I/O from the IBM 650 down to 1981.


This is a thorough survey of the computer and about its use.


Peck describes the role of the IBM Systems Engineer from 1960 to 1985. The IBM SE was as common a feature of a data center as an IBM computer. They advised customers on usage, capacity, education, and application development.


The IBM 7070 was in use until the mid-1960s before newer products, such as the IBM 360 began replacing the older machines. This is a description.


This is a history of IBM processors from the S/3 (1969) to 1980, with comments on the S/32, S/34, S/36, and technical evolutions in design and packaging of each.


He comments frequently on IBM magnetic storage from
the 1950s through the 1960s and the company's impact technologically.

IBM Printers


They detail the development of non-impact printers at IBM during the 1960s and 1970s. It has illustrations of the IBM 3800 and IBM 6670.


This publication went through many editions. The IBM 1403 and, in particular the IBM 1403 N series were the most popular systems printers of the 1960s and 1970s in the DP industry.


This overviews such equipment from IBM since the 1940s. The authors illustrate how previous developments influenced current products. It is illustrated with charts.


It begins with the IBM 1403 and goes down through the IBM 3211 (1950s-1980).


The article contains material on IBM printers as far back as the 1940s.

IBM SNA and Teleprocessing


This is as much a book on how to use TP as it is a description of the technology as of the 1960s for the transmittal of information (data) as opposed to just conversations by telephone.

While a technical paper on IBM's networking approach, it does provide a brief review of its evolution since the early 1970s.


This is both history and a technical survey from TP that was point-to-point batch transmissions down to networking (SNA and so forth), from the 1960s through the 1970s.


This is a contemporary introduction to telecommunications. It includes material on computer networks and data communications, circa 1970s and 1980s.


This adds material on telecommunications of data from computers across telephone lines.


This is a very informed report coming when time-sharing was becoming widely accepted. It describes the increasing number of dedicated time-sharing systems being developed within the U.S.


While the thrust of the paper is on anticipated developments, it does cover evolution of networking of computer systems, primarily of the 1970s.


Strauss describes a very large teletype system operated out of Westinghouse in Pittsburg, Pennsylvania, supporting several hundred locations. By 1960s' standards, that was a very large network.


The authors, both IBM engineers, describe the
Hardware, 1960s-1980s

evolution of the features of IBM's Systems Network Architecture.


The article traces the evolution of IBM's SNA from its announcement in 1974 to the present and is the most complete account of the important subject as of this date.

IBM System/360


Amdahl is joined by G.A. Blaauw and F.P. Brooks, Jr., in describing the system that they managed through design, clearly IBM's most successful product up to that point.


Published late in the life of the IBM S/360, the book is a useful technical review of the family of computers.


This was published within days of IBM introducing the family of new computers and is an initial description of the very large announcement of some 250 products: hardware (computers and new peripherals), operating systems, programming languages, and some other software aids.


The authors described the use of cache memory of a 360 Model 85. Conti became a senior IBM executive responsible, throughout the 1980s, for developing all of IBM's high end processors, sequels to 360.


Crawford, of IBM, cites the use of the 360 to describe the use of computers. It has a chapter on the history of computing (pp. 15-42). Historical references appear throughout the book on all aspects of data processing technology, both hardware and software.

This was Time magazine's account of IBM's announcement of the S/360 family of computers. All major business journals published an account of the system.


The author led IBM's technical efforts to develop S/360. This is a major publication on the most important computer built up to that time (1960s) by any vendor.


This was IBM's full, technical description of its most important product of the 1960s, and an early account of the system by an engineer involved in its development. Co-authors were also IBMers.


One of the few articles ever published to look at IBM's major announcements of the 1960s and 1970s as one historical continuum of technological change.


This includes biographies of key IBM engineers on the project, along with their views on the origins of and evolution of S/360.


This was one of the first published announcements of the System 360, announced by IBM on April 7.


He described how monolithic semiconductor memory could be used in a buffered cache memory system and how it was employed on a System 360 Model 85 in the mid 1960s.


Newsweek's article illustrated IBM's care in assuring that all the major magazines covered the announcement.

Padegs recounts the evolution of computer architectures at IBM beginning with the S/360 down to 1981. He offers details on why things were done, particularly regarding overall architectural strategic decisions.


While on the history of S/360, it also includes material on the SPREAD Report.


The author explains the characteristics of early IBM high-speed integrated circuits of the late 1960s as used in S/360.


Pugh describes memory array technology he worked on for IBM in the mid-1960s for the S/360 family of computers.


This is a book-length account of the development of the S/360 in the form of memoirs by an engineering manager on the project.


This offers some insight on competition for the S/360 family just as IBM began to ship the computer to customers in quantity.


This suggests instruction timings and cost to execute three types of problems on 5 models of S/360: Model 30, 40, 50, 65, and 75.

This reprints the actual report with an introduction by B.O. Evans. The report was written in 1961 and recommended the creation of what became known as the System 360 family of computers. This is a major document in the history of modern computers.


This was the first detailed analysis of the S/360 story to be published. It also offers material on the acceptance of the product within the data processing world.

IBM System/370


Ayling described memory in IBM's S/370 Models 135 and the earlier 145. The 145 was introduced on September 23, 1970, the 135 on March 8, 1971. IBM was the first vendor to ship commercially applied semiconductor main memory.


This is a formal description of IBM's large computer family of the 1970s by two of its developers.


This is a description of the control/switch unit for the IBM 3420 family of tape drives which had new technologies and introduced with the S/370 computers.


He describes the technology incorporated in the IBM 2401 Models 4 and 5 tape drives and developments since 1966.


He analyzed the technology in the IBM 3420, first shipped in 1973, and subsequently the most widely used tape system in the DP industry during the 1970s and early 1980s.

The author provides a history of tape and disk drives from IBM from 1953 to 1980. Four phases of development are identified: events from 1953 to 1962, 1963 to 1966, 1967 to 1980, and major developments anticipated in subsequent years.

Memory Technologies


This is a brief overview of the situation as of the mid-1960s, reflecting significant advances in miniaturization in electronics over the previous five years.


Wang worked at Howard Aiken's laboratory at Harvard University on ferrite core memories in the late 1940s and started Wang Laboratories in 1951 to build and sell computer memories.


This documents recent developments and examples where new ICs were being put to use.


This is a rare piece in that little has been published on the history chip manufacturing. It goes from germanium-based transistors to VLSI silicon, 1957-1980.


Hazen recounts recent research on superconductivity (late 1980s), including his own work and describes the meeting of the American Physical Society, March 18, 1987, called the "Woodstock of Physics."


This is a very good overview of developments over the previous several years.


Houston has written a history of various types of computer storage with data on access times vs.
capacities, cost vs. capacities, capacities vs. times.

This is an early discussion of who was making this technology, volumes and products.

This is a history of semiconductor technology from the 1960s through the 1970s.

This is on the physics of semiconductors and materials, 1950s-70s: electrons, inversion layers, injection lasers, electroluminescence, Gunn effect, MESFETS, solar cells and so forth.

The subject was timely given the large number of developments in the period 1962-65.

Leedham has published an article for the general public on recent developments with chips, an early article on the subject targeted at a non-technical audience.

The author argues that memory influenced systems more than any other component and offers evidence over a period of decades.

This is one of many published in the mid-1960s, documenting significant and recent changes in ICs.

Offers some history of chip development.

Written by an IBM engineer involved in the process, he surveys IBM memory developments since the 1950s through the 1970s, and speculates on developments in the 1980s. This is illustrated, detailed, technical and has a good bibliography.


Packaging of semiconductors into computer components is discussed from the IBM 1400 series through the IBM 3081; illustrated.

Micro Computers


This is one of dozens of such publications to appear by the early 1980s cataloging equipment types while describing the technology in general terms.


This describes an ancient predecessor to the desk-top micro of the 1970s.


This is a history of how IBM came to market with a micro computer, written by two journalist/free lance writers. It relies heavily on interviews with participants.


While an assessment of micros in the home of the future, he does describe the use of such equipment in the early to mid-1980s.


The author describes a micro computer called the Kenbak, built in 1971.

2411 Freiberger, Paul and Swaine, Michael. Fire in the

This is an important, early history of the subject that contains a great amount of detail, covering the period 1975-1983; illustrated.


The author is a psychologist who describes the characteristics of PC hackers of the 1970s and early 1980s and then comments on PC users in general.


This is a biography of Steve Wozniak and an account of the early days of Apple.


This was one of the first books to appear on PCs in a networked environment. During the 1980s that trend of networking such machines became widespread.


This was an early, widely distributed "how to" book that described the technology, its uses, and gave advice on the subject.


While the emphasis is on the IBM RT personal computer, its historical antecedents are well documented.


This was the initial "Blue Letter" announcing the IBM PC and offers the initial technical description, pricing, and terms and conditions of sale.


He lists 45 microcomputers, essentially of the 1970s, with brief descriptions of each.

He argues that Paul Friedle, of IBM at Palo Alto, made SCAMP in 1972, which was the predecessor of the IBM 5100 and the grandfather of the IBM PC (5150).


This constitutes the illustrated memoirs of a PC programmer (1976-84) and includes comments on cottage programming in general.


This is an example of a growing body of literature on the role of micros on people and their applications which appeared throughout the 1980s.


He describes how the PC is making it possible for people to do more of their jobs at home now and into the future. He offers evidence of that trend drawn from the late 1970s and early 1980s.


These volumes are not only an important, detailed source on the technical aspects of the topic, but historically significant as well because the author was the first to market micros on a national basis in the United States in the 1970s.


This was one of the first publications to describe the application of micro computers in education.


The author, an MIT professor, argues that LOGO language was useful in teaching children about computers in the 1970s. It offers much material on childrens' contacts with computers.


The Commodore 64 was an early, popular American micro computer. Its creation is described in this article.

The author reports on the first major conference ever held on the subject. Proceedings were subsequently published. It contains material, however, on micro computers.


Part of the first chapter and Appendix B is on the history of the PC. The entire book, however, is useful for a source on the technical features of early models and for a description of their uses.


This is a general history of the company with emphasis on the period of the late 1980s, after Apple had become a major corporation.


This poorly organized memoir of a USA Today reporter focuses on his initial use of a Kaypro micro computer. He also includes a history of Kaypro and Wordstar software.


By the early 1980s, books began to appear on the effects of PCs on people, particularly psychological influences. This book is an early example of this type of publication.


Sculley was the chief executive officer at Apple Computers in the late 1980s. It contains many details about the departure of Steve Jobs from the firm and then about the revitalization of Apple.


These are the memoirs of the editor of Popular Electronics of the mid-1970s. He reviews the early history of micro computers.

This is one of the few reviews of early micro computing from an economic point of view rather than functional. It also discusses that portion of the data processing world that manufactured such machines.

2435 "10 Years of Byte: Special Anniversary Supplement," *Byte* (September 1985): 197-222.

This has important data on the history of *Byte* (1970s) and on the early history of micro computers.


This is a functional description of an early, widely distributed micro computer.


The article was written just as micro computers were becoming widely available in the U.S. market but yet not fully understood by DP professionals at large.

**Storage Equipment: DASD & Tape**


He describes the role of blocking factors in logical records as an important way to continue improving the efficiency of data rates on magnetic storage devices.


They discuss software which made better use of disk storage in the early years of DASD (1963-64 in particular).


An important discussion point in this general overview is magnetic storage, such as memory and DASD, in the 1970s.


This is a technical history (1950s-1980s) on control units for DASD and cache storage with the focus on how improvements came in performance, function and reliability.

This is a general introduction to DASD of the 1970s with emphasis on technical developments over time.


It is a discussion of a track-following feedback control system a decade before it appeared in the IBM 3350 DASD of the 1970s.


The survey focuses on the period of the 1970s, offering a useful, balanced analysis.


Disk was the standard and Bubble the great hope of the future.


This contains the results of a survey of 1,215 IBM S/360 and S/370 users offering data on tape and disk used, and about memory acquired for computers.


The author discusses recent (1960s) trends in system software that made DASD more usable in the first major period of disk usage.


The authors discuss the use of a laser interferometer and a grinder spindle used in the manufacture of disk products. Literature on disk manufacturing's history is limited so the article sheds light on activities during the 1970s.


The author describes a process for handling files on tape in batch mode and recent experiences which were reflected in subsequent tape drive products.
Professional articles on information system development


Aron focuses on recent advances in file indexing which made DASD more useful in the era of the S/360.


An important early computer scientist at IBM reviews indexing on DASD devices of the 1960s.


This describes the IBM 726 tape drive, announced in 1952, the first made by the company.


Describes a machine that had removable disk packs.


Dodd reviews how this was done by OS/360, complete with device independence in the 1960s.


These were products introduced between 1967 and 1980.


This survey goes from the 1950s to 1981, from the 350 to the 3380; illustrated.

This is a history of such systems from 1949 to 1980. It takes the story from the IBM 726 tape drive through the IBM 3420 and IBM 8809; illustrated.
The history of programming languages dates back to the 1940s with their Golden Age coming in the late 1950s and early 1960s—so far. In that latter period, they became higher level languages, many of which remain in use over three decades later. This chapter contains the growing body of literature providing both histories of languages and surveys of them. The number of articles on programming languages is in the thousands. The list below focuses on descriptive materials on major languages through the late 1970s. It includes many of the original or "official" descriptions, surveys of multiple languages, and historical material and memoirs. The latter have paid considerable attention to languages.

Most historical materials on these languages are memoir in nature because they were written by the developers themselves. However, in recent years an increasing number of book-length anthologies of histories and whole issues of journals have been devoted to languages or to a combination of machines and programming languages. Bibliographies are also being published on the subject. As this bibliography goes to press, Jean Sammet's important book, Programming Languages: History and Fundamentals (1969), is being rewritten as three different ones, with one dedicated to the history of languages. Archival collections concerning languages are continuously receiving attention, particularly from the Charles Babbage Institute.

While the total number of higher level languages may exceed two thousand, this chapter concerns only the most widely used in the United States. Some attention has been paid to materials on developments outside the United States. The reader interested in programming languages should also consult the previous two chapters, since many discussions of hardware also include surveys of programming languages for specific machines. The subject of languages is currently a fast-growing sub-field in the historical literature of computing. Many of the original technical papers for these languages explain how they came about, their early uses, and their evolution. Thus they represent significant contemporary sources for the study of their history. All widely used languages have been documented and their history at least briefly chronicled.
General Descriptions


Adams discusses, for the first time, a floating point address notation (originally conceived by C.V. Wilkes). The assembler described here was the classic structure of those to follow for two decades.


Aho wrote an excellent summary of a class of compilers that created arithmetic instructions, eliminated redundant computation, thereby reducing accesses to memory.


This is an illustrated, qutobiographical piece on the work of an important specialist on programming languages (1960s-80s).


The discussion surveys compilers, interpreters, assemblers, and macro systems from 1953 to 1980.


This pioneer in the development of programming languages of the 1950s comments on functional programming in the 1970s, a period of little development in the field.


Backus, the father of Fortran, discusses this and other early programming issues.


This is a progress report on advances and limitations of higher level languages.

Scanned OCR with permission of Greenwood Press [19 June 2009]

The author offers an early perspective on British programming activities.


This is a very early history of programming languages with focus on the 1950s.


This contains material on two IBM universal compilers of the 1960s: XTRAN and Slang. XTRAN is well described in detail.


This is a useful introduction to the early programming efforts evident in the late 1940s and at the start of the 1950s.


This is a review of formal algebraic manipulation languages of the 1960s.


Written by a student of Rutishauser, this is on his own work on problem solving software.


The author covers activities between 1949 and 1952 with a well researched, illustrated, technical report.


The question was critical at the start of the 1960s.
as new languages emerged, such as ALGOL and COBOL, and just before the announcement of IBM's S/360 with its new operating systems.


This article reflected views of the mid-1960s toward the development of higher level languages coming right after an important spurt of development in the late 1950s/early 1960s.


The book is a survey of the purpose and structure of ALGOL, FORTRAN and COBOL. It gives a short history of each along with an explanation on how to use them.


This brief article reviews the history, organization and mission of CODASYL, the industry group dedicated to standardizing computer languages, covering the period 1958-1975.


Its focus is on commercial application languages of the early 1960s. It also explains the emergence of the concept of using English-like languages.


It is a useful history of linear programming with comments on some of the key individuals involved over the period 1950-1980.


His memoirs are of 1951-59 and he discusses types of programming available then and documents his role in Holland.

One of the important developers of software in the 1950s and 1960s looks at the desire of the time to create languages that were independent of any particular computer, that is, were universal and could function on any computer.


This is a history of linear programming. The author argues that it was discovered three times by three different people, all in the period 1939-1947.


This discusses programming for civil engineering, contains material on COGO and STRESS, and about their uses in the mid-1960s.


This speculates on the future of languages and is useful in appreciating the expectations of many in the late 1960s.


This is a survey of the origins of the theory of formal languages and automata with Turing and others in the 1930s, down through the 1960s. It is illustrated, detailed, and balanced.


Halpern, like many of his peers in the 1960s, was defining how a natural or human-like language could become the basis of a programming language.


He deals with issues related to conversion and compatibility of programs as seen in the early 1960s.

These are his memoirs of developing languages from 1960 forward with advice on how to manage such projects.


This is a detailed survey from the perspective of the 1950s by a major leader in the development of higher level programming languages.


She describes the evolution of programming techniques from the 1940s forward. She was active in computer science developments throughout the period.


She reports on the use of compilers on UNIVAC I.


Two of the most influential pioneers in modern computing speculate on language development in the 1950s.


This is a collection of 30 important articles on major languages. Although technical papers, they offer an historical record of programming languages.


This is an introductory text on basic ideas at the start of the Golden Age of programming, reflecting 1950's knowledge.

The author describes an early use and motivation for, digital computers to do formal algebraic manipulation with software.


This is a classic in the field of programming. It surveys how programming was done in the 1960s.


This early account is on the evolution of language processors of the 1950s.


This is an excellent review of developments from the 1930s through the 1950s.


This covers the same material as their previous publication.


The author offers a history of logic programming in Edinburgh and Marseilles in the 1970s.


There was a great deal of concern regarding future developments, especially about user friendliness and data bases. This article is a good reflection of those concerns as of the mid to late 1960s.


While a text, it relied heavily on the IBM 7090 as the basis for describing programming and its characteristics.


Argues the case for having specialized languages.

This is a survey of programming languages of the early 1950s and how they functioned.


This includes material on the history of PL/I and about the Vienna Definition Language (VIL), 1964-69.


Although a technical article, it contains an historical review of language definition and the work of such people as Backus, Dijkstra, John McCarthy, Strachey, Knuth and others.


This reflects a survey of 57 users.


This is an introductory text to computer science yet contains historical entries in eight chapters on major languages, such as FORTRAN and ALGOL, with statements about their technical significance.


This introduction to computing for the novice appeared at the sunset of low level languages. Revised edition in 1959 began to reflect the rapid changes that came in the late 1950s.


This is an important survey of programming languages of the period, especially for business applications.

This surveys trends in the development of programming languages suitable for business applications in the late 1950s.


This continues the theme of the author's previous articles.


Mittman reviewed work done to develop specialized languages to do machine tooling (N/C type) in Europe during the 1960s. The application made it possible to direct equipment what to cut, bend, fold or make.


By this publication date, computer scientists were attempting to provide a coherent strategy for the development of both computers and programming languages in a coordinated form.


This is on the importance of stored program concepts and the value of conditional branching in programming languages.


He describes an early attempt to use digital computers to do formal algebraic manipulation.


Linear programming as a computational science is described. This includes illustrations and comments about the author's role with George Dantzig and work at Rand Corporation in the 1950s.


This was the report on the SHARE-JUG workshop on programming languages. It offers comments on trends and as yet unsatisfied requirements.

While the book is on current technology, it also contains a 404-item annotated bibliography covering the period 1967-1980 (pp. 271-399).


This reports on programming activities at GE in the 1950s. GE did many leading edge user-oriented activities in data processing in the 1950s and was watched by many other corporations for trends.


A study was done in 1972 and a questionnaire was returned by 164 users. The study was on the amount of effort it took to use various types of programming languages.


This is a good survey of software technologies and methods as of the late 1960s and early 1970s.


This is a description of early programming languages and in particular their characteristics as of the late 1950s and early 1960s.


This is an introductory paper on the use of symbolic manipulation, useful in string and list languages.


Besides describing string and list processing languages, the authors also describe their uses.

Their focus is on the application of programming languages to business problems and on the benefits of mathematical programming.


This is a good reflection on programming management problems, frustrations and concerns of the late 1960s and early 1970s.


The thrust of and value of this article lies with software and the author's reflections on concerns of the 1960s for software. These writers wanted programming and software tools to do special applications.


The author, an IBM engineer, prepared a detailed, technical treatise on programming in its very early days and about the use of computers as of the early 1950s. This is one of the first publications on the operations of digital computers to appear in the United States.


This was one of the first, if not earliest, technical articles to appear describing the idea of a program compiler—a basic concept that still remained key in the late 1980s.


This was a well distributed, highly respected anthology of papers on the topic of programming languages and their use.


This is a very early publication on trends in the development of programming languages, with primary focus on the 1950s.

Although a technical paper, it includes a chronological narrative from the early 1950s to the late 1960s which includes such topics as job-by-job processing prior to 1956, batch systems of the mid-1950s and other topics associated with programming languages.


This is on the design and programming of digital computers in Europe; particularly useful for early European programming.


They compare AMTRAN, Culler-Fried, Lincoln Reckoner and MAP to each other.


This is a survey of formal algebraic manipulation languages; it has less bibliography and more narrative description.


She surveys available languages to do formal algebraic manipulations.


The topics include APL, Fortran, GPSS, PL/I, Commercial Translator, CFS, FORMAC, QUIKTRAN, and SCRATCH-PAD, all covering the period 1950s-1970s.


This nearly 800 page book is a classic on the subject and the most complete history of programming languages, down through the 1960s.


This is more history than futures, 1950s-1970s.

This is an updated version of her 1966 publication on the subject (No. 2635).


These articles listed currently existing higher-level languages, predominantly in the U.S., which had been implemented. It was the most complete inventory of existing languages produced in the late 1960s and throughout most of the 1970s.


This is a brief history of key programming languages, operating systems, and data handling software, 1950s-1980.


This surveys existing languages to do formal algebraic manipulations in the 1960s.


She argues that English could and should be the basis for a programming language, a common sentiment among some programmers and language developers.


This survey competes nicely with Sammet's (No. 2638).

Shaw, C.J. Theory, Practice, and Trend in Business Programming. Santa Monica, Cal.: System Development
Shaw reviews various languages designed to solve business problems in the early 1960s. Besides describing their features, he compares their functions.


Sibley describes a very early universal compiler developed by IBM.


A chronology of milestones in software is printed but should be used with caution due to errors.


Steel is talking about programming languages.


The author demonstrates basic programming techniques very early in the history of programming languages and even of digital computers.


This is very much a vintage 1960s publication on programming languages of the period.


The author describes programming techniques as they were at the end of the 1960s and as practised in the early 1970s.


Wells looks back on developments in the 1960s and perhaps comments based on his own experiences in the period.

This is an important, general history of programming languages and is a basic reference work on all aspects of the subject.


This was an early, important book on programming in the late 1940s as practised on the EDSAC.


The authors describe eight languages from the period 1960/61 used for business applications: FLOW-MATIC, IBM Commercial Translator, COBOL, FACT, GODEL, ELLIOTT and NESULA and SEAL.


Wirth focuses on the technical experiences he had with programming languages since the early 1950s.


Zemanek is not interested here in programming language architecture between the 1950s and the 1970s.

Specific Languages


This is a description of the first automatic coding system that could be characterized as compilers (A-0, and A-1).

2660 Adams, C.W. and Laning, J.H., Jr. "The M.I.T. Systems of Automatic Coding; Comprehensive, Summer Session and Algebraic," Symposium on Automatic Programming for Digital Computers (Washington, D.C.: Office of Naval Research, Department of the Navy, 1954): 40-68. The authors describe an algebraic coding system of 1952/1953 at MIT while working on the Whirlwind computer. It was probably the first system in the U.S. in which a user could write mathematical expressions in a notation similar to normal format.

2661 Arden, Bruce W. "GAT: An early Compiler and Operating
This compiler was completed in 1958 and was developed at the University of Michigan; a technical memoir.


MAD was a programming language, described here by its developers, that ran on an IBM 704 (1959-61). It was useful for running problems quickly in an academic environment.


This is a description of IBM's first automatic code to simplify programming, written by the project leader responsible for its development.


This was one of the most important papers ever published on programming. The author introduced here the Backus notation (BNF), which defined how a programming language could be defined more rigorously.


Backus headed IBM's 701 Speed Coding project in 1953. He describes the software.


This discusses coding on a Dutch computer called the STAMTEC ZEBRA, of which 30 were made.


COLASL was a scientific computing language created at Los Alamos for production oriented work (1961-62).

They describe Algy, the earliest language to appear for the purpose of doing formal algebraic manipulation. It came out in the late 1950s and ran on a Philco 2000 computer.


This is a description of LOLITA, an extension to the Culler-Fried system, a list processing language. It was used to process strings of symbols in the 1960s.


MADCAP II was a numerical scientific problem solving language used at Los Alamos National Laboratory on the MANIAC II.


AUTOCODE was an early (1950s) programming language.


This is a machine tool language developed at MIT in the 1950s. It was one of the first of its kind of specialized programming tools.


This is a formal description of Bell Labs' language to do formal algebraic manipulations, called ALTRAN, circa mid-1960s.


They describe ALPAK, which served as the basis of ALTRAN.


It did digital simulations of block diagrams in 1960s.

This on-line language was developed at the Illinois Institute of Technology, ran on a UNIVAC 1105 and on an IBM 7094, both in the 1960s.


TGS-II was a compiler writing language developed at the Massachusetts Computer Associates, Inc. It was also called TRANDIR software.


This is a general description of AMBIT, a minor list processing language of the early 1960s.


This list processing language is described by the developer.


The system was never implemented, but was designed to simulate digital systems.


This describes the first attempt to develop a formal algebraic manipulation language, called Magic Paper. It was never fully implemented.


Developed at Cornell University to run on a Burroughs 220 and a CDC 1604, CORC was intended to teach students. It had a powerful facility for correcting errors in the compiler.

The language was implemented at Cornell University in the mid-1960s.


They describe a way to do digital simulation of block diagrams, used in the design of computer systems.


The language was developed at Bell Labs in the early 1960s as an improvement over COMIT.


The language was developed in 1964 to do formal algebraic manipulations. Engelman developed the language while at MITRE Corporation.


The Formal Semantic Language (FSL) was an early and effective language with which to express semantics.


Feldman describes an early string and list version of IPL-V.


These are the illustrated memoirs of an early LOGO user. He discusses how the language developed from 1966 to the 1970s.


The language was used to solve numerical scientific problems.

MESA was a programming language implemented in the 1960s. Its functions are described here by its developers.


This language allowed for interpretive algebraic coding, typical of many scientific and mathematical problem-solving exercises of the day.


This is a history of GPSS by a developer/user, covering activities between 1960 and 1968. For many years GPSS was one of the more widely used simulation languages, particularly for telecommunications.


This reviews the evolution and features of Ada, a language that was strongly supported by the U.S. Department of Defense in the 1980s.


This is the only detailed description available of BACAIC, a very early numerical scientific language.


This has anecdotes on the origins of Ada computing language in the mid-1970s.


They describe the use of pattern-matching to LISP with a system called CONVERT.


The authors provided an early description of PASCAL, a language intended for scientific computing; it was popular in the 1970s.

2700 IBM Corporation. General Information Manual: IBM

This describes the functions and use of an early IBM language intended for use in commercial applications (1958-64) on the IBM 709, 7070, and 7090.


This is a description of IBM's first automatic code for simplifying programming.


SPRINT was a minor list processing language that was relatively machine independent, however.


Katz describes a business programming language for the GE-225. The author was head of the design group and he characterized GECOM as a "compiling technique" rather than as a new language.


This was a programming language developed for use on the GE-225 and GE-235 at Columbia University. It was used in numerical scientific problem solving.


This language was developed at Bell Laboratories in 1965.


This is an example of how programming was done on a major project in the 1960s.


RPG was one of the most widely used report generators of the 1960s and 1970s and was considered a language by many users. This is a very early description of RPG.

2708 Marks, Shirley L. "JOSS—Conversational Computing for

This software was described as a specialized language called "Language for Simulating Digital Systems."


This was a very early specialized language to do operations on matrices and also using arithmetic functions on these and transposition.


The author describes the compiler used in the early 1960s to develop ALTRAN, a Bell Labs programming language for formal algebraic manipulations.


This is a language designed to write other languages primarily for simulating digital systems.


This is on the use of AIMACO by the U.S. Air Force in the late 1950s for business-oriented programming problems.


Written by its developers, TRAC was a language for handling unstructured text interactively in the early 1960s.


An IBM developer describes a dialect of FORTRAN with powerful debugging capabilities.

The language was used for many years at the Dahlgren facility to do formal algebraic manipulations. The publication describes how to use it and for what applications.


The authors proposed that a new, higher level language be developed. They describe such a language and the hardware needed to support it.


This is a narrative description of ADA, a programming language developed for the U.S. military.


2720 "OMNITAB on the 90," *Datamation* 9, No. 3 (March 1963): 54.

The language was developed at the National Bureau of Standards for use on with its IBM 7090/94. It mimicked a desk calculator more than functioned as a programming language.


This 33-page document describes a language implemented only at Purdue in the 1950s.


Parnas describes an extension of ALGOL, called SFD.


This is a technical description of IAL, an early attempt (1950s) to develop a universal language, later called ALGOL.


This is a brief description of the Internal Translator, a compiler the authors developed for use on the IBM 650.
<table>
<thead>
<tr>
<th>ID</th>
<th>Author(s)</th>
<th>Title</th>
<th>Publisher, Year</th>
<th>Description</th>
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<tbody>
<tr>
<td>2726</td>
<td>Quatse, J.T.</td>
<td>&quot;Strobes—Shared Time Repair of Big Electronic Systems,&quot; Proceedings, FJCC 27, Pt. 1 (1965): 1065-1071.</td>
<td></td>
<td>The language was Shared Time Repair Of Big Electronic Systems to communicate with hardware during repairs. It was developed in the early 1960s.</td>
</tr>
<tr>
<td>2730</td>
<td>Rochester, Nathaniel</td>
<td>&quot;Symbolic Programming,&quot; IRE Transactions, Electronic Computers, EC-2 (1953): 10-15.</td>
<td></td>
<td>The author describes NR9003, the first symbolic assembly program developed at IBM to run on a 701. Rochester was an IBM engineering manager and wrote the software that tested the 701.</td>
</tr>
<tr>
<td>2731</td>
<td>Roos, D.</td>
<td>&quot;An Integrated Computer System for Engineering Problem Solving,&quot; Proceedings, FJCC 27, Pt. 2 (1965): 151-159.</td>
<td></td>
<td>ICES was a specialized languages developed at MIT for applications in civil engineering. By the mid-1960s, over 300 organizations used it.</td>
</tr>
<tr>
<td>2732</td>
<td>Roos, D.</td>
<td>ICES Systems Design. 2nd Ed., revised. Cambridge, Mass.: MIT Press, 1967.</td>
<td></td>
<td>This is a user’s guide to ICES.</td>
</tr>
</tbody>
</table>
| 2733| Ross, Douglas T.                                       | "Origins of the APT Language for

APT during the years 1956-60 was developed by MIT for the U.S. Air Force and is a precursor to CAD/CAM software.


She wanted GECOM's features in ALGOL and COBOL rather than have GE's language be a rival to COBOL. It was an issue at the start of the 1960s as COBOL was being launched.


Describes the Depot Installed Maintenance Automatic Test Equipment for testing hardware and was a highly specialized language called DIMATE.


DIMATE is again described by Scheff.


Not to be confused with LOTUS, a popular spread sheet package of the 1980s, LOTIS was a machine logic software of the 1960s, described in this article.


This is a minor language being described by its developers.


This was Sperry's answer to IBM's FORTRAN programming language for numerical and scientific computing.

Sketchpad was a minor list processing language of the early 1960s.


He describes two business-oriented languages of the late 1950s.


ADA was developed as a language for U.S. military use in the 1980s.


The system described here is of an early online word processor/text editing package developed at MITRE Corporation. It also did linguistic and logical processing to structure information.


The language described was STRUDL, used for civil engineering in the 1960s.


MADCAP was used on the MANIAC II computer.


PL/360 had some features of a high level language but was not machine independent. The system called out was the IBM S/360 family of computers.


PASCAL was an up-and-coming scientific language in the 1970s. This is an early description of it.


This is a reprint of a 1955 paper by V.M. Wolontis of Bell Labs on a floating-point decimal interpretive system that ran on an IBM 650.

The book is based on the use of an IBM 650 with focus on programming. It has a great deal of material on a language called SOAP.


This describes the first known case of a computer being constructed with programming language order; it became the NCR 304.

**ALGOL**


This is on the birth of ALGOL.


Proposes the design of a computer to support the use of ALGOL 60.


This is an important publication, taking the story from conception of ALGOL through its early life. It is also funny.


He was a pioneer in the development of ALGOL.


Although better known for his work with artificial intelligence, McCarthy was also involved with ALGOL.


Naur was a major figure in the development of ALGOL.

This is a general description of Formula ALGOL.


Part of the debate, at that time, was over the issue of universal languages and whether to support one or the other, or both.


This was written by one of the developers of Formula ALGOL, offering a description of the language.


The period covered goes from the 1950s through 1962 and was written by a father of ALGOL.


He covers the period 1956-1960s. The author was a major player in the development of ALGOL.


Written by the two creators of Formula ALGOL, they offer a short description of this multipurpose language.


Weber describes how microprogramming on a computer was done to improve the efficiency of an ALGOL language called EULER. It was an early instance of a digital computer being modified to run more efficiently for a particular language.


This is on the birth of ALGOL and early features.
**APL**


This is an illustrated, one paragraph biography of an important developer of APL.


This is a short, illustrated biography of an APL developer.


Two developers of the language provide a description of it.


The period is 1961-68 primarily and is written by its developers as a technical retrospective.


This was the first formal technical description of S/360 but it also included comments on APL.


This was the first book-length study of APL, written by one of its developers.


The father of APL reviews his ideas for the language, a tool that only came into its own a decade later.


This was an early description of APL.


The describe a language with many APL-like features.
This offers a good description of the design decisions made and on the early history of APL.

This is a description of how to use the language, published at the dawn of its popularity.

The focus is mainly on the origins and evolution of APL in its early years (1950s-1960s).

This individual helped to develop BASIC, a major programming language.

This is the history of one of the most widely used programming languages between 1965 and 1985, written by its two developers.

This is a short, illustrated history of BASIC.

The history covers in detail the period 1956-71 and includes details on the role of Dartmouth College and General Electric.

This is a description of BASIC as it was in the early 1970s and as it worked on a large computer.

This is a standard text on BASIC.
COBOL


Bemer was involved in the creation of COBOL. He tells his story, covering the period 1959-60.


This is a short biography of an IBMer active in the development of COBOL and a noted authority on the history of programming languages.


This was the session that decided to try and design COBOL based on the Honeywell Business Compiler. The author argues little was accomplished at the meeting.


This is a history and analysis of COBOL. It is critical of its capabilities in the mid-1980s.


The author compares COBOL on 23 different systems, offering data on costs and speed of operation.


The author describes the use of COBOL in the U.S. Air Force during the early 1960s.


This was published at the time COBOL was just beginning to be widely accepted as a business-oriented language.


This is a description of a programming language related to COBOL.

Jones was one of the leading advocates for COBOL, and chairman of the task force set up in 1960-61 working on its development.


These are the minutes of the Short Range Committee meetings. It was this group that initially created COBOL.


This reproduces notes from crucial meetings held on October 8, 9, and 14, 1959 on COBOL.


The author, of the U.S.D.O.D. reported on the development of the language, initially in April 1960. This report includes revisions made into 1961.


He was considered by some observers as the midwife at the birth of COBOL because he chaired the language's development committee.


This illustrated article is a brief history and includes details on the author's role.


This is a major history of COBOL.


This traced changes in the language during its first 25 years.

The author analyzes the rocky relations between COBOL proponents and computer scientists. The author supports the value of COBOL.


Strong was a member of the CODASYL Executive Committee that early-on took on the task of discussing the potential benefits of a COBOL-like language.

2801 "Time to Switch to COBOL?," *EDP Analyzer* 1, No. 11 (December 1963): 1-11.

This appeared just as Cobol was becoming recognized as a major business-oriented programming language.


This is the first published account of COBOL, written by the Short-Range Committee which designed the language between June and December, 1959.


The revised standard specifications was used by COBOL users from 1961 forward in developing their own versions.


This was written by a very early user of COBOL.

COMIT


This has many ideas drawn from COMIT, used in CONVERT and LISP.


A COMIT-based system is described which ran on a GE-225. It was a string and list programming language.

This is a discussion of the use of COMIT, an early string and list processing language developed at MIT in 1957.


He describes COMIT's features.


The author was one of its developers describing its features.

**FORMAC**


The authors describe an early language designed to do formal algebraic manipulations. FORMAC is an extension to FORTRAN and on an IBM 7090/94.


This is a description of the functions and use of FORMAC as described by the head of the development team for the language.


Describes the use of FORMAC as a programming language.


This covers similar ground as the previous citation.


Essentially this an article on how to use FORMAC as a formal algebraic manipulation language.

This is a description of the language's features.


This explains the benefits of FORMAC as a formal algebraic manipulation language. The author was a developer of the language at IBM.

FORTRAN


These are the illustrated memoirs of an IBMer, covering mid to late 1950s.


The author speculated on the impact FORTRAN would have on future compilers.


The father of FORTRAN evaluates the language's performance.


This is a history and full statement of his views about FORTRAN.


They argue the case for developing a computer specifically designed to run FORTRAN. In 1967 this was still the most widely used such tool for scientific computing.


These are memoirs of the 1930s and 1940s and on the significance of FORTRAN.
This is a short, illustrated biography of the father of FORTRAN and an early, important contributor to the standardization of FORTRAN. The experiences of University of Michigan and University of Wisconsin are included in the account.

These are memoirs on how the compiler evolved in its early days (1950s). His focus is on the impact of FORTRAN standardization that made it easier for many people to use the language.

This history is broken into periods, 1960-66, 1967-70, 1971-78, 1978 to present.
He describes the first compiler which permitted
source code to compile on more than one computer.
It was a subset of FORTRAN and appeared in 1957.

2832 Hughes, Robert A. "Early FORTRAN at Livermore,"
Annals of the History of Computing 6, No. 1 (January

FORTRAN was used in nuclear research in the 1950s.

2833 Lee, J.A.N. "An Annotated Bibliography of FORTRAN,"
Annals of the History of Computing 6, No. 1 (January

This is a detailed bibliography covering the period
1954-78.


He reviews the NCC session on the history of FORTRAN
at which John Backus and Robert W. Bemer spoke.

2835 Leeson, Daniel N. "IBM FORTRAN Exhibit and Film,"
Annals of the History of Computing 6, No. 1 (January

This illustrated article was on the exhibit celebra-
ting the 25th anniversary of FORTRAN, one of the long-
est used programming languages. The full text of the
film is included.

2836 McCraken, Daniel D. "The Early History of FORTRAN
Publications," Annals of the History of Computing 6,
No. 1 (January 1984): 33-34.

He describes a number of publications, including his
of 1961, A Guide to FORTRAN Programming (New York:

2837 McPherson, John C. "Early Computers and Computing
Institutions," Annals of the History of Computing 6,

This offers background on why FORTRAN-like software
was needed in the 1930s and 1940s.

2838 Melbourne, A.J. and Pugmire, J.M. "A Small Computer
for the Direct Processing of FORTRAN Statements,"

They describe a proposed machine which would never
be built to support FORTRAN by using micro-programs.

Annals of the History of Computing 6, No. 1 (January
This brief, illustrated review is of non-Fortran software with comments on the effect they had on the design of FORTRAN.


These are memoirs of FORTRAN at Standard Oil. The answer to the question was that it was available which generated libraries of programs and subroutines quickly and because it was very adaptable.


These are the memoirs of Sakoda's work with FORTRAN from the 1950s into the 1970s.


This is a history of DYSTAL, a list processing language related to FORTRAN.


He offers a variety of stories on FORTRAN and reprints comments of others published in a variety of places.

Human-Like Languages


The author surveyed various efforts to make human languages, such as English, a programming device.


By the 1960s the nature of a language that looked like English was an attractive topic for computer scientists. This one puts forth the case that it could be the basis of a programming language.


Argues that English could be the basis of a programming language and why.

2847 Kirsch, R.A. "Computer Interpretation of English Text

The author describes an early attempt to develop a software tool that served as a bridge between English-like text and machine level language.


She argues the case for having English or "natural" languages as programming languages.


This is a snapshot of various attempts to produce English-like programming languages in the U.S. in the early 1960s.

2850 Simmons, R.F. "Natural-Language Processing," Datamation 12, No. 6 (June 1966): 61-72.

Simmons reviews current efforts underway (mid-1960s) to develop human-like programming languages.


There were many such publications that appeared in the 1960s looking at how and why to make English a programming language.


This describes one project to produce English-like programming tools.


This important scientist, noted for his work on artificial intelligence, discusses the possibility of English-like programming languages.

IDS


The author describes IDS, which was GE's programming language for business applications on the GE-225. The was in charge of the language's development team.
Bibliographic Guide

This describes IDS.

This publication presents IDS as an extension of COBOL for GE users.

IPL

He describes the development and use of an important and early list processing language.

This was the initial paper that introduced IPL-V. It is very important because IPL introduced the idea of list processing in computer languages.

This is a user's manual for IPL-V, the earliest string and list programming language. It offers details on features and initial use of IPL.

JOSS

This was RAND Corporation's language, written by a developer/user, covering the period 1960-67.

Baker helped to develop JOSS, and worked with the JOHNNIAC and other early machines.

This describes JOSS II with some history.

This was written by the man many called the father of JOSS. JOSS was the first widely-known interactive programming language developed in the U.S.


The creator of JOSS describes its use in remote, interactive computing. It involved users at RAND located at various U.S. Air Force bases in the U.S.

JOVIAL


The father of JOVIAL is featured in a brief biography.


This is a description of the features of JOVIAL.


This is a discussion of two general purpose languages which, in 1960-61, were potential rivals to become the most widely endorsed language used by the U.S. military.


JOVIAL's history began in 1958 at the RAND Corporation. This account takes the story down to the 1970s. JOVIAL was used with SAGE, ALGOL, and CLIP.


Klein describes a text processing application using JOVIAL.

This contains an early description of JOVIAL's use.


These are the memoirs of JOVIAL's developer. It is a detailed, technical paper with details on the SAGE project for the U.S. military.


Shaw compares JOVIAL to the DP industry's most widely used language for scientific and mathematical programming.


This is an annotated description of JOVIAL.


This is a general survey of the language's features.


This describes a very early version of JOVIAL.


This is a user's manual for JOVIAL.

LISP


This surveys the objectives and features of LISP2, a multi-purpose high level language developed in the early 1960s.


This is a complete and useful survey of the language.


They focus on the use of LISP 1.5, an early yet important list language developed for use in artificial intelligence.


Artificial intelligence represented a major research initiative in Japan during the 1970s and 1980s. This describes some use of LISP in Japan.


This is a detailed, useful survey of the language. LISP was first developed at MIT for use in AI.


This is a useful history of the language, covering largely from 1956 through 1958, its very early stages.


This is a very early user's guide; many would be published over the next 30 years.


This is a tutorial chapter focusing on LISP 1.5.

List Processors


This is a useful overview of a whole class of programming languages under development in the 1960s.


This is an excellent and detailed source on list languages.
NELIAC

This was written by one of the developers of NELIAC, an ALGOL-based language for numerical scientific programming of the early 1960s. It was used mainly by the U.S. Navy; the account is very complete.

This was written by developers of the language, done for the U.S. Navy between 1958 and 1960.

This is a description of how NELIAC was used by the U.S. Navy.

This is an early publication on NELIAC's features.

This describes a civilian application using NELIAC.

PACT I

This is a technical description of a very early compiling system written by one of its developers in 1954-55.

This is a description of one of the more important features of this innovative compiler of the mid-1950s.

The author affirms the value of programming languages while suggesting further avenues of research.

The technical article was one of a series on this early compiling system, one of the first to emphasize storage optimization as well.


PACT I ran on an IBM 701, initially in 1954. Its performance is reviewed here.


This is an important description of how the language was developed in the 1950s with lessons on what was happening with other language development projects.


This is a description of the technical features of PACT I.


This is a visionary piece, presaging programming concepts employed in the late 1950s and throughout the 1960s.

PL/I


This is a complete explanation of the early version of PL/I (pronounced PL one).


Radin, an IBM Fellow, was a developer of the PL/I.


This is an early overview of PL/I as a multi-purpose programming language that just got its start in the 1960s.


Described a possible use for PL/I for which the language had not been designed.
<table>
<thead>
<tr>
<th>Entry</th>
<th>Author(s)</th>
<th>Title</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2912</td>
<td>McCracken, D.D.</td>
<td>&quot;The New Programming Language,&quot;</td>
<td>Datamation 10, No. 7 (July 1964): 31-36. This is a general description of PL/I.</td>
</tr>
</tbody>
</table>

**Query Languages**

<table>
<thead>
<tr>
<th>Entry</th>
<th>Author(s)</th>
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<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2916</td>
<td>Bennett, E. et al.</td>
<td>&quot;AESOP: A Prototype for On-Line User Control of Organizational Data Storage, Retrieval and Processing,&quot;</td>
<td>Proceedings, FJCC 27, Pt. 1 (1965): 435-455. This early online query package was one of many developed at MITRE Corporation running on the STRETCH (IBM 7030) system. It used a CRT and light pen, one of the first to do so.</td>
</tr>
<tr>
<td>2919</td>
<td>Climenson, W.D.</td>
<td>&quot;RECOL—A Retrieval Command Language,&quot;</td>
<td>Communications, ACM 6, No. 3 (March 1963): 117-122. RECOL was developed in the U.S. as a query language.</td>
</tr>
<tr>
<td>2920</td>
<td>Connors, T.L.</td>
<td>&quot;ADAM—A Generalized Data Management System,&quot;</td>
<td>Proceedings, SJCC 28 (1966): 193-203. ADAM was developed at MITRE Corporation in the 1960s. This one ran on STRETCH (IBM 7030).</td>
</tr>
</tbody>
</table>

This describes an early query language. It was developed by the author at IBM.


This package was developed at General Electric, beginning in 1963. By 1968 it was no longer in use.


This is a useful, if short, review of query languages of the early 1960s.


This is a functional description of an early query tool.


This was one of the first query tools (1959) to be developed. It was written in IPL-V as a list processor of data.


This survey is of early query languages and covers a wide range of software tools.


Reviews a query language typical of the mid-1960s.


This is the only known publication on GIM.


This variant was an attempt to develop an English-like query tool.

This article is a description of the features and use of ASP, a query language.


This reflects an early desire to use English. This package has English-like phrases but no structured data base against which to make queries. It was called Protosynthex.

2932 Simmons, R.F. "Natural-Language Processing," Datamation 12, No. 6 (June 1966): 61-72.

Simmons surveys research by many in developing query languages in the mid-1960s; well done.


This reviews work done by the authors to do file/data queries.


The author reflects research typical of the early 1960s on data query software tools.


This ran on an IBM 1401 and was developed at the MITRE Corporation in the early 1960s.


This was as much an artificial query language as it was a data management system; developed at MITRE.


DIALOG was a very early online data query package.

SNOBOL

2938 "Biography of Ralph E. Griswold," in Richard L. Wexelblat (ed), History of Programming Languages (New York:
Griswold was involved in the development of SNOBOL programming language as a major proponent and designer.


They described the frustrations of trying to implement SHARE 709 and about its inferior quality.


This early language processor, described in technical terms, had new functions for the mid-1950s. This is a good account of such functions as SQUOZE.


There is a painful description of how modules of SQUOZE decks were located into this early language.


This was the first publication to describe SNOBOL. The authors are its developers at Bell Laboratories.


This is on how to use the features of SNOBOL as of the mid to late 1960s.


They describe source-level debugging capabilities in this early language processor.


This is an important account of SNOBOL of the 1960s.

This was a language processor for an IBM 709/7090/7094.


This is a description of its features.

Soviet Programming


The author is the leading spokesmen on Soviet computing for the period 1950s-1970s.


This 57-page document consists of lectures he gave on his work and on Soviet data processing from 1950 to 1980. It is useful for a quick survey of Soviet projects and computer scientists.


This short book covers Soviet programming on their BESM computer of the 1950s.


This is an early Soviet report on projects in the USSR.


This is on Russian developments from about 1948 through 1963. Both authors were involved in various Soviet computing projects during the period.

Time-Sharing Languages and Systems


This extended ALGOL to online usage on an IBM 7044. It describes DIAMAG programming.

RPL was hardly used but was intended for application with remote job entry processing.


This was an early effort to develop a time-sharing system.


The article is a description of MIT's CTSS system, developed in the 1950s by students; written by its chief developer.


This was the first full length study, and user's guide, on CTSS, MIT's time-sharing system of the late 1950s and early 1960s.


This details the history of Project MAC by its first director, a project at MIT in the 1950s in time-sharing.


PLANIT was a time-sharing system of the 1960s described by its developer.

UNCOL


This language was never implemented but is described. Many languages were designed in the 1960s that were never implemented, this is one example.


It was intended to bridge the gap between machine code and higher level languages of the late 1950s.


This discusses the problem of bridging higher level languages to machine code.

This is the case for a universal language, called UNCOL (UNiversal Computer Oriented Language). It was written by its chief architects.
The history of applications and software products has barely been touched on by historians. The exceptions, and there are only a few, include the use of computers in space exploration, data bases, and operating systems. But applications in particular, the reason why organizations acquired data processing in the first place, have received no attention to speak of. Applications represent the single largest gap in our knowledge of the history of computing and data processing. Although the bibliography below has very few entries on the history of applications and software, it attempts to pull together relevant materials of use to historians. Because the subject of application software is terra incognita, citations below are overwhelmingly contemporary and sporadic at best. What they have in common is that they were readily available materials as of their date of publication. Thus one can assume these must have had some influence. Ironically, the volume of publications describing software packages and their use run into the tens of thousands just in English alone! At best, therefore, the purpose one could hope for below is to suggest the kind of literature there is on the subject.

Historically, publications on applications have appeared in several sources. Beginning in the early 1950s, some indigenous to an industry carried articles on the particular uses computers were put to in their world. By the late 1960s, these journals were also carrying articles on software packages and their uses and, by the early 1970s, advertisements by software vendors. Industry specific journals represent the single largest source of materials on uses. A second body of publications consists of articles published by journals in the office equipment or data processing industry. Finally, there were numerous books published on the uses of computers in business, medicine, liberal arts, education, and so forth since the 1950s. None of these materials has been studied by historians. Little of it has been captured in bibliographies intended for scholars.
General Descriptions


The author includes comments on the history of software abstraction.


Besides a description of computers, this offers comments on how they were being used in the late 1960s.


Although a technical piece, it contains an historical overview of the subject.


This is perhaps the best known of the early books on the development of software. It remained in print into the 1990s. Brooks was the manager at IBM responsible for many crucial developments on the S/360.


This reviews past achievements in software and includes material on time-sharing, networking, AI, software and file systems, 1950s-1970s.


The author discusses the evolution of assemblers, compilers, operating systems, and is well researched.


He summarizes some of the issues that worried computer scientists of the 1960s about how best to develop complex software.

2971 Gries, David. "My Thoughts on Software Engineering in the Late 1960s," Annals of the History of Computing...
Gries describes his role at a 1968 software conference hosted by NATO in Garmisch, Germany.


These were two early, annotated inventories of software packages available in the United States. They described functions, costs, availability, what systems they ran on, and degree of documentation.


CIS (1979-88) was software and curriculum. He offers an explanation of why it was terminated after generating 121 graduates.


It focuses on the relationships of information science and various technologies to library science.


Software engineering was of growing concern in the 1960s. This was a major conference on the subject. For a review of the conference see Annals of the History of Computing 11, No. 2 (1989): passim.


Perlis describes conferences held in the 1960s and the issues discussed at these. He participated in many software engineering projects of the period.


This is particularly useful for details on U.S. software engineering efforts of the 1950s and 1960s.


She was at Carnegie Mellon and describes the impact
on herself and software engineers in general in the U.S. caused by the 1968 NATO conference on software (1960s-1970s).


This is a collection of seminal programs being described that involves both applications and programming, circa 1950s-70s.


This is a continuation of the theme of his earlier book (No. 1979).


The writers cover developments from 1968 to 1978 with a survey of the origins of software engineering.


This is a history of the software industry (1960s-1970s). U.S. sales in 1969 were $25 million, in 1979 they reached $1 Billion.

Applications, 1930s-1940s


The Comptroller describes the use of Burroughs equipment by his city government.


Written by an early DP consultant who writes a description of computer possibilities in the 1940s.


This describes early use of computers in insurance.

2986 Burroughs Adding Machine Company. **Budgetary Control Through Modernized Mechanical Methods.** Detroit: Burroughs Adding Machine Company, 193(?).

This is an illustrated application brief.

Calls attention to growing use of equipment by cities.


This covers activities in various cities using data processing equipment.


This surveys uses made of the ENIAC.


This describes the Voice Operation Demonstrator put on display at the New York World's Fair of 1939. It was an analyzer and synthesizer of human speech.


This is a more detailed account of the material in the previous citation concerning the VOCODER.


At the major office appliance show of the year new devices were introduced; their applications described.


This describes early scientific/mathematical uses of digital computers in Great Britain.


The author describes the application as well.


This was a very early publication on operations research relying on the use of linear programming.

It focuses on the use of commercial electronics.


This describes early uses of computers in the 1940s.


This 42-page report reviews problem solving on ENIAC.


Much of the discussion is about the kinds of problems being solved at the NBS using digital computing.


This is an early piece on the use of computers in a commercial environment.


This is a collection of case histories on OR.


This was an early definition of applications for digital computers and in highly technical terms.


This is on early problem solving in mathematics using a digital computer.


He offers a great deal of information on the use of computational equipment in the study of meteorology from the late 1800s forward.

This application relied on the use of analog devices.


The Director of Revenue and Finance for Newark describes his use of office equipment.


This is on a voice simulator built at Bell and displayed at the New York World's Fair in 1939.


It includes a discussion of how machines in the 1930s and 1940s were used to imitate voices.


The article was an early one on using computers in office applications.


This 90-page focuses on library research and how data processing equipment was being used and would be.


This 60-page document reviews how to solve problems in mathematical logic using a digital calculator at RAND Corporation in the 1940s.


Describes weather forecasting in the late 1940s using computers.


This is an application brief on electronic machines.

This 11-page document discusses computer use in weather forecasting, a very early such publication.

Applications, 1950s


This 82-page publication also describes applications.


This consists of a series of papers presented at the AMA's 7th Annual Data Processing Conference, March 1961. Issues include management, economics of DP, functions and uses and applications' cost studies.


This is a useful overview of late 1950s applications of computers, management issues and technological considerations. Includes Chrysler's role with DP.


Testimony reviews government scientific applications and the state-of-the-art of computer technology.


The pamphlet describes the requirement for computers and details applications for checking and savings account management. ABA was very aggressive in endorsing computing in the 1950s.


Discusses the use of computers in commercial environments and impact on management and personnel.


It includes a contemporary description of the American Airlines reservation system as it was in the 1950s.


All the examples cited involve data reduction techniques in aircraft design of the early 1950s.


This widely distributed book describes applications, role and structure of computers, and impact on society.


This summarizes the pros and cons of each as applied to the control of plant processes in the early 1950s.


This may well have been the first important survey conducted on applications of computers in the U.S.


Describes the use of a UNIVAC to predict outcome.


They compare payroll applications done manually, on punched card equipment, and then with computers to illustrate the differences as experienced by one manufacturing company.


Describes inventory control systems of the 1950s.


This included monthly update newsletters on new equipment and applications.

3032 Buckingham, Walter. Automation, Its Impact on Business
Based on his testimony before U.S. congressional committees on automation, covering office and industrial applications and implications.


He describes the experience of the U.S. Bureau of the Census with computers and includes general commentary on automation.


This is a useful introduction to applications of the late 1950s and computers of the period.


Does the same as the previous citation.

3036 Calhoun, Everett S. The Challenge of Electronic Equipment to Accountants. Stanford, Ca.: Stanford Research Institute, 1953.

This 13-page booklet describes how computers could be used in accounting early in the computer era.


Yes; this describes how in order processing, inventory control, materials handling and in retail.


Historically significant because this was an early description of computers at work on orders and production scheduling.


This is a typical second generation guide to applications of computers.

They analyzed features of digital computers of the period and how they might be used in scientific study.


This 32-page booklet describes management issues and problems which could be addressed with computers and recommends applications with examples.


This 2nd edition is an authoritative resource on electronic accounting machines covering all aspects of the subject, including business applications.


This was a typical example of a rapidly growing body of literature evident in 1954-55 on how to cost justify DP. Chapin wrote extensively on the subject in the 1950s, setting standards followed by many U.S. companies.


This very long book (645 pages) was a major guide to OR and computing as of the late 1950s.


Reviews how computers were being used in mid-1950s and describes their cost justification and uses.


She describes how to use electronic equipment to record, arrange, process and print information in accounting; a period piece on batch processing.


Many applications are described in refineries, office applications, central processing of statistical data, and role of service bureaus for smaller firms.


It discusses the U.S. census of 1950.

This describes one of the earliest computer-controlled facilities. It was established at the Texaco Polymerization Plant, Port Arthur, Texas. Includes evidence of benefits.


Surveys use of DP in 14 applications in U.S. with data on why used and justifications with information on acceptance and rejection in 20 industries.


Recites cases of process and manufacturing uses.


Includes hardware and software descriptions.


Same publication as No. 5052. Volume 4 describes 383 company and government DP installations in the U.S. Describes what was installed and applications while presenting products from 34 U.S. and non-U.S. vendors.


Gille became American Data Processing, Inc., soon after publication. The book is a discussion of punched cards and computer applications, hardware and forms with 26 case studies, bibliography, and equipment comparisons.


This explains how to use computers to process records. It was intended for a non-technical audience.


Reviews intended use of computers in U.S. census, 1950.


This is an early, widely distributed volume on the subject. It is a useful gauge of the optimism felt for future automation in the 1950s.

He explains the nature of automation, including computerization, and why its benefits.


This reflected ongoing interest since the 1930s on developing equipment to handle interpretation of handwritten numbers and words.


He describes the use of a UNIVAC to predict the results of the U.S. elections in 1952.


The subject of U.S. Government accounting and computer automation early-on became a major issue.


Banks discovered the benefits of computing during the 1950s; benefits of computers are described.


This is on bookkeeping for checking accounts at Bank of America in the 1950s; system called ERMA.


This was an early volume on the subject of CAD.


Feedback and continuous process control using computers is explained from the 1950s to the 1970s.

This was the first article published by the HBR on commercial uses of computers, recognition of their impact anticipated on business, a process underway.


Reviews use of computers since 1950s and speculates on future uses. This was written by a scientist and one time director of the computer center at Lawrence Livermore Laboratory.


Surveys 81 users as of 1956 on what was installed, applications, and number of programmers employed.

Furlong, B. "Can You Trust the Weatherman?," Natural History 65 (September 1956): 345-351ff.

Describes recent improvements in weather forecasting some of which involved use of computers.


This is an application brief involving UNIVAC.


This edition includes extensive material on data processing equipment and uses in accounting.


This was the largest reference work to-date on DP applications and technology and as such a good mirror of the subject circa mid-1950s.


Surveys how computers developed and their prospects and concludes with discussion of their use in science, business and process control.


This is an early piece on using computers. Readers are cautioned to do systems analysis in detail before installing this new equipment.

Hundreds of articles such as this one appeared in the 1950s for mass public exposure in the United States.


This is a very usable history of the subject.


This describes business uses of computers in U.S.A.


Covers many types of applications and industries from the 1950s to 1980 and about how they evolved.


He surveys impact of electronics on personnel issues. Argues that computers have not created significant unemployment, reflecting an issue of concern in the 1950s.


This overviews some applications in engineering.


The authors worked for MIT and Arthur D. Little respectively. They introduced the subject as a new scientific method of management.


Three naval officers describe their experience with an IBM 701 and IBM 702 in the mid-1950s.

This article focuses on operating characteristics of first generation computers, their economic advantages and anticipated usages in business.


A user surveys U.S. Air Force experience with computers, describing use and results of the early 1950s.


This is on the use of electronic digital computers in insurance industry for commercial applications.


All-State Insurance Company's utilization of a computer for commercial applications is described.


This details an application not well done on punched card equipment but made easier with computers, a gendre of applications made possible in the 1950s.


Preaches the gospel of technology applied to decision-making scientifically with computers.


Its business was largely driven by the introduction of computers suitable for commercial applications, such as the IBM 650.


This 31-page publication explains available electric accounting machines and sample applications explained.


This is a collection of European papers on American DF installations. They include reviews of Associated
Grocers of New Hampshire, Inc., Service Bureau Corporation, Dennison Manufacturing Co., Chesapeake & Ohio Railway Co. It includes questionnaire used.


Kruse, Benedict. "Electronic Brain Keeps Tabs on 11,500 Rexall Stores," American Business 24 (December 1954): 41-44. This compares applications before computers at the Rexall chain with comments on the impact of computers on the way the company was run.

Kuhnel, A.H. "Industrial Uses of Special Purpose Computers," Instruments and Automation 28 (July 1955): 1108-1113. This describes process control and industrial production from the late 1940s to mid-1950s.

Langman, A.W. "Television; Election Returns and Computing Machines," Nation 183 (November 3, 1956): 374-376. TV returns that year in the U.S. also included the use of computers to predict the outcome.

Lassing, Lawrence P. "Computers in Business," Scientific American 190 (January 1954): 21-25. The cases studied were Remington Rand's inventory management at John Plain Company, use of IBM 701s at Douglas Aircraft for engineering, and at Monsanto Chemical, UNIVAC at GE, all useful application briefs.

This is an early article on the use of computers in medicine and discussion about their potential uses.


Lehmer, of Berkeley, did research on number theoretical conjectures, using SWAC at UCLA.


The U.S. Army had been collecting such data since the 1880s and had, in fact, been an even earlier user of punch card equipment than most U.S. Government agencies of the late 1800s.


Inventory control became a major computer-based application in the late 1950s. This one describes the experience of a gas utility company managing materials and supplies.


The consulting firm reports on a May, 1959 survey it did on the use of DP: personnel displacement, improved management control, reduced expenses due to faster billing, and on improved competitive positions with 11 case studies. Nine were in manufacturing, and one each in railroads and airplanes.


This describes an electronic quotation service at the Toronto Stock Exchange in the early 1950s.


Papers presented at a symposium hosted by the Systems Development Corporation in Santa Monica, Cal. July 1959, are published. These application descriptions.


The author taught at the University of Indiana. His book was aimed at business managers on applications.

The topic is inventory control for a mail order firm. Benefits are described for the application.


Written at the dawn of the first generation of computers, the authors describe the use of digital processors in economic analysis, accounting, and in management.


20 applications are described in detailed along with available data processing equipment.


Describes use of a small computer on large statistical problems.


The application was at the John Plain Company and at GE in Louisville, Kentucky.


This very important book is a history of computer-based automatic machine tools (numerical control) from its earliest days at MIT (1940s). It includes the role of the U.S. Air Force (1950s). Argues that computers made it possible to shift control of production from skilled labor to managers and programmers, and not for economic but control reasons.


Although technical, this offers a comparison between manual and DP systems solving business, scientific and control problems.

This 29-page publication provides an early overview on computer uses in accounting and about ERMA.


Focus is on accounting/office applications.


Osborn was the business procedures manager at GE and was responsible for installing the first computer in the U.S. for commercial applications. He reviews the experience and describes the value of computers for business in general. It was an important article.


They describe the use of an IBM 650 at GE Research Laboratory in 1955 to study quantum mechanics.


This is an illustrated story of computers in medicine.


Surveys where it is being done, effects, and possible future from the vantage point of the mid-1950s. It includes applications in accounting, military, manufacturing, transportation and processing.


This application brief describes the first commercial use of a computer, UNIVAC, installed at GE's Appliance and Television Receiver Division in the early 1950s.


This was a very early report on the use of computers to process insurance records in the U.S.


Describes the rapid acceptance and use of computers in the U.S. for commercial applications in the previous, particularly in banking.

These applications are described and how to install explained. They were widely adopted by data centers.


Production control for a plant with 1,000 workers is described: use, costs, and benefits.


Focus is on the design and use of both types of computers and their application.


This describes work underway at Lockheed's Georgia Division to implement these applications.


This reports on GE's use of a UNIVAC, the first acquired for commercial applications: payroll accounting and scheduling.


Describes work done on a UNIVAC at the U.S. Bureau of the Census. The user describes how the application was done on the computer.


He describes how to use computers for economic analysis.


He describes statistical analysis as an application on the UNIVAC I computer.

An early user of LEO, a British computer, describes its application (1953-1960s) for payroll initially for 17,000 employees then other uses.


The author describes his experience using an NCR 102A in Ottawa. Velvet Gloves was the code name for an air-to-air guided missile designed in Canada.


This was extensive coverage on computers for its time for such a general U.S. audience. It is a good reflection of second generation computing costs and uses, as of 1958.


The author reviews use of a UNIVAC I by the John Hancock Mutual Life Insurance Company.

Spinning, H.M. "Calculation of Crude-Oil Run Tickets by Electronics," *The Oil and Gas Journal* 51 (February 1953): 70-71ff.

This industry became a major user of computers. This article was one of the first to describe uses of computers in the oil business, describing a tracking system for crude oil from gaugers' tickets to royalty payments.


Contains material on development of weather prediction with computers; illustrated.


This describes early use of computers for airline reservations.

Stickney, George F. "Treasury Department Check Reconciliation Project," in Lowell H. Hattery and George P. Bush (eds), *Electronics in Management* (Washington,
18 Bibliographic Guide


He surveys use, justification and plans for computerization of the management of over 350 million checks drawn annually on the U.S. Treasury.

3139 "Underwood's Electronic Brain; Elecom 125," American City 71 (December 1956): 19.

More than a description of a machine, how it was used by a city government is included.


These are hearings held on June 5, 1959 on their use by the U.S. Government and has material on the Census Bureau.


Papers by experts describe various types of uses in banking, technology, management. Contributors include Walter Buckingham, Vannevar Bush, John Diebold, James P. Mitchell, Ralph J. Cordiner, A.R. Zipf, and Walter P. Reuther. The volume is over 600 pages in length.


This is a comprehensive survey on the use of computers as of 1960 and is a major source on installed applications.


This 793 page document is a mine of information on the subject as applied to the U.S.

3144 U.S. Congress, House Subcommittee on Census and Government Statistics of the Committee on Post Office and Civil Service. Use of Electronic Data-Processing

Includes material on the management of such equipment.


These were very early hearings on data processing, surveying uses in banks and other financial institutions. Roger W. Bolz, editor of Automation Magazine, testified. Contains material on magnetic ink character recognition application.


This was an early study of the role played by instruments and automatic controllers in automation. Systems engineering and automation receive considerable attention by Albert F. Sperry who testified.


Offers considerable volume of data and argues that this industry in the U.S. was an early and extensive user of data processing equipment.


He explains the rationale and then describes uses.


Watson describes calculations done on the WHIRLWIND.


This is a detailed compendium of cases in the use of computers in the U.S., 1950s-1960s.

ERMA was the most widely-known banking application of the 1950s in the U.S.; described.


Its focus is on general management techniques, use and operation of computers, and operations research. It includes case studies and material on applications and management using such systems as IBM 702, 705, and UNIVAC.

Applications, 1960s


Application descriptions reach back into the 1960s.


This is a selection of articles published between 1962 and 1966 on accounting applications in the *Journal of Accountancy and Management Services.*


This is a history of its development in 1958 by Willy Higinbotham at Brookhaven National Laboratory. It was tennis on an oscilloscope; illustrated.


Covers all manner of equipment not just computers.


In addition to describing hardware, it describes commercial applications using computers and cards.


This is a common use of computers, to manage traffic.

CAD applications came into their own in the 1960s. This is a good introduction to the subject.


Describes an early word-processing package called ESI, a batch system.


Process control applications are described.


Continues the theme of the previous citation.


This surveys computers and nursing from 1960s onward.


This is a history of video games from 1972 to 1978 in the U.S. Reviews Space Invaders, Pac-Man, Donkey Kong, along with the people and equipment involved.


He describes the evolution and features of one of the largest online systems in the world. It was used by IBM's salesmen from 1970 onward.


Prepared for the Business Equipment Manufacturer's Association, contains compilation of applications.


This is an important survey of all aspects of computing with emphasis on the uses to which such technology was put by the mid-1960s.

3168 Brewer, Donald W. The Impact of the Electronic Computer

Process and manufacturing applications are described.


This was one of the first publications to teach methodically DP techniques, including how to organize data files and sort type; a minor classic.


These included office applications and simulation.


This describes scientific uses of computers in U.S.A.


CAI came into initial form in the 1960s, described.


Chemical engineering relied on computers by the 1960s with their applications described here.


This contains descriptions of such common applications as payroll, general ledger, and accounts receivables and inventory management.


This reviews status and plans for state and local governments in California in 128 locations.


This was an early, important, and well done introduction to the subject of DP and on its uses.


They survey the evolution of this application from 1958 to 1980, particularly for semiconductor designs.

Includes some history of computer applications from the 1940s to the 1970s from a series of seminars.


The system managed diplomatic communications between consular and embassy locations with Washington, D.C.


This describes an early commercial use of cooperative processing in which numerous users employed the same computer and for a fee.


Essentially inventory and retail applications as applied to book stores are described.


Project MAC was MIT's campus-wide time sharing system.


This is a case study on the use of computers in the British financial community in the 1970s and 1980s.


Describes the use of computers in CAI education before the advent of the micro computer.


Surveys text processing methods up to the mid-1970s.


This is on programming large projects in the 1960s; done at MIT.
This is a British "how to" book for hackers.

This reports on one of the first, major such projects in the United States.

Diebold, already well recognized as an expert on automation, comments on future trends in data processing.

This was a very lucid, early book on the subject as of the early 1960s.

This is an inventory of recent application trends in the U.S. banking industry.

It includes discussion of many application areas.

This addresses the interactive and data handling abilities of computers to provide "what if" simulation of decision options.

This is a broad study of applications and equipment as of the early 1960s.

Besides a general discussion of the subject, they include comments on systems at MIT.
This describes IBM's role in managing air pollution, solar energy, plasma physics, coal gasification, and energy conservation with computers in the 1960s and 1970s.

This is on law effecting computers and is a compendium of cases, applications and sources of information—a major source on the subject.

Written at a time when insurance companies were moving toward computerized applications quickly.

The period covered is from 1962 to 1982, and surveys hardware and applications for automated teller terminals used by U.S. banks.

Focus is on scientific uses, circa early 1960s.

Reviews two major U.S. DP projects, one at Sylvania and the other at American Air Lines, both of the 1950s.

The article consists of cases in the use of computers in industrial applications and why.

Compares Marcus Vitruvius Polio's work on design methods to what is done today with some material on methodologies of the 1960s and 1970s.

3204 Geller, I. "Master Machines of Retailing," Duns

Describes retail applications and machines (point-of-sale terminals) of the 1960s.


These are good examples of how the banking industry applied computer-related technology to specific applications.


A commercial application relying on computerized data management, described and with benefits.


Eighteen incidents illustrate dependence on computers and impact of such events.


This is a good introduction to CAI applications.


This is one of several important surveys done in the early 1960s on what applications had been implemented in the U.S.


This is a brief survey of CAI applications.


Surveys trends, reviews TP, EFT, ATMs, credit cards as part of the account of changes in banking.


The author, of Bell Telephone Labs, described computers as of 1970 and their use in business, science, and education in non-technical terms.

In addition to discussing the application, the authors include a bibliography on the topic.


This is comprehensive, well-prepared, covering all types of library applications, existing installations and costs and benefits as of the late 1960s.


He describes this class of applications with cases.


This short book surveys all kinds of public sector applications for computers as of the early 1960s.


This introduces basic applications as of late 1950s.


Describes their use of an IBM 7090 at RCA's laboratories at Princeton, N.J.


On the use of, terminology and technology of computers in humanities; includes a bibliography.


Surveys over 2000 computer users in the U.S., showing installed applications by industry, programming languages in use, manpower, and expenses.


The application is in education.

In the 1960s U.S. Internal Revenue Service began to develop computerized applications; this is an early report on the project.


This became an early application to be computerized.


This is on research and teaching in U.S. hospitals and on medical computing's impact on medical culture.


Describes the impact of DP on accounting and auditing and describes standard uses of computers in these fields.


This collection of lectures were delivered by the creator of BASIC.


They developed a system for teaching students about computing; they describe the application.


By the late 1960s this application was over twenty years old. Recent developments are discussed.


The author describes software he used to make movies.


Surveys over 100 computer installations using this technology for process/manufacturing control.


This became one of the most widely read books on why
and how to use DP in business; it preceded hundreds of other books on the same subject.


This was a relatively new application area in the early 1960s, but one that grew all through the 1960s.


This American "how to" book was written by a highly experienced computer hacker on the subject.


Described software that could be used to do analysis of photomicrographs of neuron dendrites in the early 1960s.


This is a very early article on the subject.


Contains advice on how to manage, install and pay for DP, and describes applications.


Provides a good survey of the application.


By the early 1960s computers were beginning to play a major role in complex engineering applications.


This describes who they were and then offers a series of stories of true incidents of the 1970s and 1980s. It offers comments on their characteristics and is well researched.


This covers both applications and implementation as of the mid-1960s.

This describes applications, their benefits, costs and how best to implement with cases and examples.


This includes a history of robots (pp. 33-55) and then describes their application today and future.


Describes a fixed format form for resolving inventory level projections.


"Cooperative use" was the phrase employed in the 1960s for either time-sharing on a system or work done through a service bureau, both described here.


Describes computer applications at the U.S. IRS.


Surveys the use of micros and applications in the financial industry in Great Britain during the 1980s with some data on the 1970s.


Describes IBM's software to teach young children how to read using micro computers. It was a widely used software package in the late 1980s; includes its development.


This is as much a description of applications and data management as it is of DP technology.


This constituted the largest and earliest, set of commercial applications brought onto computers in the 1950s and 1960s.

This is a formal description of Xerox's local area network offering of the 1970s, still available in the 1980s.


PERT was a useful batch system for planning such activities as the volume of transactions on a telephone line for optimal use and managing the tasks of a complex project.


What-if analysis with computers just came into use in this period; possibilities are discussed.


This technical, quantitative analysis reviews ATLAS in 1966 and how it performed; a confusing paper.


The authors review available accounting and office equipment and their uses as of the early 1960s.


An early application of computers to data gathering from a telescope is described.


The focus is on management in general: their ability to make decisions differently, impact on organizations and cost structures in the 1960s.


This 16-page report reviews uses and equipment for point-of-sale transactions as of the late 1950s.

It contains discussion on selection and training of DP personnel, along with application briefs.


This reviews just applications in these two fields.


Describes applications, cost comparisons, organization; a major work on the subject.


The period is 1956-1980, the subject is application work at the Federal Systems Division of IBM on military systems and technical developments.


Contains a chapter on the history of computers in education and a detailed bibliography.


Describes office applications.


This is the only history available of the stock quotation software used from the early 1960s to the 1980s. It had over 72,000 users; illustrated.


This describes how telecommunications was done and gave examples of applications.


Describes specialized equipment and their uses in manufacturing, processing, and refinery installations.

Describes their nature, how to manage, with examples.


Focus is on applications of computers in Great Britain's insurance industry in the 1970s and 1980s.


RIA surveyed 2,422 organizations about how they did or, did not, use computers, explaining reasons, costs and number and type of applications.


This banking application is explained in detail.


Discusses U.S. IRS's early use of computers in tax collection and management.


Survey results of a study done by the American Bankers Association involving 4,865 banks are presented with details on what was automated and why.


Describes investment management automation.


PERT became a popular management tool in the 1960s; described.


This is on an R&D project for computer usage in science.

Surveys over 10,000 jobs run on an IBM 7090 at the University of Michigan.


Discusses the role of security and privacy as social and legal issues growing out of new applications.

3278 "Rx for Hospitals: Computers; Information System at Massachusetts General Hospital and Missouri Medical Center," Business Week (May 15, 1965): 142ff.

Medical uses of computers are described along with what hardware.


The response is to growth of systems that could not share data, a common problem of the late 1970s/1980s.


This was one of a series of AMA reports on new uses for computers; this one was on simulation of options.


This survey of applications is in response to vast expansion in use of computers in the mid-1960s.


Its basis was the experience of Federated Department Stores, Inc., in the early 1960s using a computer to model options in decisions.


This is a witty tale of an historian using a computer to research the stage's calendar, 1600-1800.

Scheduling is described, an early use of computers for the management of schools and colleges.


This 112-page monograph has some history of expert systems although its primary focus is on descriptions of such applications and about their construction.


This was a new use for computers in the 1970s, some background on the 1960s is provided.


This describes "cooperative use" or time-sharing in a service bureau environment.


This describes the applications involved.


This describes a novel use of computers, one that would become very common during the 1980s.


This became a series of new applications by the early 1960s which are partially described here and why.


It offers a history of speech synthesis and a survey of then available speech synthesis techniques.


It goes from writing to computers with details on the
author's work at Stanford University in 1963 on CAI.


The exception principle was to produce computer generated reports with data only on situations out of the norm rather than the results of all transactions of one type. It became a common design feature by the 1970s.


The concept is described with examples of use.


This is a very useful introduction to the subject.


Booze, Allen & Hamilton surveyed U.S. companies to see how they used computers in the 1960s.


The use of computers to help design buildings was a new application in the 1960s described here.


The use of TP in business applications is described.


Describes how IBM machines were used to track and predict the results of the U.S. national elections of 1960.


This is the original user guide for the use of PERT, a project management package developed as part of the POLARIS submarine program.

3301 U.S. Office of Technology Assessment. Effects of

Done at the request of the U.S. Congress, it covers the activities of U.S. banks (1960s-80s).


This is an interview with Van Dam who discusses how the application evolved from SAGE days to the present.


This continues the work of R.F. Rosin (No. 3276) on work run on an IBM 7090 at the University of Michigan.


Process control application is described.


This time it was done with a computer.

3307 "Western Union Hums with Data; Computer Data-Transmission," Business Week (February 20, 1965): 150-152.

This is a telecommunications application brief.


This describes engineering CAD applications.


This is about CICS, one of the most widely used application sub-systems in the industry, made by IBM.

Artificial Intelligence


Includes contributions by Alan Turing on computer capabilities to think.
This is a biography of Minsky and about his work in AI at MIT, 1940s-1970s.

Represents a summary of arguments in favor of expert systems.

This is a multi-disciplinary collection of papers on AI with a bent toward philosophical issues.

This is a survey of stories of a robotic creature that had AI qualities from the Middle Ages.

Catalogs various AI projects of the 1970s and arguments in favor of such research.

It is an historical review down to the 1950s.

This is an important work, written by a professor at Berkeley (university of California), he attacked the field of AI.

Originally published in 1885 as Über das Gedächtnis, this book reflected the modern psychological study of memory, a subject area as precursor of AI.

This is a sampling of papers by members of the AI community and includes A. Turing's essay, "Computing Machinery and Intelligence."

This is a collection of AI papers presented at conferences between 1964 and 1980.


Fodor suggested that a human's mind is a computer.


This has some historical perspective and is a side-avenue of AI.


This is an excellent history from the revolt against behaviorism through Turing, von Neumann and Wiener down through the early years of computers. It also describes parallel developments in cognitive sciences.


Set in a social context, this is a good survey of the subject as of the late 1950s.


Contains historical data on AI, linguistics, neuroscience, psychology, philosophy and anthropology. Includes a good bibliography.


AI was a field riddled with false promises and constantly with controversy. These are reviewed.


She argues that people always were in search of AI and that much progress had been made in the development of this field of study. Includes historical notes.


This collection of material includes his "Essay on the Origin of Language" which deals with the debate in the 18th century on "artificial language."

This mechanistic view is an early piece on AI by the individual who later developed BASIC programming language.


This is a biography of Donald Mitchie and about AI at the Turing Institute. Mitchie also worked on the Colossus computer during World War II.


In this well-written article on the 1986 Fifth World Computer Chess Championship in Cologne, is a history of computer chess.


This is a very good history of AI with focus on motivations of computer scientists working in the field; covers 1950s to 1970s.


A collection of reprinted writings of his, the physiological psychiatrist, who worked on physiological aspects of neural network theory and on the theory of automata, reviews his ideas.


The subject is cybernetics and education.


This was one of the earliest articles to suggest humans thought like computers, even calling the brain a storage device.


One of the giants of AI writes on the subject in general terms.

This is his version of AI's history: intents, issues and results since the 1950s.


This series of articles by various scientists working on AI reflects activities of the 1960s.


This critical piece reflects his views on AI, a seminal article by Minsky.


This discussion of AI is on vision-type intelligent devices. It was an early work on Minsky’s interest in robotics.


This was at the heart of AI’s role and mission.


A better understanding of how the human brain did that would allow AI to progress to a similar pattern of behavior, the subject and intent of this work.


This is an illustrated history of AI, taking the story from the 17th century down to von Neumann computers.


Builds the case for AI, vintage 1970s.


This illustrated account is a popular history of robots with AI intermixed.


Details role of MIT and of the U.S. Government in AI.

This describes computer use of chess-playing games.


Describes the evolution of computers, how human minds work, and then how the two will join together. It includes history of artificial intelligence.


Linguistics influenced scientists working on AI. This book offers a history that serves as good background to a branch of AI.


This is as much a survey of how computers were being applied to leading edge applications in the 1960s-1980s, as it was on AI.


This describes computer chess-playing in 1958; 704 refers to the computer used to perform the tasks.


This popularizer of serious scientific thought, a professor of astronomy, wrote that computers represented an advancement of the human brain.


By the early 1960s AI's potential were being written about in all manner of publications, including in political science.


A major figure in AI and information theory poses some of the fundamental questions on AI while describing the characteristics of a chess-playing machine using computers.

This was the first major work on the subject of information theory in modern times. This important work illustrated how data on a line could be quantifiably measured and analyzed. It was the book that most launched information theory as a subject for study. It was based on research done at Bell Laboratories on communication problems.


Edited by two important figures in the early history of AI and information theory, these are the proceedings of a conference held at Dartmouth College in the summer of 1956, one of the first held on AI. The publication is a crucial piece of AI history.


A strong proponent of AI articulates his views. He thinks of man as a processor of information.


Two leading AI experts reviewed their early work with IPL-V at Carnegie in the 1950s.


This is a non-technical survey of AI and includes history, philosophical implications and current issues.


The author attacked the fundamental ideas and hopes of those working on AI. His was one of the earliest attacks on the general field of AI.


This is primarily on U.S. developments since the 1940s.


This is on Soviet research on AI; the author is a specialist in the theory of automata.
This is an historical account of computers down to and including AI.

This is an illustrated biography of a great mathematician and proponent of AI.

This is a short biography of Claude Shannon and about his work in information theory.

This is a survey of AI for the general reader with an historical overview.

Games and AI were bound together in the late 1950s and early 1960s; this explains much activity of the period in computerizing chess and other thinking games.

This is a history of science fiction's treatment of artificial intelligence.

This is an outstanding book on the impact of computers and on the scientific relationship to man's rationality and self image. The author taught at MIT and developed SLIP.

This important paper in the field of AI described a language that simulated discussions between patient and psychoanalyst.

It was the first seminal book to contain the argument
that human language influenced one's view of the world. It encouraged the study of linguistics and programming languages.


This is a classic in the field of AI, first published in 1948. It gave definition to the new field.


This paper explained his notion of cybernetics, and introduced the word. It was the case for AI before it was called that.


This is one of his later works on the subject of AI.


All through the 1960s Wiener continued to discuss human thinking, the structure of nervous systems and role in information theory and handling.


This is the second volume of his autobiography. This focuses on his career and how he helped to establish the field of cybernetics.


He answers the question with No.


This is a large collection of his papers with commentaries. Volume 4 is on cybernetics; the first three are on mathematics, physics and philosophy.


Argues that computers could be the greatest threat to man's ascendancy by outgrowing his control.

CAFS was better known in Europe than in American computer circles in the 1980s.


This helps understand DB developments of the 1970s.


SEQUEL was a general purpose query language that had DBMS features common to many systems of the 1970s.


This early relational data base was developed at the University of Toronto; a technical description.


This is a market survey for DBMS packages.


DMS was Univac's DBMS software of the 1970s.


This is the only survey available on DB and file management software covering the period from the 1950s to the mid-1970s.


This is a technical description of an early relational DBMS, developed at the University of California, Berkeley.


See also No. 3388 for more details on CAFS.

This surveys the role IBM played in the development of DBMS from the 1950s through the 1970s. States that the term data base came into existence in 1964.


This was an important, formal technical description of IBM's DB and data communications subsystem of the 1970s and early 1980s.


This is a very brief survey of major file handling methods and software from the 1940s to the 1980s.


This was one of the first technical papers on data structuring and on hashing as a method frequently used in the 1960s.


This is a relatively non-technical review of DB designs at the dawn of the 1970s, the decade that saw the appearance of numerous DBMS.


This was a semantic data base of the 1970s; the article is a technical description of its features.


ORACLE was an early relational DBMS.


This technical description concerns a DBMS developed by General Motors.
Discrete Simulation


Crane describes how computers were and could be used in support of social science topics.


Described SIMULA, developed in 1965 and ran on a UNIVAC 1107.


This was a software modeling package developed at RAND Corporation.


This is a technical description of GPSS, originally developed to model telecommunication networks.


The father of GPSS describes the program.


He describes the features and use of GPSS.


This is a short description of OPS, developed at MIT in the early 1960s.


This is the fullest description of the features and uses for OPS, a very early online simulator.


Describes a later version of a widely used tool.

He describes OPS-4.


This surveys languages of the mid-1960s.


Describes an ALGOL-like modeling package.


See previous citation; same theme.


This is an excellent survey of the strengths and weaknesses of languages for discrete simulation such as DYNAMO, GPSS, SIMSCRIPT, SOL, MILITRAN, SIMULA and OPS.


This is the earliest book-length description of a language to do computerized simulations; developed at RAND Corporation.


This is a useful survey of programming languages to do simulations of the 1960s.


A useful snapshot of the tools that were available in the 1960s.

Graphics

Corbin, H.S. and Frank, W.L. "Display Oriented
Provided graphic display outlet for Fortran problems.

This is a survey of available graphic tools of the early 1960s.

GL was used to display data.

This is a useful snapshot of graphic software of the 1960s.

Surveys issues related to the development of graphics software in the mid-1960s.

Originally run on an IBM 7040 under MULTILANG, the software was called PENCIL, a simple data structure graphic language.

This describes PENCIL that ran under MULTILANG.

Surveys the effort to build a staff at Metropolitan Life Insurance Company.

This is an anthology of 25 papers delivered at the AMA's 1959 Annual Office Management Conference and range from automation to operations research with case studies.


Twenty representatives of U.S. companies described their experiences at AMA's Electronics Conference, March 1955. Topics included evolution of DP, planning, equipment and uses; includes glossary of terms.


Thirteen papers are presented by U.S. companies from AMA's third Annual Electronics Conference and Exhibit, February 1957. Topics included feasibility studies, applications, and prospects. Others were selection and training problems, operations research.


Sixteen papers and four cases are from an AMA conference held in February-March 1956. Topics included installation efforts and management of people.


Focus is on methods as influenced by DP on people management.


Thirteen papers are from the AMA Conference on Automation, October 1955. Topics included computers, factory automation, and cases.

American Management Association, 1956.

Eleven papers are from the AMA conference Electronics at Work, February 1956. Topics included feasibility studies, personnel, applications; 11 companies presented.


These papers deal with basic principles, centralization vs. decentralization, applications, operations research, and include case studies.


Discusses financial considerations influencing decisions of the mid-1950s in the U.S. as second generation computers shipped in quantity.


By reviewing how an insurance company cost-justified its acquisition of a computer, one sees what factors were used in the mid-1950s; payback was 5-6 years.


Bagby comments on his experience in installing the first computer at Pacific Mutual in 1953 and about how employee morale was preserved.


Describes punch cards, computers, DP and how to develop applications, their design and programming.


Services as a lucid survey for non-technical readers.


Management is defined as all managers, not just those in data processing.

More than just a description of hardware, this tells how they were being configured and used in 11 cases.


While a general introduction, it covers their use as of the mid-1950s and comments on the IBM 700s.


They surveyed organizational issues associated with the installation of a computer system; excellent.


Surveys management problems and issues related to automated manufacturing; includes 13 U.S. cases that had leading edge applications in 1954.


This manual describes operating procedures to make effective use of its products.


Identifies sources of expenses associated with installing computers in the early to mid-1950s and shares what early users have discovered.


Provides advice on how to use and select DP solutions with cost justification.


This is a tactical guide with numerous case studies.


Offers cost justification, operational advice.

Chapin's overview of computer concepts was one of the best of the early books and was widely read by management concerned with data processing.


While based on first generation technology, focus is on potential uses of computers in business applications, costs and benefits. It includes a list of computer service bureaus of the period.


Included subjects are experiences with acquisition decisions, introduction to DP systems the first time, conversion from other systems and methods, management of DP systems, relations with vendors.


This involved computerization at the Port.


This offers suggestions on how to address the issue of cost justification and financing data processing.

Craig, Harold F. *Administering a Conversion to Electronic Accounting.* Boston: Harvard University, Graduate School of Business Administration, 1955.

This is a cost study of an insurance company's experience in moving to punch card accounting and reflects a very early experience with EDP (1950s).


This is an excellent look at the concerns of employees when a computer was first installed in early 1950s, with suggestions on how best to manage the issue.

Describes experiences at the U.S. National Bureau of Standards computation lab, emphasizing the importance of teamwork in complex projects.


The debate whether to keep all computing in one data center or distribute computing to many locations has its pros and cons, discussed here in an early article on the topic.


Presents results of survey on DP job descriptions, titles, salaries all from the New York area, 1957.


This is a 54-page catalog of why people do not use computers, why and how some do, and who makes the decision to acquire them.


Includes cartoons on automation; a light survey.


This consists of 43 short articles by McKinsey's employees on lessons for management. Topics include DP in transition, information systems, management.


The author, Director of Control Data Processing at Detroit Edison, described the first computer installation there and effects on staffs; an early publication by a DP manager.


This is one of the earliest articles to discuss the effect of computers on organizational structures and processes; based on experience within the U.S. Government in the early to mid-1950s.


This described Sylvania's first installation and its effects on management.


Describes how businesses were using computers most efficiently and about management's role. Surveys uses at American Airlines and at Sylvania Electric Products, Inc.


Surveys publications of the early 1950s on the management of computing.


This is a well-done reflection of managerial concerns of the mid-1950s.


An internal GE publication, it reviews role of computers, applications, and management as of 1952.


Surveys the history of computers, programming and other DP issues. Cost justifications are included.

Covers all aspects of the topic. Vol. 1 is primarily on mathematics and control functions, 2 on DP technology, 3 on systems and components with focus on systems engineering.


Reflects DP technology as of the late 1950s, management and acquisition patterns.


This surveys equipment, systems design, programming and applications. Both authors worked at RAND Corporation; includes bibliography and list of widely read DP journals of the early 1960s.


Sylvania, a highly decentralized firm, wanted to reverse the trend toward increasing numbers of clerical staff and thus created a centralized DP center but run with decentralized management.


Carries on the same theme as the previous citation.


This is as much an article about its use and management as it is about its development scientifically.


Summarizes functional characteristics and costs of 148 DP systems and covers management issues associated with computers.

This is a manager's guide to data processing.


Reviews challenges facing managers applying this new technology to their organizations, 1950s-1960s.


This is a collection of papers presented at the First Institute on Electronics in Management held at American University in November 1955 with focus on management issues and case studies from the 1950s.


The article is detailed and a useful reflection of both managerial and organizational issues.


Reflects the concerns and lessons learned in installing computers in 19 organizations for the first time.


This IBMer looked out at the future for management issues involving computers and in the process discussed concerns of many managers in the new industry of 1955-56.


IBM reviews what a DP organization should look like and offers job descriptions, circa second generation era.


These were papers presented at a conference held at Wayne University on manpower requirements and education for DP professionals.

Scanned OCR with permission of Greenwood Press [19 June 2009]

The central theme is the organizational consequences of DP, and argues that computers are forcing various departments to work together due to centralization of data required for computer-based applications.


Written by a computer literate accountant, this reflects concerns of accountants during the 1950s and 1960s while describing accounting applications.


This is a discussion of how to plan for an initial computer installation, using Port of New York Authority as the base case.


This well-known author of management books surveys the office of the late 1950s/early 1960s stressing human relations as crucial rather than the use of technology or specific methods of management.


Emphasis is on applications in business, experience with initial uses, impact on management, control and selection of devices.


Computers made possible either alternative, igniting considerable debate on the issue.

3497 Laubach, Peter B. *Company Investigations of Automatic Data Processing.* Boston: Harvard University, Graduate School of Business Administration, 1957.

Surveys how various companies conducted feasibility studies in the early 1950s for new computers.


Covers systems analysis, charting, auditing, measurements, forms control, records management, DP equipment selection and DP personnel.

This attempted to define trends in management that included the use of computers.


This is a series of lectures delivered at Dundee Technical College on computers with attention paid to how they worked, the measurement of their value, effectiveness, and applications.


Experiences of the 1950s suggests that changes were significant due to all manner of automation.


With equipment becoming more reliable and less expensive, more was being used.


This was made possible by the advent of new technologies, such as the computer.


Reviews the effects of a DP decentralization decision at Prudential Life Insurance Company.


Describes how to develop a computer application based on the experience at Middletown Air Material Area, Olmsted Air Force Base, Pennsylvania.


Focuses on how to organize for and implement second generation computing with examples.

It includes a review of management issues, such as training and organization in data processing.

Includes a chapter on integrated management reporting systems, and discusses DP feasibility studies, concepts and applications; revised version of 1950 ed.

This became a classic on systems during the 1950s, written at the dawn of the computer.

This 10-page publication describes problems, justifications, avoidable mistakes and guidelines for management based on experiences gained in the 1950s.

This Harvard professor included material on the use of business machines of the 1920s and 1930s with comments similar to many made in the 1950s.

He offers a general theory and observations on systems analysis for the development of business applications. Includes 10 case studies on how companies handled computers in the 1950s.

This 77-page document was a byproduct of a European visit to the U.S. in April–June 1960 on how best to do installations and when to use service bureaus. It also comments on the role of government.

3514 Place, Irene. *Administrative Systems Analysis.* Ann Arbor, Mich.: Bureau of Business Research, School of Business Administration, University of Michigan, 1957.
This 83-page document is a useful description of the role played by systems analysts in the 1950s; survey results included.

3515 Postley, John A. *Computers and People: Business Activity in the New World of Data Processing.* New York:
The author, from RAND Corporation, surveyed impact of computers as of the late 1950s, on business, end users, applications and its industry at large.


Surveys auditing in DP systems with suggestions on how to maintain an "audit trail" in systems, using a payroll application to illustrate the process.


This was one of the first conferences held on the subject in the U.S.


Topics included purchase vs. rent, programming and feasibility studies in the insurance industry. LOMA conferences annually included discussions about computing issues beginning with the conference of 1957 in Washington, D.C.


Summarizes experiences in tailoring a DP system to fit logistic and business applications for the U.S. Navy; the study sponsored by the ONR.


This user described management issues involved when switching to a computer system in the 1950s.


Eleven papers are presented from a seminar hosted by the Graduate School of Business Administration of the University of Chicago and the McKinsey Foundation in February 1959. It has 4 sections: "Information: Technology and Management Organization," "Technical Developments and Their Use by Management," "Organization: Concepts and Problems," "Information Technology: Experience in Five Companies."

3522 Simmons, Leo C. "Executive Problems and Opportunities Arising Out of Automatic Systems," in Lowell H. Hattery and George P. Bush (eds), Electronics in Management (Washington, D.C.: University Press of

Reviews experience of the U.S. Steel Corporation with computers in the early 1950s.


Reviews its possibilities for the 1960s.


This is typical of many such publications of the period; directed toward non-DP management.

3525 Smith, Robert M. "Is This a Blue-print for Tomorrow's Offices?" Office Management (August 1955); 12-14ff.

Describes the installation of office applications at Sylvania Electric in the mid-1950s.


Describes how the County of Los Angeles did it in the 1950s, with financial examples.


This is a set of 3 excellent booklets on applications, programming, and an annotated bibliography.


This 12-page publication advises on programming, recruitment of personnel, training, site preparation, delivery and installation of computers.

3529 Starbuck, William H. "Computing Machines: Rent or Buy?", The Journal of Industrial Engineering 9, No. 4 (July-August 1958); 254-258.

This is a detailed analysis of the topic and is a good window into second generation computer economics.


The automation includes computing.

The discussion goes beyond computing to N/C machines and shop floor automation.

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This is a series of papers presented at the General Management Conference of the AMA, May 23-25, 1955.


This is an 8-page report on the impact of DP on SPA member companies in the U.S. Contains results of a survey on the tasks of the systems analyst along with the role of 15 vendors.


Cites examples of clerical and mathematical applications and discusses hardware needs for these.

3535 Thurston, Philip H. **Systems and Procedures, Responsibility.** Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1959.

He describes the opinions of systems analysts and operators regarding their work in the late 1950s.


Suggests what one had to do in order to install DP systems in the early 1950s.


Reviews the basics of DP, offering information on installing DP equipment in the late 1950s.

Reviews problems experienced by U.S. Government agencies in setting up DP shops in the 1950s and includes excellent material on general worker forces, such as at the U.S. Veterans Administration.


Carl Barnes, of CSS, directed the preparation of this study, a "how to" based on lessons learned in the 1950s.


The U.S.A.F. was, in the late 1950s, the world's largest user of computers. This publication is an excellent guide, reflecting this service's experience with data processing and computers.


This early U.S.A. publication on DP covers most aspects in an introductory manner along with management tips and cost justification.


This is a useful introduction to issues of the 1950s and sizing of the acceptance of computers in U.S.A.


This provides occupational descriptions for 13 jobs that range from "coding clerk" to analysts, programmers to tape librarians.


Known as the Navy's "Gray Book" on DP, offering advice, particularly on personnel matters.

"UCLA to Train Computer Technicians," Business Week
University of California—Los Angeles had a long and early association with computers; this describes its computer training program.


Surveys the failure of Bremfort Company to use computers effectively, describing why. This is an unusual survey since most described why they were successful.


This accountant argues, as did most in the 1950s, that computers should be justified on the basis of reduced clerical costs; explains how to do the analysis.


Relates experiences of several U.S. organizations with emphasis on effects upon employees with the introduction of computers.


Includes a salary and position survey done in 1960.


See No. 3542 for a variation in the citation.

Management of Data Processing, 1960s-1970s


An early article on physical security of systems.


Automation is primarily computer-based.

In addition to discussion of applications and their management, as known in Great Britain, is a chapter on ICT in the 1960s (pp. 164-193).

3554

This is an early college text reflecting thinking of the 1960s.

3555

This was a widely-used volume and reflects early concerns with the audability of applications.

3556

This describes specific experience using PERT.

3557

124 companies were researched on the management of data centers, covering all aspects of a DP manager's job; excellent for late 1950s and early 1960s.

3558

Argues that many executives were resisting use of computers and gives many examples of why.

3559

This surveys the "sociology" of programmers: their work habits and behavior.

3560

The effect on management was reviewed as well.

3561

This describes management issues.

3562
This technology causes changes to vertical and horizontal structures and to decision-making.


While mainly in the insurance industry, the effects on management generally are a reflection of the thinking of the 1960s.


This is very much on organizational issues.


Useful for defining job positions of the 1960s and typical management issues.


This is on British experience.


This is a DP view of the subject.


Recounts his experience in the 1960s.


The authors were all business executives who discussed the impact of computers on their organizations in the 1960s.


Now applications and usage were decided upon in the 1960s is the subject.

3571 Daniel, D. Ronald. "Measure Your EDP Progress: A

He comments on the growth of computer usage in the U.S. and its characteristics.


He argues that computers did not affect senior management's ability to control business functions.


Based on the experiences of various U.S. companies.


They challenge the notion that programming's documented remains can tell us about the nature of a programmer's behavior.


This covers the subject broadly with many comments on the use of computers in the American economy.


The first such article to be published on the subject.


This is a series of papers presented at SUNY, Stony Book, N.Y. in 1967 on American programs in graduate and academic projects; research included.


Case studies of experiences are presented.


All were management related and grounded in case studies.

This is advice to management by a consulting firm.


This is less about personnel than about organization as affected by technological introductions.


Published at the peak of academic debate on whether DP was a new discipline or not.


Argues that this was a new field, different from either mathematics or engineering.


Describes the DP department and how to run it.


They describe the function as practised in the 1960s.


Haines and co-authors describe data processing organizations.


Decentralization of information and responsibility is the theme of the article.


Useful as a reflection of practises in early 1960s.

This publication focuses on the use of DP as decision-making tools for management.


This was an ideal sought after and elaborated upon all during the 1960s and 1970s, described here.

3591 "How to Spend the Computer Budget; Buy, Rent, or Lease," Business Week (June 1, 1968): 100ff.

Based on U.S. tax and accounting practices of the 1960s.


This continues a discussion begun in the 1950s and extended down to the present.


Focus is on the measurement financially of a manager's performance using computers to help in the 1960s.


This is an application brief directed toward management based on late 1950s and early 1960s experiences.


By the mid-1960s quite a body of literature was developing on the subject; this reflects the issues.


Describes how it was becoming considerable and why.


Kraft has studied programmers and their work.

This is a major study of work flows in DP shops.


Essentially restates his position from his book on the same topic.


This is not limited just to DP workers of the early 1960s and late 1950s.


Obsolescence is of equipment, applications and procedures.


The effects were clearly evident by the early 1960s. This is one of many publications to describe the process at work in the U.S.


This is a useful analysis of a workforce that came into its own only in the late 1950s/early 1960s.


Defines such positions as programmer, systems analyst and computer operator as of the 1960s.


A useful source that describes how application development took place in the 1960s.


Suggestions based on experiences of the 1970s.

Management Review 3, No. 3 (Spring 1961): 4-16.

Their focus is on management structure and controls.


Computers were making it possible to know how things were happening as they took place, making it possible to make changes quickly in a timely fashion.


Computers created more deadlines than before existed. Deadlines were now more important than before.


A fascinating view economically of our response to more information with which to manage organizations.


Besides being focused on scientific applications, the notion of what was more managable is included.


For the historian of DP it is useful for understanding the impact of great technological complexity and change on the management of a large project.


This "how to" book was directed at DP managers of the early 1960s; contains 10 case studies of DP centers.


Computers were determined here as not taking over, helping and with examples from the early 1960s.


Carries on the same theme as the previous citation.

As with other articles of the early 1960s, many were identifying the initial effects of computers.


This reprints 9 papers from a conference on the subject covering such issues as organizational control, economic environments, real-time systems, computers and profit centers, and integrated manufacturing.


Myers calls up a common view of the time, that more computers would be used in creative ways.


Now a minor classic, he defines various stages in the evolution of DP: organization, applications, technology, and administration.


This collection of papers deal with DP management issues.


Discusses the cost effectiveness of data processing.


Intended for the DP manager of the late 1960s with discussion on project management, feasibility studies, and application development.


Besides explaining the technology, it discusses management issues.


Reflected practise of the period.


In part it was caused by the use of computers.

Surveys literature on the subject and then impact on a manufacturing company.


This 330-page book contains many experiences drawn from the 1960s.


This is a college text with some history, and includes a lengthy discussion of the use and management of DP as of the early 1960s and late 1950s; includes illustrations, bibliography and glossary.


A rare study of the effect of computers only partially mentioned in other studies.


Reviews the significant commitment to computers made by Travelers Insurance Company, describing the effects on it and the industry.


Focus is on labor and automation, a subject of major concern in the early 1960s.


While describing U.S. military practice, the subject at large was explored as of the 1960s.


This was one of many studies on the subject since the U.S. Government was an extensive user of computers.

IRS was an early user of computers; applications and management practices are reviewed.


The subject was frequently studied by U.S. agencies in the 1950s and early 1960s as it affected the American at large and through case studies.


Organizational and justification issues are major themes of the period and the article reflects common opinions of the early 1960s.


In this useful, early study of the subject, he shows how to study programs to understand programmers and their work.


This is as much on time-sharing and the interest in it as about SDS.


The issues are management of organizations, circa 1960.


Discusses leasing and renting of computer equipment.


It includes examples of centralization, mid-1960s.


More than the title suggests, accountancy is part of the discussion.


Besides describing hardware of the 1970s, it describes its use and management.
Office Applications


Surveys use of computers in accounting and small office applications at the start of the 1950s.


Describes office applications at U.S. Steel Corp.


Focuses on how to install applications doing clerical work on insurance and payroll files.


Shows examples of integrated systems of the 1960s. This issue of Duns Review has several articles on DP.


This is a comprehensive manual on what to install for which applications in accounting, science, all first generation activity.


Describes existing office applications in detail.


Useful for understanding offices of the late 1950s.


Levin details common applications, many on office.


Studies secretaries and word processors covering all of the twentieth century in the U.S.

Includes material on 7 basic clerical operations and computing equipment to work on these of the 1950s.


This is a major review of the status as of the mid-1950s in the U.S. with many examples.


Analyzes possible trends during 1985-95, including social and economic, and impact of U.S. Government.


Useful for measuring expectations in the 1960s.


Includes observations on an international committee's study on "The Effects of Mechanization on Automation in Offices."


Contains many details typical of numerous offices of the 1960s, not just unique to IRS.


Studies employment as influenced by DP and other technologies as of about 1960; an M.A. thesis originally.


An excellent reflection of the issues, applications and justification/costs of office automation, late 1970s and early 1980s.


Gives mixed reviews for the benefits of office automation in the late 1970s and early 1980s.

Focus is on office automation during the 1980s.


Surveys trends in automation and experiences, 1960s.


On the advance of automation in the U.S., primarily covers the period 1950-60 and on office workers.


Has much material on job types as of the 1950s.


This is a thorough study of the costs of paper work as of the 1960s.


Describes computers usable for bookkeeping in banks and offices, arguing they would come to dominate.

Operating Systems


This is a major collection of materials on AT&T's important operating system.


This history of MVS starts with older operating systems of the late 1950s through the 1970s.

Describes the evolution of memory management aspects of IBM operating systems, such as virtual memory.


Describes two IBM operating systems for the S/360.


Included are descriptions of BTAM, QTAM, TCAM, RTAM, XTAM and VTAM.


This second generation system was developed at MIT as part of Project MAC as a programming tool.


Describes MIT's student's time sharing system.


Deals with the history of UNIX and U.S. Government's (DARPA) support for UNIX R&D at University of California, Berkeley in the 1980s.


This is a technical history of the IBM VM/370 operating system from 1964 to about 1974.


This excellent article offers a comparative analysis of operating systems of the 1960s.


Describes the concept and its appearance in the 1960s.


Historical examples come from assemblers, compilers, and operating systems with a description of how they reduced programming efforts, 1950s-1970s.

This describes software on the British super computer.


Recollections of a GE operating system developed to help process missile test data from the Atlas missile, 1957-1959.


DPPX was the operating system announced in 1978 for the IBM 8100 distributed processing computer.


This is a formal description of an IBM operating system for the S/360 computer; IBM's first VS SCP.


Describes evolution of UNIX of the 1960s and 1970s and its implementation on DEC equipment, such as the PDP-7.


Reviews Pioneer Day at the NCC Conference, June 17, 1987, which included a discussion of operating systems of the 1950s and 1960s.


This early, formal statement of IBM's SNA, describes a bedrock telecommunications architecture, 1970s-80s.


This was IBM's major operating system of the 1960s.


Describes VM suitable for interactive computing.

One of its developers describes its function and history.


Surveys languages in wide use between 1965 and 1975 and contains details on operating systems.


Surveys evolution of operating systems, 1950s-1968.


Describes the features and development of MVS, IBM's largest operating system of the 1970s.


Although a text on design of operating systems, it contains material on their history.


This is one of only a few articles on the subject, beginning with rudimentary elements in the 1940s and continuing down to about 1980.


This is a formal statement of SAA, the design architecture IBM used for software and systems in the very late 1980s and into the 1990s. The entire issue of the journal is devoted to SAA.


This was one of a series of technical papers describing the operating systems of the S/360 computers of the 1960s.

Acer, John W. Business Games: A Simulation Technique. Iowa City: Bureau of Labor and Management, State
University of Iowa, 1960.

Describes business games and concludes with an evaluation of their future potential.


Over 3,000 references are presented, current through 1957, through the first decade of OR.


Reprints 8 papers presented at an AMA seminar held in January and March 1956. Describes OR applications in resource allocation, production distribution, plant scheduling, aircraft maintenance and engineering.


Surveys why one would use OR, includes its history and uses as of the early 1950s, and potential.


This 866-page publication cites 4,195 titles.


Surveys how scientific discoveries are made with discussion of experimentation, chance, hypothesis, difficulties and strategies, all OR themes.


The conference was held in Aix-en-Provence, 1960. In 810 pages it covers all aspects of OR and contains many case studies of current uses in industry, government, and in the military.


This is an early aid to statistical decision-making and includes a history of decision-making.


Discusses all aspects of OR, with example, circa 1960.

Intended for advanced users of OR and covers all aspects of the subject as known in the late 1950s. Includes case studies, management issues, and game theories.


Focuses on the relationship between problems of value and those of fact and uses examples from the late 1950s to show how they are handled with OR.


This 655-page book includes a history of OR back to World War II; this was a basic text in the 1950s.


These are conference papers on all aspects of OR.


This is an early text such as used in OR work.


Focus is on uses of statistics in business with OR applications, circa late 1950s.


A collection of papers on OR that reflects thinking on the role of computers and information theory.


Describes the theory of linear programming and how it is applied.


This was the first textbook on the subject.

They describe how to use decision games to solve business problems; includes 7 games of the 1950s.


This very early book on OR includes a history of the application and surveys its status as of 1949.


This is a technical volume on how to do OR.


In addition to examples, the benefits of OR is detailed.


Survey the Behavioral Models Project at the Bureau of Applied Social Research, Columbia University, and includes an extensive bibliography.


This is a very early description of OR and theory of games for the general reader; illustrated.


Describes how OR was being used with two case studies on water resource management.


This is an early publication surveying mathematical theory of games of chance and strategy, the kind of approach that launched OR.


This is a useful snapshot on linear programming.


They describe executive decision-making, circa 1950, and include a bibliography.

This is useful for appreciating the early history of OR in the U.S. and includes actual cases of usage.


This is a 20-page look at how OR could be used to solve problems in business.


This is on OR as practised in the 1960s.


This 6-page report describes the role of OR analysts in the U.S. Government.


Focuses on top management decision-making with cases.


This is a clear explanation of linear programming and OR from the period of the 1950s, with applications.


This is an historically important book on the use of games theory to solve complex problems. It became a basic text for early OR. A 1947 edition served as a widely-used source on OR.

Space Exploration


Includes the role of computers, 1950s-1960s.


Describes an on-board IBM system for astronomical observations in the 1960s and 1970s.

Includes discussions about the role of computers, 1970s.


DP and space programs, 1957-early 1960s, are described as part of an "official" history.


This is suggestive of many uses put to DP in the late 1950s and early 1960s.


Includes discussion about how computers were used by NASA in the 1960s.


Includes discussion of the role DP played in the 1960s and early 1970s on this project.


This is a good overview of NASA and IBM's role in using computers for space explorations from the mid-1950s to 1980.


This monograph is on rocketry and JPL with discussion about the use of many technologies, including DP.


This is useful for patterns of institutional response to a high-technology field of major proportions.

Includes 3 articles on NASA and software developed during the 1960s and 1970s.


This is the most complete history of the subject, covering events from 1957 to 1987.


Argues that NASA's contribution to computing was in software verification and fault tolerance rather than in using leading edge technology.

Storage and Retrieval Methods


This 20-page booklet describes basic methods in use in the 1950s. By the 1960s these were being applied to DP systems.


This was the first of 3 guides published by this organization on legal requirements of the U.S. Government on this subject. Many of these practices drove the demand for computerized record keeping.


This is a collection of papers presented at the Fourth Institute on Information Storage and Retrieval, held at the American University, Washington, D.C., February 1962. Included was discussion of the role being played by data processing.


This 16-page publication describes the process and how it began.


Illustrates basic issues about record retention.

3750 National Science Foundation. Nonconventional Technical

This 66-page report describes then in use applications incorporating new management methods for data storage. A supplement was published in March 1960.


This was a standard and major reference on the subject in the 1940s and 1950s. It also addresses the issue of data on punched cards.


This consists of 8 papers presented at a symposium in New York on February 23, 1961, on machine readable files.


Describes trends in information gathering technologies of the late 1950s and early 1960s at various U.S. Government agencies.

Word Processing


Describes a product which combined magnetic tape transport units with SELECTRIC composers, a basic piece of magnetic tape products of IBM of the 1960s.


Reviews technical features of a high-quality printing system, as available on the IBM OS/6 word processor announced in January 1977.


This is one of the first articles to appear on "word processing" using DP technology instead of typewriters.

Covers developments at IBM from 1964 to 1980 in the development of products and applications for word processing.


This is typical of hundreds of such articles to appear in the 1970s on the marriage of data processing with word processing and about its expanding role. As such it is a good period piece.


This is a good snap-shot of word processing and DP's role at the start of the new decade.


This article presents the business case for word processing and examples of what had been done.
This chapter's citations survey the information processing industry, its institutions, major vendors, national activities, and collections of biographies. While the majority of these materials deal with the post-World War II era, some cover a broader period. Most of the publications were written by journalists, government analysts, and economists. A few were written by historians. The majority are contemporary, but these are also full of useful information on the history of the industry. They also reflect the growing activity in Europe and Asia.

The industry in postwar America represents the fastest growing body of literature on computing's economic activity. Historians have begun to focus on company histories, while biographical collections are now in vogue. Industry surveys are predominantly economic. Studies of the impact of computers on society are beginning to rival the output of economists, although not their thoroughness. The major antitrust lawsuits of the 1970s in the United States flushed out an enormous amount of material from company records, making them public and usable. A number of publications of the late 1970s and early 1980s used this new body of data to describe events, particularly of the 1960s.

Publications on the contemporary period are best used in conjunction with those listed in earlier chapters on programming languages, software, applications, and hardware.

Despite the growing volume of publications, very few articles and books rely on a thorough and critical examination of archival materials. An impressive amount, however, has grown out of interviews of participants, particularly biographical publications. These, therefore, represent significant primary materials on the period. Many of the economic surveys are well done, thorough, and useful, and most government publications provide mountains of raw data on the topic.

Little attempt has been made to include news articles from magazines unless they are obviously major contributions to the history of data processing. However, what is included helps to define the issues of the industry in terms useful to historians.
AFIPS


Summarizes retrospectives from July 1984 and is anecdotal, informative and illustrated.


Describes the mission and activities of AFIPS and its history from 1961 to 1975. Ralston was its president in 1975.


This biography/obituary is of a man who helped to organize AFIPS.


This is a collection of paragraph-length briefs on each.


Describes AFIPS' role from 1961 to document the history of DP and includes personal recollections.


Memoirs of AFIPS presidents are presented, 1961 onward.


Rector was involved extensively with AFIPS and offers much new evidence on its activities.


Ware was AFIPS' first chairman. He contrasts what it was supposed to be with what it became.
Asia


This reports on developments in China in the 1970s.


This is a broad view of China's computer projects with materials on both the 1960s and 1970s. Argues that China was very behind the West on computing.


This is a thorough discussion of India's DP industry of the 1960s and 1970s and is useful for appreciating computing in the developing world.


This is a collection of essays on DP in New Zealand since about 1960.

AT&T


This is based on interviews, court documents and published materials. Argues that it was in AT&T's best interests to abandon local telephone service in the 1980s.


This is a general history of the company and about telephones.


This is a hostile survey of post-World War II AT&T by a journalist.


Although a political history of the breakup of AT&T in the early 1980s, it offers perspective on company rivals versus public interests at work.

Includes a survey of AT&T's breakup in the early 1980s and its impact on the U.S. TP and DP worlds.


This is the only memoir on AT&T's breakup published in the 1980s.

ACM


Reviews early days of ACM (late 1940s-early 1960s).


Surveys mission, activities and history of ACM from 1947 to 1975. ACM was the oldest of the more important organizations within the DP industry.


This was one of several 40th anniversary articles published by this issue of *Communications*.


Does much the same as Cochran in No. 3780.


The author was actively involved with ACM in the period under discussion.


Like the others above, this is a memoir of the ACM.

Bell Laboratories

Describes Bell's 5th relay computer, its first general purpose programmed computer; contrasted with ENIAC as well.


Surveys the development of relay computers at Bell in the late 1940s and early 1950s.


This is an illustrated description of the Model VI.


This is a history and a description of early Bell computers, 1940s-1950s.


Used the Model V and describes how it was programmed at Bell Labs.


Reprints No. 3788 and includes an introduction.


This is a memoir that discusses, in part, work done at Bell Labs in the 1940s.


This brief review highlights activities at the lab.


This is an illustrated history of Bell Labs.

Surveys Model I through V from Bell Labs, Mark I from Harvard and Booth's Automatic Relay Computer.


This is an excellent history of semiconductors with considerable materials on Bell Labs from the 1940s to the 1970s. Second edition takes the story down to the date of publications and with revisions of earlier chapters.


Describes the development of the M-9 by Bell Labs during World War II.


Includes some details on the role of Bell Labs.


Describes what eventually became a Bell Labs computer, focusing on its military applications.

3798 "Complex Computer Demonstrated," Bell Laboratories Record 19, No. 2 (October 1940): v-vi.

This is a very early report from Bell on the use of relay calculators, intended to improve telephone service.


Describes defense-related research on fire control mechanisms at Bell Labs during World War II.


Describes Bell's early fire control mechanism.

This is a history of R&D in information and telecommunications, with a special emphasis on the role of Bell Labs. The text is divided into two parts: R&D in basic research and R&D in applied research. The first part covers the period from 1925 to 1960, while the second part covers the period from 1961 to 1990. The text is written in a clear and concise manner, and it is easy to follow. The author provides a wealth of information on the history of Bell Labs, including the development of new technologies and the people who were involved in these developments. Overall, this is a well-written and informative book that is highly recommended for anyone interested in the history of R&D in information and telecommunications.

Reviews Bell's Model III computer and activities of the 1940s.


Discusses his leadership role in the 1930s and 1940s.


This is a general history of the Bell Labs.


This is a history of their uses at Bell Laboratories in the 1960s and early 1970s.


Bell Labs had techniques in the 1950s for making computer-based music; a history of the project.


This is a biography and analysis of Fry's work on computers at Bell Labs between the 1930s and 1950s.

3817 "Relay Computer for the Army," *Bell Laboratories Record* 26, No. 5 (May 1948): 208-209.

This describes Bell's relay computer for the U.S. Army in the 1940s.


Contains details on the early history of relay computers and other computer-related projects.

It reviews the early relay computers. For additional details and later developments see the same publication, 52, No. 1 (1974): 13-20; 52, No. 2 (1974): 55-63.


Reprints memos of 1947 and 1950 by the author on what DP could do.


This was written in 1940 while at Bell Labs. It is an early description of how a computer might function with binary decimal number representation.


Describes sporadic incidents at Bell Labs covering the period 1938-1945.


Discusses the need for better program specifications, index registers, and so forth.


These are memoirs of his work at Bell Labs on computers, particularly in the 1940s.


This is a short review of desk top calculators and has material on Bell Labs' relay computers.


Includes a short biography of Stibitz.

3827 U.S. Navy Department. Computer Mark 22 Mod.0: Development and Description. Report No. 178-45. Washington,
This publication describes a relay computer built by Bell Labs for the U.S Navy.


Describes early transistor projects at Bell Laboratories (1940s-1950s).


This is a good description of the Model V computer and work done at Bell Labs on it; illustrated.


This is a general review of Bell Labs' Model V computer by a developer of the system.

Biographies and Memoirs


This is an illustrated obituary of a major logician from the University of California at Berkeley.


This is a listing with addresses and so forth.


This is a major study of their concepts for computers and is a detailed, technical study, 1930s-1940s.

Chevion was very active in fostering computing in Israel; an obituary.


This is an illustrated obituary of a Danish computer builder; active period was in the 1960s.


Includes short biographies of contributors to this issue of the journal; most were pioneers in the development of IBM hardware and software, 1950-1980.


This was one of the first such compendiums on the data processing community in the U.S.


Ross worked with software development in the 1950s and 1960s.


Gordon was a consulting systems engineer at IBM who developed GPSS, a modeling programming language.


Jacobs worked on computing projects for the U.S. military in the 1940s and 1950s; illustrated.


Brown was a research executive at RCA who led many of his company's early computer projects.


Hazen was a leading computer engineer at MIT in the 1920s and beyond; illustrated obituary.

3843 Bryden, D.J. "George Brown, Author of the Rotula,"

This is a serious biography and description of his device for addition, using a single carry wheel.


Contains illustrated biographies of 61 people; its strength are the photographs.


This is a directory of the industry and of some of its leaders.


Provides over 150 biographies of key individuals in the history of computing and data processing.


This is an obituary, biography with an illustration.


This is an obituary notice of a computer science professor from the University of Illinois; developed the Illiac IV in the 1960s.


Contains a discussion of the work of Adriaan van Wijngaarden at the Mathematical Centre in Amsterdam, 1942-1981.


Includes some biographies of computer scientists.


This is an obituary of ACM's founder and publisher of Computers and People; lived 1908-1988.

These are 1 hour long taped interviews with major figures in computing. For a survey of contents see Annals of the History of Computing 3, No. 4 (October 1981): 417-420.


Feynman recalls his work at Los Alamos National Laboratory with calculators and computers in the 1940s.


Describes IBM's first successful time-sharing tool: TSO and the role played by Scherr.


These are memoirs of various individuals including R.L. Anderson, D.J. Finney and Tosio Kitagawa.


This is a biography of Lewis Fry Richardson (1881-1953). He used mathematics in weather prediction and employed the ENIAC at Aberdeen Proving Ground, 1950.

3857 Grath, Robert W. The IBM Alumni Directory. Dallas: Privately Printed, 1970s (?).

Contains over 2,500 names of ex-IBMers and where they worked; various editions published.


This is the obituary of the founder/president of Computation Planning, Inc. He was a cryptographer.


Albert A. Michelson (1852-1931) was an American physicist who work contributed to the early research leading to electronic computing.


Buie developed the transistor-to-transistor logic type of ICs (1960s); worked at TRW, Inc.

19 pioneers participated and involved all the major developers of the 1970s and early 1980s.

Contains a biography of Louis Nicot Ridenour, Jr., one of the developers of ORDVAC and ILLIAC machines.

This is an important biographical source; illustrated.

Obituary of the person most responsible for organizing the IEEE's annual solid state circuit conference for 31 years. It was the most important such conference held in the computer industry.

Obituary notice for the American physicist who worked on the ORDVAC and ILLIAC.

Interviews J.P. Eckert, Grace M. Hopper and Konrad Zuse.

Interviews David Lundstrom, author of a book by the same title on UNIVAC Division, Sperry Rand and about CDC; illustrated.

This is a memoir of the Data Processing Digest and her role from 1954 to 1985.

Contains a detailed analysis and life of Birkhoff. Useful for understanding his work on topography and early computational projects at Harvard University.

This is the obituary notice for an IBM veteran engineer who developed the I/O interrupt and was the first chairman of the IRE Professional Group on Electronic Computers; worked in the period 1950s-1970s.


Covers his work with bookkeeping machines, punched card devices and character recognition units.


This is an interview with James H. Wilkinson.


This was Edmund C. Berkeley's pseudonym for second editor of Computers and People.


Svoboda was a computer scientist in Checkoslovakia.


Sheds light on Phillips' work on computing in 1936.


A good source on his work with computers in advancing the study of weather prediction, 1950-1980s.


Chapter Six is a biography of William C. Norris, founder of CDC.


Minker was a mathematician and early programmer at Bell Labs and at RCA where she worked on the BIZMAC.


Based on interviews, covers all the major figures, such as Stibitz, Zuse, Aiken, Atanasoff, Mauchly.

Contains biographies from Blaise Pascal down to the present.


This is an obituary notice.


This is a biography and survey of the views of IBM's corporate vice president for marketing in the late 1970s to early 1980s.


This covers 34 people active in the 1950s to late 1980s with interviews of most; an uncritical study.


These are the memoirs of Ford Motor Company's most important production expert; sheds light on attitudes and activities concerning all manner of automation.


Contains 37 drawings and short biographies; very inaccurate, poor quality illustrations.


This is a memorial volume dedicated to Bech, the leading Danish computer designer who headed Regnecentralen during the 1960s.


These are short biography of industry giants: Seymour Cray, Lester L. Kilpatrick, Ruth M. Davis, Jay W. Forrester, Frank R. Lautenberg, J. Prespert Eckert, John W. Mauchly, Dan McGurk, William Shockley, Max Palevsky, Gene M. Amdahl, William Rogers and others.

Curtiss headed the Applied Mathematics Division of the National Bureau of Standards, 1946-53, and helped launch SEAC and SWAC.


This is on American computing based on interviews with Stibitz, Aiken, Atanasoff, Eckert, Mauchly, von Neumann and people at NCR and IBM.


This is the transcript of the meeting which involved recollections of the 1940s to the 1960s of computing pioneers on their work; it is not on the ACM.


This is a biography with a statement of his historical significance to computing's past.


Memoir material on the 1960s and 1970s reflected here.


Brown was an early radio engineer (1930s), eventually became RCA's vice president of research and engineering who retired in 1972; lived 1918-1987.


Feynman (1918-1988) won a Nobel Prize for reconstructing quantum mechanics and electrodynamics after World War II.


By the third edition it was a 3 volume compendium.


These are memoirs about computing in the 1950s-1960s.
<table>
<thead>
<tr>
<th>Entry</th>
<th>Title</th>
<th>Author(s)</th>
<th>Details</th>
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<tbody>
<tr>
<td>3900</td>
<td>Young, Jeffrey S. Steve Jobs: The Journey is the Reward. Glenview, Ill.: Scott, Foresman and Company, 1988.</td>
<td>Jeffrey S. Young</td>
<td>This is a biography of Apple Computer's founder.</td>
</tr>
<tr>
<td>3905</td>
<td>Dijkstra, Edsger W. Selected Writings on Computing: A Personal Perspective. New York: Springer-Verlag, 1982.</td>
<td>Edsger W. Dijkstra</td>
<td>These are his trip reports, 1973-80s, and about his views while a Burroughs Research Fellow.</td>
</tr>
</tbody>
</table>
This short biography also describes his development of a practical adding machine in the 1880s.


The author was chairman and chief executive officer of Burroughs; this is a short history of his firm.


This is a short history of the company from the 1880s.

Canada


This is the most complete account available on the subject and is illustrated.


These are memoirs of the constructors of the M2 Computer at the University of London; M3 at Saskatoon in 1964.


Canadian schools were early users of DP; that interest is reflected in this article.

Company Histories

3912 Baum, Claude. The Systems Builders; The Story of SDC. Santa Monica, Cal.: Systems Development Corporation, 1981.

This celebrates the firm's 25th anniversary and serves as an institutional history down to merger with the Burroughs Corporation.


This is a survey of LOTUS Inc, largest vendor of micro computer spreadsheet software of the early 1980s.

This is a history of an early packet switching telecommunications package and the organizations that developed it.


This is an illustrated history in chronological order and is not a critical analysis of GE.


Relying on interviews, the author describes the history of the micro computer company from 1972 to its decline in the 1980s.


The entire issue is devoted to the history of CSC (1959-84), one of the largest software firms in the U.S. during the period.


This is a brief, chronological history; illustrated.


ERA's history is described, 1946-1955.


This is on the rise of these two firms in the 1970s.


Provides brief details on an early British computing company.


This is a massive history of one of the oldest software firms in the industry.

In the 1970s Dataproducts was the largest manufacturer of computer printers.


This is an institutional history.


This describes videodisc development in the U.S. during the 1970s and early 1980s.


Offers a survey of its activities throughout the 1970s as a leasing company and provider of other services.


This illustrated pamphlet offers a brief history of the company which dates back to the 1930s.


This is a short history of the microcomputer firm.


Describes the services of Computer Sciences Corp.


This is a history of MCI by a reporter based on interviews and publicly available documents.


This 51-page publication is an illustrated history of the company (1968-84) and catalogs its products.


Surveys the history of an industry favorite magazine.
This is a well written company history with a great deal about the microcomputer market in the U.S.A.

This is a memoir of an employee about Control Data Corporation (CDC), particularly of the 1960s.

The author describes how he set images for companies with details on Intel's effectiveness during the 1970s and 1980s.

The author was chairman and chief executive officer at TRW at the time of publication; a history of TRW.

Held in September 1986 to celebrate the 40th anniversary of ERA'S founding, his article contains material on the company and on the industry at large.

Describe's CDC's initial marketing strategy, 1960s.

These are Osborne's personal views on how his company rose and fell.

This is an illustrated history of CDC with interviews of key company executives.

Steve Wozniak helped developed the Apple microcomputer.

Raytheon participated in a number of U.S computer projects during the 1940s and 1950s as a defense contractor for the U.S. Government.


This describes the origins and functions of the totalisator and the company that sold it.


This describes the work and products of Nixdorf, a European word processing provider of the 1960s.


This is an analysis of TI's products of the 1960s and marketing programs, particularly for chips.


This is an illustrated company history full of information on all facets of TI's history.


Tomash was present at the creation of ERA and comments on other organizations as well, such as CDC and UNIVAC.


This illustrated pamphlet details history from 1901 to the early 1980s.


This is a contemporary account of Amdahl's plans to market plug compatible computers against IBM.


Wang reflects on his early work at the Harvard Computational Laboratory, upon his development of computer memories in the late 1940s and about Wang Laboratories.

This is a history of the company that, in fact, began as a supplier of shoe repair products and includes details on Radio Shack stores back to 1969.


He describes barriers, their characteristics and consequences for manufacturing firms with comments on management style and role in innovation.


Speaks to the general issue of monopolistic behavior in the United States.


Mergers were very common in the office appliance industry in its early years; the features of such mergers in the U.S. are described.


This is a major work shedding light on how technology emerged through the economy into products brought to market.


This is a comparative analysis of R&D at GE and at AT&T's Bell Labs with a description of these evolved and influenced their parent companies.


This is useful for appreciating the U.S. situation in the 20th century in which the DP industry functioned.


The tradition was a strong one in data processing.

While less specific on office appliance companies, it details how trusts were done, a pattern evident even, for example, at C-T-R, the precursor to IBM.


He focuses on change and how to do it well, citing examples from many firms including H-P and IBM.


Useful for understanding a process also at work within the U.S. data processing industry.


Useful for appreciating a process evident in the office appliance industry in part, as with typewriters and adding machines at various times.

Digital Equipment Corporation (DEC)


DEC celebrated its 25th anniversary in August 1982. Olsen was DEC's first president and only CEO up to that time.


This is the founder's view of the company's origins and development all through the 1960s and 1970s.


This is a product and company history of DEC, 1957-1985.


This is a full length biography of Olsen and history of DEC written by two journalists associated with Computerworld.

This is based on interviews and secondary sources. It is a review of personnel, salaries, hardware, installations, applications, and has a bibliography.


These were major events in the history of the industry; the account is contemporary.


This summarizes activities of the top 100 companies in the DP industry with data on sales, volumes, profits. This was the first such survey by the magazine and has been published ever since on a yearly basis.


This is a very early survey of the DP industry once it was selling and installing computers.


This is a general history of the industry from 1957 to 1982 covering many aspects of its development.


Focus is on the U.S. data processing industry.


Details are given on every Latin American country, giving details on how many computers there were per million people and per billions of dollars of GNP as of 1972 and 1973.


This is on vendors in the U.S. DP industry of the mid-1960s.

Surveys emerging career paths in data processing as they seemed in the late 1950s.


This is an analysis of the DP industry at the end of the 1950s in the U.S.


Retirement from the computer field happened with many firms; this was an early one explained here.


This is full of information and data about the U.S. industry of the 1960s; an important early study.


This is an economic analysis of opportunities and realities.


This is an extensive study of costs and profitability in the computer services business which is judged to be competitive in the early 1970s.


This is as much a history as an economic analysis. He suggests that IBM be broken up into several firms and uses data generated by various antitrust lawsuits against the industry giant.


This is useful for appreciating what was happening in the U.S. industry in the late 1960s.

He compares the number of locations with computers by major SIC codes, looking at 24,500 cites in 1975 versus 17,600 in 1968.


Burnett conducted one of the largest such surveys to date to compute how many establishments there were per computer in each major industry in the U.S.


Surveys 38 cites with descriptions of installed computers, prices, and activities in the U.S.


Offers data on what kinds of computers were installed in the U.S., their market shares by vendor, and defines future opportunities; a snapshot of the 1970s and early 1980s in the U.S. industry.


This is a 27-page overview as of the late 1960s.


Surveys a trend that began in the early 1950s and became significant by mid-decade. It identifies the applications that made possible the expansion of the computer business into commercial fields.


Informative analysis of what was happening in the U.S. DP industry in the late 1960s.


This illustrated supplement to the newspaper reviews all aspects of the DP industry between 1967 and 1987.


This offers histories of over 160 organizations in the industry.

This 27-page publication contains an enormous amount of statistical data on volumes, primarily concerning U.S. exports.


Identifies the historical elements constituting the world of computers in 1976.


This Booze, Allen & Hamilton study of 108 companies reveals trends on how DP was managed, spent on it, and for what in the mid to late 1960s.


Twenty-two essays survey prospects for users, trends in computer usage, discuss socioeconomic effects, and changes expected in technology, covering the period between the early 1970s and deep into 1990s.


Reprints his testimony from the 1950s on the case for using computers.


This is a wealth of information on various uses of computers and about the industry supplying machines.


She focuses on the role played by large, established companies and small start-up firms in driving technological changes, primarily in the U.S.

**EDP Idea Finder, Data Processing Digest, 1957-1959.**

This 656-page book is a collection of articles on DP issues published between 1957 and 1959 and is a useful reflection of the period. It is well indexed and cross referenced.


This is an economic analysis of trends and actions taking place in the late 1970s and early 1980s.


The father of the IBM S/360 reviews the evolution of computers, their costs and economic impact and volumes sold. He does the same for telecommunications and concludes with implications for the 1980s.


Fahey describes the trend for industry-wide technical standards emerging in the 1980s.


This is as much a snapshot of the "computer industry" of the mid-1960s as it was an opportunity statement.


Intended for a general audience, this includes an illustrated history of computing and its industry.


This is a fact filled survey of the technology, uses and events in the world of computers covering all major nations and the industry during the 1970s and first half of the 1980s; excellent survey.


This focuses only on U.S. job opportunities and the situation as of the early 1960s.

Summarizes the origins of computer technology and the early growth of the DP industry in the U.S.

Offers data on employment in the DP industry for the 1960s in the U.S.


They survey all manner of schools and universities, estimating how many graduates have come from this source into the DP industry since 1965 in the U.S.

This is a statistical snapshot of the industry as of 1971 and projections to 1976. Includes some data on the late 1960s.

Surveys regulations from the 1950s to 1971.

Looks at the history and prospects of the U.S. microelectronics industry, arguing that the U.S. will continue to be world leaders in this technology.

This is a collection of papers on present and anticipated computing trends.

Greenberger, Martin (ed). Computers, Communications
Information Processing Industry


This is a good introduction to public policy issues of the 1960s and 1970s concerning these technologies in the U.S.


Explains why the need for more DP has been rising in the 1950s but also why computers have not yet influenced clerical productivity in the U.S.


This is a quantitative analysis of the industry with emphasis on the role of IBM; contains much industry census data covering the period 1940s-1960s.


This is an early article on a trend that became, in time, a significant one within the industry.


This continues the magazine's analysis of trends in the U.S. DP industry of the late 1960s.


These are memoirs of Los Angeles (1942-57) and the furthance of DP on the U.S. West Coast.


This is a short collection of stories on the subject in California, circa 1970s and 1980s.


This is a survey of computer population and uses.

This has some history of computers and data processing in general; some of the factual material is suspect. Intended for the general reader.


This is a history of the industry in the U.S., Europe and in Japan.

4026 Hershman, A. "Boom In Used Computers?," Duns Review 90 (December 1967): 63-64.

By the late 1960s there was an active market for used computers; that market is described here.


Describes companies within the U.S. industry.


Surveys the U.S. industry as of the early 1980s with data on volumes and size.


This is a major survey of the U.S. industry with a large quantity of statistical information on volumes and sizes.


IDC's survey of the DP industry is widely-read. It reviews product types, people, applications, and industry segments, such as service bureaus, vendors.


This analysis was prepared for the Massachusetts Department of Commerce and Development and includes data on activities of the 1960s and suggests what should be done in the 1970s. The state developed a significant computer presence during these two decades.


Argues that the FCC regulations restricted innovative entrants into the industry during the 1960s, particularly in telecommunications.

This is a massive, 750 page compendium listing firms, their financial rankings, products, industry organizations and so forth for 1985-86 for both the U.S. and Europe. A subsequent edition was published for 1987-88.


This is a useful survey of the industry's features as of the late 1970s.


This very important economic analysis contains data on volumes shipped and analysis of the office equipment and computer industries at large. Continues his work of the same title, published 1961.


He includes specific material on office equipment and computing products through 1958.


This was a report on an early economic snapshot of the U.S. DP industry.


Klein surveys U.S. data processing service bureaus of the early 1960s.


Contains information on bibliography, conferences, seminars, training programs, surveys of equipment and costs, applications and lists 13 commercial computer centers in the U.S.


This is an economic review of high technology industries in Massachusetts in the 1970s and 1980s, including data processing.

His is a high level economic survey of the DP industry in historical perspective.


This is an economic narrative covering the industry in the U.S., Europe and in Asia.


This describes the role of the U.S. Department of Defense's R&D funding organization (Defense Advanced Research Projects Agency), which played a major role in funding work on computers, 1958-82.


He comments on utilization, impact on society and role in the U.S. Its quality does not compare to that of the better economic studies published on the same theme.


The article and the journal are a good source on computing activities in Australia.


This is a very useful study that is well documented on the early phases of the computer's introduction into the U.S. economy.


Surveys companies offering computer services with data on size, age and processors used as of the late 1950s in the U.S.


Covers the period 1946-61 of the International Computation Centre.

Reports on the sale of used computers in the U.S.


This is a very useful survey of data processing firms in California including on H-P, Fairchild, Intel, Advanced Micro Devices, National Semiconductor among others; based largely on interviews and published material.


This is a major source on the topic as applied to the U.S. industry throughout the 1960s and 1970s.


Surveys the U.S. industry by company, providing some history, current situation, and forecast through the early 1990s.


This is an important source on all aspects of information handling, not just computers and associated products, in the U.S.


The survey on U.S. data centers, was taken on the verge of significant increases in spending on DP, and covers all phases of the budgeting process in 181 U.S. and 13 Canadian installations. He published other such surveys in Datamation (February 1973): 61-63; (March 1975): 63-74; (February 1976): 52-58.


The entire issue is devoted to the subject with a great deal of information on the use of computers in the U.S.A.


Military flight demands encouraged miniaturization of electronics; the article explores the issues as of the early 1960s.
Contains material on the evolution of the DP industry in the 1960s and 1970s.

Describes developments in technology over the previous several years and identifies trends evident at time of publication.

Surveys developments in public policy in the U.S. since the 1960s with particular attention to AT&T and the role of the FCC. Sees a trend toward more regulation; in fact it was the opposite.

Written by an editor of Datamation, it is a survey and memoir of 1972-1979.

Contains a great deal about the corporate cultures of Apple Computers, DEC, IBM, H-P, Intel, ITT, Lanier, Litton, Motorola, NCR, STC, Tandem, TI, TRW, United Technologies, Wang, Western Electric, and Westinghouse. Millions of copies of the book were sold in the 1980s.

It is useful in large part for the 1950s and 1960s.

This contains a massive amount of data on all aspects of data processing costs from the 1940s to the early 1970s, primarily U.S.

Updates the previous edition with data on the 1970s.

Assumes that a growing number of workers in the U.S. work with information as their primary task and then measures that; includes data on data processing.


Contains brief comments on the U.S. industry, 1970s.


This is the agency's "official" history and details its role in funding R&D projects in the U.S.


This is a detailed study of the service bureau piece of the U.S. DP industry.


Describes Silicon Valley in detail with material on Apple, Intel, and other firms.


This is a serious of observations on the U.S. industry by a long-time observer of its activities.


They argue that "knowledge industries" made up 29 percent of the U.S. GNP in 1958, 34 percent in 1980.


In effect, this is a market survey of the U.S. DP industry of the 1970s.


It is a useful introduction to social and economic
issues of the early 1980s concerning data processing. It also is an update on trends in DP technology.


It contains a general history of the DP industry.


This is set up as a directory on both European and American firms.


Reviews important patents in the history of digital computers and their role in the development of marketable products.


This is a highly technical and detailed study of pricing and selling patterns for computers of the 1960s and affects on the industry's economics.


This is a major source on DP organizations since World War II and is a sociological analysis of their formation, mission and history.


Emphasis is more on electronics than computers but with a sense of the experiences vendors in the DP industry faced in the 1960s.


The rankings and data are on U.S. firms in the DP industry.

4081 "Software Gap, A Growing Crisis for Computers; Shortage
This was one of many such articles to call out the lack of programmers in the U.S. during the 1960s and 1970s as the industry grew rapidly.


Reproduces 21 advertisements from Datamation, 1957 to 1982 on DP products in the U.S.


Focus is on the U.S. DP industry, with emphasis on legal implications and issues, 1960s and 1970s.


This is a history of computer activities in California in the 1940s and 1950s, particularly in support of defense projects.


This economic study surveys such topics as cross-border marketing, international patent licensing, and the global industry, circa early 1970s.


The author describes recent developments in the service bureau business in the U.S., circa 1960s.


This surveys Canada's industry, major firms and leaders, primarily of the 1970s and early 1980s.


This is an economic analysis of Latin America's largest DP market, circa 1970s.


This is a U.S. market survey on service bureaus.

Describes service bureau work in the U.S. in the 1960s.


Reflects the views of the 1960s on the impact of DP on society and with a statement of its significance.


This is the only book available on KGB efforts in the U.S. dealing with data processing. Estimates that 20,000 agents are at work, many in Silicon Valley.


Characterizes IBM's position within the industry as dominant but with competitive activity evident.


This is a market survey as of 1969 with much tabular data on volumes.


Various editions and revisions have appeared over the past three decades. It is the major statistical summary on the U.S. economy with data on office and computer sales throughout the 20th century.


This edition listed DP professions for the years 1958-68 with populations and salaries. This annual publication first began appearing in 1954.


Discusses the state of the industry as of early 1983 in the U.S., Europe and Japan.

Describes the opportunity and recent volumes.


This is a good source for statistical data on the U.S. office appliance industry of the 1930s.


This surveyed the largest collection of computer users in the world, circa 1960. They had 20 percent of all computers installed that were built in the U.S. as measured by sales value.


These hearings took place at the same time that the U.S. Government had sued IBM for violating antitrust laws.


Continues the theme of the previous citation; much of this testimony hostile toward IBM.


The inventory is as of 1974/1975 and is significant.


A brief survey of rate of change in U.S. technology.


Comments on the U.S. industry of the early 1970s.

Reviews actions of the Manufacturing Automation Protocol group which joined with Corporation for Open Systems to set technical standards across the industry.


This is a 633-page directory on the DP industry.


This was one of the first, thorough economic surveys of this subsector of the information processing industry worldwide, circa 1960s and 1970s.


This is an important, early source on the population of computers in the United States.


This is an analysis of major vendors, often a chapter each, with data on who they are, what they sell and their business prospects with considerable amounts of data on the period of the 1970s and early 1980s.


Covers the period from the 1920s to the 1950s; chronology included (pp. 265-278).


Surveys how data privacy in computer systems was handled between 1969 and 1971.


This is a survey of social/political issues.

FM firms were not new to the office appliance industry but were different when, in the 1960s, they existed with computer services.

Reviews the technology, its industry, and uses as of the late 1960s.

Contains stories on computer crimes and about how it was being stopped in the U.S.

While an excellent survey on the roles played by venture capitalists in the U.S. in the 1970s and 1980s, it cites examples of their work in data processing, e.g., Lotus 1-2-3 and with microcomputer firms.

Offers data on the industry, machines, people, and volumes in the U.S. for the period.

This analyzes the growth of DP worldwide and the marketing of products from Europe and Japan.

Data Processing Organizations

Reprints a presentation he made in 1956; a forward offers a brief history.

Describes the mission, activities and history of ASIS.

AEDS is described from its inception (1962) to 1975.


AFCET's history is reviewed, 1969-1975.


BCS came into existence in 1957 and is a major British computer/data processing organization.


Reviews its role from 1953 to 1975.


Surveys its history from 1956 to 1975.


This is a history of SIAM from 1952 to 1975.


This illustrated article is a key publication on IFIP (International Federation for Information Processing), covering the years 1955 to the early 1960s.

Data Processing Management Association. This Is DPMA. Park Ridge, Ill.: DPMA, 1983.

This describes the mission and history of DPMA, 1949 to 1983.


Surveys ICCP from 1973 to 1975.

This includes histories of the American Institute of Electrical Engineers (AIEE), the Institute of Radio Engineers (IRE), and their merger into the IEEE.


This is a history of NCC from its creation in 1973 to 1985. It was the U.S. DP industry's biggest computer exhibit and conference.


This is an illustrated history of the Univac users group.


This is a major source on the International Computation Centre from 1946 to 1961.


This is an illustrated history of DPMA (1951-76).


These are the proceedings of the 25th anniversary deliberations of IFIP, Munich, March 27, 1985. He reports on the event in "A Quarter Century of IFIP," *Abacus* 3, No. 2 (1986): 28-33, 57.


An American government official surveys building and use of computers of the 1950s in Britain, France, Germany, Holland and elsewhere.


The subject covers the 1960s across all Eastern Europe.

Surveys installations by country from 1955 to 1965.


Details the number of installations of computers by country between 1965 and 1967.


This is an important, detailed study of installations and uses of data processing.


This is an important survey of the DP industry in Europe: installations, vendors and uses.


Describes in large part U.S. sales to Europe.


This is a detailed history from Hollerith punch card days to the present with much material both on IBM and other vendors: their products, installations, organizations and by all countries.


Surveys the DP industry in Europe, arguing that IBM dominates it. Describes what has been done to establish national computer companies and recommends a united resistance to American imports.


Catalogs systems installed in the U.S., Benelux, France, Germany, Britain, Italy, Scandanavia as of July 1962 by vendor and by machine type.


This is an economic analysis, particularly useful for events of the 1960s and 1970s.

4148 European Economic Community. L'Industrie électronique des pays de la communauté et les investissements
Information Processing Industry

EEC studied the size and role of the industry in Europe and the activities of local governments in support of national firms in the 1960s.


Describes computing at the University of Madrid in the 1950s and 1960s.


Argues that the U.S. industry was more effective in claiming greater market share in the 1960s than local European vendors.


Surveys the industry in Europe which he argues was dominated by U.S. firms in the 1960s and early 1970s.


This is a useful survey on Dutch activities where computing was an active field since the early 1950s.


Has data on the use of computers in different countries.


Describes the discussion going on in Europe in the 1980s concerning its computer industry's competitive posture.


The author was a European computer journalist in the 1960s and 1970s. He describes a group that met informally to focus on real time computing in Europe.

This is an illustrated account of work done by the author, 1946-59.


Concerns Svoboda's work with computers in the 1950s and 1960s.


Argues that it is crucial for a local DP industry to exist and that currently IBM dominated it.


Surveys European computer developments from the 1950s into the 1970s and the development of a European computer industry.


This announces that one of Europe's largest electronics firms is entering the computer business and why.


Describes trends evident in the early 1960s.


This is an illustrated account, beginning with 1950 and the Z-4 then about the ERMETH, down to 1962.


Contains an assessment of Europe's computer science capabilities and role in the 1970s and 1980s.


Describes growing resistance to IBM in Europe and response to the development of local DP companies.

4165 Svoboda, Antonin. "From Mechanical Linkages to Electronic Computers: Recollections from Czechoslovakia," in
Information Processing Industry


This is an illustrated memoir of 1937-1954 and about the SAPO computer.


Contains comments on computing there in the 1960s.


This is a company history, contains material on its role with computers, and data processing activities in Germany during the 1970s and 1980s.


Creating partnerships was common in the industry; this was an early important example described here.


This is primarily on Austrian automata, punched cards and the work of Otto Schäffler.

France


Contains material on the size, nature and activities of the DP industry in France during the 1970s and early 1980s.

4171 "Bull at the Alter; Deal with Machines Bull," *Fortune* 70 (September 1964): 59-60ff.

Describes the early relations between GE and Bull.


At the time the firm was not considered competitive. This is a survey of its activities in the 1960s.

Surveys who acquired French output and the plans to encourage the development of a local computer industry in France.


This contains a great deal of material on semiconductor activities in France during the 1960s and 1970s.


This is a useful contemporary discussion of what role the French DP industry should play.


This is valuable as a contemporary statement of French concern that IBM would dominate the local DP industry.

4177 "Gamma Invasion; Compagnie des Machines Bull," Fortune 59 (April 1959): 78ff.

More than a discussion of the Gamma series of computers, this surveys the role of Machines Bull and on the French DP industry.


Has material on office equipment, telecommunications, and on the French postal system of the 1960s.


This is a detailed study of the French computer business. Although not well documented, it is the only useful narrative of events of the 1950s and 1970s currently available.


Focus is on French government actions taken to bolster a national computer industry in the 1970s.


Describes the French industry of the 1960s and 1970s and the role played by the French government to support a local industry.

Contains data on French semiconductor production in the 1960s and 1970s.


Describes the use of data processing equipment and other related devices available in France during the 1950s and 1960s, with examples.


Includes discussion of the French CUBA computer of the late 1950s and its use in French defense.


This is on European government policies aimed at fostering local high-technology industries and includes material on French activities of the 1970s and early 1980s.


Describes the French plan to foster a national DP industry.


Narrates the merger of GE and Machines Bull DP activities in Europe.

Germany


Focus is on the German semiconductor/computer industry of the 1960s and 1970s.


Discusses German data processing industry of the 1970s and 1980s.

4190 Haake, Rolf. Einführung in die Informations-

Surveys office equipment and punch card systems available in Germany during the early 1960s and is illustrated.


Details the structure and size of the German computer industry of the 1970s.


Narrates post-World War II developments at the Technische Hochschule Dresden (1948-1950s).


Reviews early German semiconductor activities.


This is a survey of the German electronics world of the 1970s with considerable attention paid to the computer market.


This lengthy publication surveys office and DP equipment available in Germany in the late 1950s and early 1960s; includes a bibliography of German sources.


This is an early American account of Nixdorf and of its activities.


This is an early article surveying the German computer industry of the 1950s and describes the activities of Zuse, Brown Bovierä Mannheim and Siemens.


Comments on the West German industry of the 1960s.
Great Britain


This is a memoir of activities involving ARC, APEX, MAC, and the M3; illustrated.


Offers material on the Ferranti computer firm.


This is a history of ICL's origins.


This was a major event in the history of British data processing; this is a contemporary account.


British agencies attempted to bolster their industry in the 1970s with little effect. This is a description of the effort in its early stages.


Focus is on events at Manchester University and about the Williams tube of the 1940s and 1950s.


This is an OEEC study reviewing the state of Britain's DP industry as of 1959; thorough and critical.


This is a small, illustrated study on British computing of the early 1950s.

The author was the chief executive officer of BTM in the early 20th century; these are his memoirs.


Argues that the history of British computing in the 1960s and 1970s is very much a story of firms consolidating and of joint projects, some of which began in the 1950s and are described here.


This is a history of the first British company to market computers. Its first product was Leo.


Focus is primarily on British events and government attitudes toward this technology in the 1970s and 1980s.


This well-researched article includes material on radio, television, microelectronics and an overview of the British electronics industry.


This was one of a series of publications on Europe's competitiveness in the world economy.


Contains a history of Elliott-Automation, Ltd. (pp. 25-29) and comments on the structure of British firms in general.


This comments on the British computing industry of the 1960s.

This is more an analysis of IC's activities in the late 1960s than a survey of its history.


Discusses the British computer market from the 1950s to the mid-1970s and the role of the U.K. Government.


While the thrust is on the future, this does catalog computers then in use within the British government and their applications.


Includes data on what was installed and for what uses, and impact on people.


The subject is the DP industry's prospects in the 1970s in Britain what the government's role should be. Includes testimony from many segments of Britain's DP industry.


Continues the work of the previous citation; recommends more pro-active government role, particularly in R&D.


Contains material on the development of LEO.


This is on the use of commercial devices for scientific applications in Great Britain.
Honeywell


Describes Honeywell's marketing efforts in the U.S.


Describes their plans to work together in the 1970s.


This is a general history of the firm.


This has a wealth of information on both companies from the 1950s into the 1970s.


The author was chairman and chief executive officer of the company in the 1980s; an illustrated history.

IBM

4228 "Another Great Divide; Major Lawsuits Against IBM," Forbes 103 (February 1, 1969): 15-17.

Describes lawsuits brought on by competitors in U.S. courts in the 1960s.


Focus is on IBM in Europe's semiconductor and DP industries of the 1970s.


This is a collection of 14 papers (1961-83), all technical, on activities of the lab, such as SCAMP and PL/1.


This is the first major biography on Watson, the founder of IBM.

Describes IBM's antitrust problems of the early 1970s.


The author is a lawyer and survey's the major case and argues in favor of IBM.


Based on the lab's archives and taped interviews, this is a 68-page history from the 1930s to 1970 with special emphasis on the development of the IBM 610 Autopoint Computer.


The commentary is on competitive pressures.


Much of the story is about IBM's successes in Europe.


This hostile account of IBM argues that it has a stranglehold on the DP industry, using data on the 1960s to generalize on the 1980s weakly.


IBM was a major landlord with hundreds of facilities in the U.S. during the twentieth century; its practices on real estate are described.


Describes the growth in the use of computing at the IBM Thomas J. Watson Research Center, Yorktown Heights, N.Y. since 1968.


The author, a leading authority on business management, offers a very incorrect but positive biography of Thomas J. Watson.


This is the most definitive study of the IBM anti-trust suit of the 1970s available.


This is a 500-plus page history of many companies in the U.S. industry, not just about IBM. Covers the period from the late 1940s to 1980.


This is a short history of IBM's operations in Europe down to the early 1970s.


This is a short description of IBM since the 1960s.


Argues that IBM was investing heavily in R&D, creating a new level of sophistication in the market.


Describes the facility and its mission.


The 1956 decree fundamentally influenced all marketing at IBM down to the present. The other involved AT&T.


This is an illustrated history of IBM on the 75th anniversary of Watson, Sr., joining C-T-R.
4250 IBM Corporation. Development of International Business Machines Corporation. New York: IBM Corporation, 1936. This is an early history, beginning with Hollerith's tabulators, time recording etc., down to the 1930s.

4251 IBM Corporation. Highlights of IBM History. Armonk, N.Y.: IBM Corporation, 1971. This is a chronological history of IBM and of its products.

4252 IBM Corporation. New Methods for Knowing. New York: IBM Corporation, 1960. This is an illustrated introduction to the company and to its history and products.

4253 IBM Corporation. Thirty Years of Management Briefings, 1958 to 1988. Armonk, N.Y.: IBM Corporation, 1988. These are CEO pronouncements to the management team at large within IBM and reflects the management philosophy of the firm.

4254 "IBM's Growth Power," Duns Review 82 (July 1963): 33-35ff. This is a detailed analysis of the firm and of its potential as of the early 1960s.

4255 "International Business Machines Co.'s Robots That Read and Tabulate Reports," News Week 7 (February 8, 1936): 34-35. Contains financial data on IBM's performance during the 1930s with analysis.


4257 Kean, David W. IBM San Jose: A Quarter Century of Innovation. San Jose, Cal.: IBM Corporation, 1977. This is a history of the location primarily responsible for disk drive products from the early 1950s forward. Contains material also on the 701, 650, CPC, and NORC; strongest on the 1950s and illustrated.


This announces the death of Thomas J. Watson, head of IBM.


These are the memoirs of a senior IBM executive, covering the period 1940s to the early 1980s. He began in IBM France and ultimately worked at corporate headquarters.


This is a journalist's account of IBM's history and current role, with primary focus on Europe.


FSD is the Federal Systems Division, the organization with responsibility of marketing to the U.S. Government within IBM.


Discusses women at IBM.


The book is a description of strategic "errors" made by IBM in the 1970s and 1980s and how competitors are taking advantage of these, particularly high function work station vendors.


This is a brief, illustrated biography of IBM's founder.


This Harvard professor argues the case for full employment practises and cites how IBM preserved its during major reorganizations in the 1980s.


 Begins with 1950 and carries through the creation of
the laboratory under Ambros P. Speiser, down to 1985.


Describes the creation of the new position of SE at IBM, serving customers. The position has remained a significant one down through the 1980s.


The whole issue of *DP Digest*, an IBM publication, is devoted to the 25th anniversary of the IBM SE. The article is an illustrated history of the position.


The son of IBM's founder is reviewed, particularly IBM's introduction of the S/360.


This is an illustrated history of IBM computer development from the IBM 603 (1942) through the early machines of the 1950s.


This is an illustrated chart of developments from 1937 to 1984 for processors, storage units, input and output equipment and software.


This monograph studied personnel practices at IBM's oldest U.S. plant, home for all manufacture of punch card equipment and R&D at the time.


IBM's Corporate Vice President for marketing during the late 1970s and early 1980s described how the firm marketed and sold.


This was an early and better history of the company down to the late 1960s.

SRA was the first significant acquisition of IBM since the end of World War II and during the 1960s. What IBM wanted to do with SRA is explained.


Surveys IBM's expansion into Europe during the late 1950s.


This is one snapshot of IBM several months after the death of Watson, Sr., focusing on changes underway.


This is the best general history of the company written by an historian and taking the story down through the 1970s.


This is a death notice and biography of IBM's founder who died in late June.

"Tackling IBM; Antitrust Suit Filed by Control Data," Time 92 (December 20, 1968): 77-78.

This was one of the more important suits filed against IBM; this is a contemporary account of its initiation.


They describe the European Community-IBM agreement whereby IBM would share technical design details with mainframe competitors operating in Europe.

"Thinking Man's Exhibit; IBM Pavilion at World's Fair," Esquire 60 (October 1963): 118-123.

Describes IBM's exhibit and high profile at this particular world's fair.

"Thomas John Watson (1874-1956)," Think 22, No. 7 (July, August, September 1956).

The IBM company magazine presented a detailed review of the founder and of his company in an illustrated report.

In reaction to the U.S. Government dropping its antitrust suit against IBM, the authors analyze the significance to the firm.

4286 Watson, Thomas J. "As a Man Thinks". Thomas J. Watson, The Man and His Philosophy of Life as Expressed in His Editorials. New York: IBM Corporation, 1954. An earlier edition was entitled As a Man Thinks (New York: IBM Corporation, 1936).

These were anthologies of editorials, primarily from Think magazine.


These are his views on management issues.


These various editions of over 880 pages were collections of his speeches and articles.


IBM's CEO and chairman (1950s-70s) recalls how he expanded the company into computers and how it evolved. He announced he was writing his memoirs.


These are recollections of leadership at IBM and his thoughts on the subject of managing change.


In large part reviews the S/360 decision and other actions Watson, Jr., took.


Describes some of IBM's actions in a period of enormous growth for the firm.


This is a brief history of the company with focus on the role played by Thomas J. Watson, Sr.

Italy

The author surveys the Italian semiconductor industry and the role of the Italian government for the 1970s.


Does the same thing as the previous citation.


This describes government programs to encourage the development of a national semiconductor industry in the 1970s and 1980s.


Describes the efforts of the Italian government to support R&D in microelectronics in the early 1980s.


Although useful on Europe's semiconductor industry, it also offers material on Italy's own activities of the 1970s.


Describes the Italian data processing world and, in particular, the semiconductor industry of the 1970s and early 1980s.

Japan


Covers the period 1892 to 1970 with focus on administrative issues with details on what machines were made and used, impact of Hollerith and then computers. Includes a bibliography of 350 items, all in Japanese.


Surveys Japanese computer industry as part of his plenary address at Compcon Spring, 1986.

4302 "Chronological Chart of Digital Computers in Japan, Compared to those in Western Countries" (in Japanese)
Goes from the relay to the electronic computers (1940-1950s), especially Fujitsu events.


The Ministry of Trade and Industry (MITI) was the single most important organization in launching Japan's DP industry during the 1950s and 1960s.


Describes the organization and mission of ETL which became part of MITI in 1952 and a major developer of Japanese computers.


Describes some of the firms activities in the 1970s and early 1980s.


Details the role of transistor technology in building Japanese computers in the late 1950s and early 1960s. NEC's involvement with computers is described.


This is a useful introduction to the subject for the 1960s and 1970s.

Includes 34 photographs to chronicle developments at this company from 1940 to 1956.


Describes the market in Japan in 1968-69: vendors, customers and business volumes.


This includes profiles of leading Japanese firms, case studies, applications, and assessment of Japan's technologies as of the start of the 1980s.


ETL played a significant role in the development of Japanese computer technology in the 1950s and 1960s.


Includes a chronology of Japanese computers, 1950-82.


This is a major source of statistical data on the Japanese data processing industry of the 1970s.


Describes Japanese intentions of invading the U.S. DP industry with goods by 1980.


This is a very detailed and useful history of MITI and its impact on the Japanese computer world after 1950.


Contains material on Fujitsu, Toshiba, and Oki from the 1950s forward.

Written by the CEO of NEC Corporation, this was originally published first in Japan. It contains material on the history of Nippon Electric Company from 1899 onward and also his views on technology at large.


This is a history of the DP industry in Japan from 1958 to 1967.


Focus is on the role of the Japanese government on R&D, particularly on computers in the 1960s and 1970s.


Begins in 1935 with a counter and goes down through electronic computers (1957-77); bibliography included.


This was an early look at the Japanese DP industry as a threat to the U.S.


It predicted extensive competition from Japan on data processing; has a great deal of useful data on the 1970s.


A very short account with emphasis on the 1930s and 1950s.


This is an interview with Fujitsu's chairman, Taiya Kobayashi, in 1982, in which he describes how his firm competes against IBM around the world with Amdahl.

Describes machines developed primarily in the second half of the 1950s, most of which were Mark class.


Covers the period 1944 to 1964 with an illustrated, detailed account of the technology, companies and ends with an analysis of the situation as of 1971.


Surveys the subject from 1950 to the mid-1960s.


Describes early efforts with ICs in Japan during the mid-1960s, in large part as a response to the announcement of the IBM S/360.


This has comments on European and Japanese practices of the 1980s regarding the U.S.


This was one of many publications from the U.S. Government to come in the 1970s and 1980s studying the impact of Japanese Government support of its DP industry and impact on U.S. computer business.


This contains a great deal of information on the DP industry in Japan.

This is an analysis of the Japanese DP industry and its influence within the U.S. industry.


It contains a great deal of material on the activities of specific Japanese computer companies with respect to their activities in the U.S. during the late 1970s and early 1980s.


This describes Fujitsu's early interest in computers dating to the 1950s, and initial developments with that technology.


This is a brief overview of its size and function and includes a description of its major organizations as of the early to mid-1970s.

National Bureau of Standards (NBS)


Describes projects at NBS directed toward World War II needs using calculating and punched card equipment.


Surveys the important role played by NBS in early U.S. computing (1938-50s).


The project involved preparing basic tables of exponential and circular functions using desk calculators and punch card equipment (1938-40s).


Deals with all aspects of NBS, not just computers.
The U.S. Government sponsored the bulk of all American R&D in computers in the late 1940s; that effort is described by one active in the process.

He describes some of the very early projects and mission of the INA.

This documented was originally drafted in 1947 to suggest thinking about how to get more involved in computing projects. It is an internal NBS report and describes the mission of the INA.

Delivered as a speech on September 9, 1950. He discusses projects at the NBS at a time when he was the Chief of the National Applied Mathematical Laboratories.

Describes the use of computers and the creation of the INA.

Details early professional meetings on the use of computers in scientific work hosted by NBS in the 1940s and 1950s.

This includes a description of computational work done by the NBS during World War II with MIT.

Contains a description of computation with calculators and punch card equipment at NBS in the 1940s and prior work of the 1930s. It is a good snapshot of contemporary scientific/numerical projects.

Describes an early professional meeting in computing hosted by NBS.


He describes the NBS project that ran from early 1938 to mid-1939 involving the use of computational equipment to produce numerous tables.


Provides some details on early projects at NBS of the late 1940s and 1950s, along with an explanation of the origins of the INA.


Contains a description of some computational projects dating back to World War I, using office calculating equipment. The survey covers 1917 to 1924.

National Cash Register (NCR)


This senior executive at NCR describes the company during the middle decades of the 20th century.


While this illustrated biography of Charles Kettering focuses on his automotive achievements, it does discuss his work for NCR.


Kettering was actively involved with NCR in the early years of the 20th century; these activities receive treatment in this biography.


Primary focus is on his automotive achievements and concerns.

NCR constantly participated in trust activities and had monopolistic problems with the U.S. Department of Justice. This book provides useful background on the general problem.


Reviews NCR and business ethics in general at the height of that company's legal problems with the U.S. Department of Justice.


This is a biography of NCR's founder and a major influence on Thomas J. Watson's business practices at IBM. It covers activities of the late 1800s.


Commonly known as the Blue Book, it discusses NCR just before World War I and its legal problems.


This describes his views on the subject.


Describes in part his role at NCR in its early years.


Describes NCR in 1905 in considerable detail.


Reviews his work from 1880s through the 1930s. He worked first for NCR and later for IBM on cash registers and other office equipment.


Contains a great deal on NCR's marketing efforts before World War I.

4366 Johnson, Roy W. and Lynch, Russell W. *The Sales Strategy of John H. Patterson, Founder of the*
This is a short, illustrated review of the Electronics Research Laboratory where work was done on the NCR Electronic Calculator Project.

Contains references to both NCR and IBM.

This is the best available biography of Kettering with some comments on his role at NCR.

He was the senior executive at NCR in the 1930s and had been involved with the firm in one fashion or another since the start of the century; a biography.

This is an early history of NCR.

This a collection of four well written, highly illustrated pamphlets on NCR. This represents the most complete history of the company available.

The focus is on NCR and its activities prior to World War II.

Describes the careers of Joseph Desch and Robert Mumma who worked on NCR electronics, 1938-42, and on Don E. Eckdahl, head of MADDIDA project on an analyzer, complete in 1949.

4375  Whitney, Simon N.  Antitrust Policies.  New York: The
Includes material on NCR in the second volume.

This is a very early article on the cash register business in the U.S. in which NCR was already a major vendor.

RCA

Describes his own work between 1939 and 1950 briefly.

This is an 8-page on the origins of computer-related research at RCA in 1939. It was done primarily for military projects.

Describes research on computer memories from the late 1940s and early 1950s conducted by him.

This is a useful history of RCA written by a business historian who has also written about IBM.

Semiconductor Industry

In addition to surveying the industry of the 1970s, this contains data on Japanese hand held calculator sales during the same period.

Focuses on Japanese threats to the U.S. industry with data from the 1970s.

This is the best single-volume history of semiconductors available. Well-researched, it describes the evolution of the technology and its economics and includes a detailed bibliography.


This was an early study of the international nature of the industry.


Contains data on production and sales volumes for both for the 1970s and analysis of market conditions in the U.S., Europe and Japan.


Describes a technological paradigm for the solution of technical problems in this industry evident in the late 1960s and early 1970s.


This is a detailed look at direct foreign investments in the semiconductor industry in the 1960s and 1970s.


Finan is a serious student of the industry's economy and this article, like his book, is an important source for the period beginning in the 1950s.


4390 Flaherty, M.T. "Field Research on the Link Between Technological Innovation and Growth: Evidence from the International Semiconductor Industry" Graduate School of Business Administration, Harvard University

This helps expand our understanding of the role played by users of semiconductor components of such technology in the 1960s and 1970s.


Covers all aspects of the issue, reflecting technical, economic and social analysis, circa 1970s.


Argues that financial strategies were crucial for a nation's development of a high technology item. His dissertation contains a great deal of information on semiconductor economics from the 1950s through 1970s.


The author actually discusses all types of semiconductors from the 1950s to 1970.


This is a useful survey in English with considerable amounts of data on volumes and structure of semiconductor business in these two nations.


This is particularly useful for early developments dating back to the 1930s and 1940s at, for example, GE and at Bell Laboratories.


This review documents technical innovations affecting development of semiconductor components in the 1950s to the 1980s.


More than a technical study, this is an early analysis of semiconductor economics.

Focus is on the period from the 1950s through the 1960s with observations on historical issues while defining current patterns of economic behavior.


This reflects early concern over Japanese activities that threatened the U.S. position in semiconductors.


Focus is on LSI activities in Europe with material particularly useful on Germany and Italy in the 1970s.


He describes the growing irrelevance of Europe's semiconductor efforts in the 1970s and 1980s.


Focuses on European and U.S. features of the 1970s.


This Japanese survey has data on local semiconductor activities of the 1960s and 1970s.


Discusses the status of the semiconductor industry in Europe during the 1960s.


This is a particularly useful study for understanding
the semiconductor industry's weak performance in Great Britain from the 1940s to the 1980s.


They concentrate on scientific and technological factors that influenced the European semiconductor industry in the 1960s and 1970s.


Contains data on British and European semiconductor activities of the 1960s and 1970s.


This sounds the alarm that Japan would come to dominate the world's semiconductor industry if steps were not taken to protect the U.S. manufacturers.


This details many of the financial programs of the U.S. Government in support of the DP industry during the 1950s and 1960s.


The author provides material and reasons for how the industry developed in different countries with emphasis on Europe and the U.S.


Describes a British government program to support basic research on VLSI and CAD technologies in the 1980s.


Contains data on the poor working relations between various British government agencies fostering LSI business in Great Britain during the 1970s and early 1980s.

Surveys how they develop and argues that automation and software also affects, e.g., pricing and not just the evolution of solid state physics, 1960s-70s.


Documents product and process innovations of the 1970s.


This is a useful source for statistics on volumes, particularly for the U.S. for the 1950s.


This was one of many U.S. studies on the industry documenting the threat to it from Europe and especially from Japan.


He argues that innovations which were not appreciated by users were not used. He also defines the role they played in the 1960s and 1970s.


This offers statistics on volumes of components shipped in the 1960s and 1970s.


This is one of the better descriptions available of the industry of the 1960s and 1970s.

While dealing with collaborative government-industrial programs in high technology fields, they also discuss the U.S. industry of the 1970s and 1980s.

Society and Computers


This is a collection of 15 papers read at a symposium at Carnegie Institute of Technology by leaders from business, law, education, social sciences and religion on future trends as viewed from the late 1950s and early 1960s.


Their analysis is of 10,000 advertisements from 1950 to 1980, examining this technology within a social context.


A leading figure in the industry projects enthusiasm of the early 1960s into a projection of things to come.


This is an example of a growing body of literature on the impact of computers on society at large. This one is useful for Europe of the 1970s and 1980s.


This report was prepared for the British Government. It surveyed the penetration of computers and argues that chips would replace workers in massive numbers; a controversial report at the time of publication.


This is a highly influential book in which Bell argues that industrial society is evolving into a new, post-industrial phase characterized in part by the use of computers.

The book was a significant piece, the introduction an important statement from Bell. The father of the concept of post-industrial society raises the question of the role of computers in an electronically based society and called for social policies that took that reality into account.


He continues to define society as one with a heavy reliance on electronics and computers.


Bibby was the president of the Remington Rand Division of Sperry Rand Corporation and this was his address to the Eastern Joint Computer Conference in Washington, D.C., December 12, 1961. He argues that computers can make the U.S. more productive.


This is a collection of essays which, like so many other books on the subject, survey the impact of computers on industrialized society since the 1960s.


Focuses on the intellectual consequences of computers and compares its impact to that of other technologies, such as mechanical, clocks and earlier developments.


Often pithy, he comments on computers and society and includes a section on the history of computers.


By the early 1960s economists were defining knowledge and information as a new economic sector.

Brzezinski, Zbigniew. Between Two Ages: America's Role

Argues that we are evolving into a technocratic society in which the computer will play a dominant role as society moves away from an industrial-based economy.


This is the latest of many such studies defining the influence of technology economically; this one also addresses the issue of electronics.


This may be the first use of the phrase "Computer Age" in print.


This is a detailed look at the influence of computers on American society/economy, circa 1970s.


This is a rare Soviet view of computing in which is presented a forecast of a world order in which science and technology lead to a new era.


This 64-page report is Diebold's view of future trends in business organization and function due to computers.


His focus is on the technological and commercial consequences of automation on society.


This is a collection of 41 articles on the impact of computers on all aspects of society, a major work.


This well known U.S. economist argues that American
society is headed toward greater consolidation of power under larger corporations made in part possible by developments in electronics and computers.


Argues that they are becoming more obvious in science.


Gill looks at the impact of computers in Great Britain, circa 1970s and 1980s.


The lessons of the Greek experience with one knowledge revolution is instructive on the effects of DP-based information societies.


The author characterizes the introduction of the computer as a major watershed in western civilization which he then describes.


This is a philosophical mirror of Turing's man, reflecting commonly held views about data processing in the 1970s.


This argues the case that man is similar to an electronic computer.


Includes a short history of data processing. The study was commissioned by the Club of Rome on opportunities and problems arising from changes in DP technology.


Nearly three dozen contributors from government, education, and industry review automation's past and
future. Includes 37 case studies of applications in the U.S. and in Canada.


The real concern was whether such technology would place large numbers of workers out of jobs.


This is an early, pioneering work on the impact of automation.


Covers all manner of automation on work in the 1970s with futuristic statements included.


This is a major attempt to identify the economic basis for the output by industry in the U.S. in the twentieth century.


All the discussions were set in an historical perspective: machines, people, and society.


This is an analysis of the process at work in the U.S., part of which involved the use of computers.


The impact of clocks on Europe was significant; the lessons learned from the effects of that technology are useful to those looking at computers and society.

4459 Machlup, Fritz. Knowledge: Its Creation, Distribution,
Information Processing Industry

This is a major study that identifies the tasks and industries involved in information transfer in U.S. society. These are quantified and measured in economic terms.


This was the initial version of his study cited in the previous entry.


Martin describes the expanded use of computers and telecommunications in the Western world right into the home, and the effects on society in general. Martin has published over 30 books on data processing technology.


Has material on the history of computers, impact on society in the U.S., current uses and effect on Western values.


She argues that computers are humane and civilized, amplifying human qualities. This is heavily historical and philosophical.


Defines cybernation as both automation and computers. He reviews early 1960s' thinking about advantages, problems and control of cybernation and impact on society in a 48-page booklet.


This great American classic in sociology also has comments on the effect of office automation on white collar workers.

The dynamics of one to the other are under study, teaching us lessons applicable to computers.


One of several publications by this author on the social and cultural implications of computers, circa 1970s.


One of the greatest American social critics of the 20th century takes a critical and negative view of society's future relationship with technology in general. In the earlier work he links technological development to the patterns of Western Civilization since the Middle Ages.


His focus is on the economic impact of computers on society, especially in Europe and in North America during the 1960s and 1970s.


This continues the line of research begun by Fritz Machlup (nos. 4459 and 4460).


Reports on a symposium held on the topic in 1966.


The author, a political scientist, focuses on the impact of computers on American society and upon its institutions with various effects noticed.


This is the English translation of an important report that documented the expansion of electronics and computers throughout French society in coming years.

Argues that technical people, such as those in data processing, accumulate and concentrate power and thus weaken society's ability to control a technology making it a danger.


This short book is a response to the growing availability of computing on society and affect on its activities.


They argue that the influence is profound and coming quickly. In the process they survey events of the 1970s.


This reflects a continuing concern about how computers might displace workers; focus is on U.S. conditions in the 1970s and early 1980s.


This anthology reflects concerns in the U.S. during the late 1950s in education, science, government and business.


Contains material on Babbage, Aiken, von Neumann, Bush, Shannon, Turing, and George Forsythe—papers written by each.


Considers labor's views and hostility toward this new technology.


This was an early study on a crucial aspect of application development and installation.
This is an early recognition of the interrelationship among all three, the subject of this management book.

They review the English Industrial Revolution of 1780-1830 and conclude that we are not undergoing a special revolution of equal importance because the new information age is not causing a new way of living to come about.

This is sociology at the macro level: computers and civilization, circa 1960s and 1970s.

This updates statistical data on the same theme which concerned other authors cited in this section of the Bibliographic Guide.

This nearly 650-page book describes computers of the mid-1960s with emphasis on the social impact of automation.

Offers considerable amounts of DP history, circa 1950s-1970s, and describes the roles of communications and automation in society at large.

This is a collection of papers presented at an AFIPS conference held at the University of Chicago dealing with social aspects of communications, including data processing.

A prolific writer on DP management issues of the 1970s and 1980s comments on what computers are in general and how they were being used in society.


He provides a useful survey of the concern and goes farther than most writers to illustrate how labor has used computers, rather than just fear them.


Smith was Director of Marketing, Univac and this his presentation at Emory University on the use of computers and how useful they had become.


This was an early article, but only one of hundreds in the decade, on the issue of loss of privacy due to computer data banks in the U.S.


Contains observations relevant to the social impact of new forms of information transfer using data processing technology.


This is a very early lecture on the general theme, one that would draw a great deal of attention by 1950.


More than an application brief, it describes how computers were already part of society's activities.


This was a widely-read book when it first appeared. It was his view of society's future, one filled with computers and telecommunications.


Scanned OCR with permission of Greenwood Press [19 June 2009]
Although as not widely-read a volume as his earlier one, this continues the theme of social change. He pays particular attention to the role of information and the role of data processing in society.


This is a very early collection of American comments on automation, containing testimony by officials from unions, government, universities and corporations.


Describes information networks and impact on humanity as of the start of the 1980s.


A leading artificial intelligence expert comments on broader social issues and computing.


While a survey of contemporary trends by various experts, it also reflects economic and social developments of the 1980s.


Reflects hostility toward computing's pervasive influence on society, a lash back, of limited sorts.


This is a sociological study of the computer age in the U.S. with comments on its economic, social and emotional influences.

Sperry


This analyzes the role of Univac in the late 1950s and early 1960s as a business.

4506 Hughes, Thomas Parke. Elmer Sperry: Inventor and
Information Processing Industry

This is a detailed look at the firm and its actions during the 1970s, a decade about which little is available on the firm.

This is an illustrated booklet on ERA on its fortieth anniversary. ERA became part of what eventually became Sperry Rand.

This is a 32-page history that includes discussion of the Eckert-Mauchly Company (acquired in 1949) and Powers Accounting Machine Co. (acquired in 1927).

This is a contemporary account of the merger of Remington Rand with Sperry to form Sperry Rand.

This is a detailed analysis of the merger of Remington Rand and Sperry.

Telecommunications Industry

Describes the technology and its uses as of the early 1980s.

Describes the development of early commercial video (cable) enterprises in the U.S. during the early 1980s.

Survey's cable TV technology and connection to TP.
584 Bibliographic Guide

Telecommunications technology and its use are described.

This is a history of MCI, a major rival of AT&T during the 1980s.

They describe telecommunications in Europe at large, not just in Italy of the 1970s.

Describes videotext and TP technologies as they developed in the 1970s and speculates where they might go in the 1980s and beyond.

During the 1970s, DP, TP and TV began to merge together; this book describes some of the non-technical issues that emerged as a consequence.

This is a useful survey of telecommunications in Europe with data on the 1960s and 1970s.

This surveys the U.S. TP and DP industries as they involve telephonic technologies and then focuses on why the breakup of AT&T came about.

Comments on telecommunications within the broader context of deregulation of many industries in the U.S. during the 1970s and early 1980s. Discusses divestiture of AT&T.

His focus is on telecommunication trends of the late 1970s involving voice, data and software applications.

U.S. Government Agencies.


Includes an interview with Mina Rees, discussing her work during and just after World War II in fostering R&D with computers.


These are his recollections of the period 1949-53 working with the AVIDAC computer at Argonne.


Originally written in 1953, but never published, this reports on the work of the NAML in its first five years.


Curtiss described the computing needs of the period and then current projects underway around the U.S.


Describes its legislative history (1945-50), early administrative structure and policies, then NSF's expanding role in the Cold War following Sputnik.


This school long used data processing equipment, was funded by various U.S. agencies and maintained ties to important vendors, such as to IBM.

4530 Leslie, Stuart W. "Playing the Education Game to Win

Reviews the relationship between the U.S. military, industry, and Stanford University in the development of R&D projects, 1930s-1960s.


Describes events at the U.S. Office of Naval Research and its relations with the National Bureau of Standards.


This is a history of its extensive programs of the 1940s.


She surveys major computer projects supported by the U.S. Government in the late 1940s.


This is an illustrated reprint of the previous citation.


This is a comprehensive survey conducted by William A. Gill of 531 large processors in 1960; 755 were planned for 1961.


This reports on "part-time and intermittent use of someone else's ADP facilities and services" in the U.S. Government, in the 1950s.

Describes how it was done in the 1980s and sheds light on the specific uses of DP technology. It also offers comments on the use of electronic publishing in the 1980s.


Reproduces two important surveys on DP in the U.S. Government made by the General Accounting Office and Harry Fite of Lester B. Knight & Associates for the Bureau of the Budget.

U.S.S.R.


Describes some developments in the 1950s through the 1970s, despite enormous bias against the U.S.S.R.


This is a status report on developments in the late 1950s that recently became possible to discuss in the West.


This is an historical study on the extent of DP use in the Soviet Union. It is a major source on the subject.

4542 Parry, A. "Are Soviets Ahead in Data Race?," Science Digest 52 (December 1962): 64-73.

There was real concern about Soviet scientific achievements in the very late 1950s/early 1960s. This is reflected in the article on data processing.


This is a 185-page study of the computer industry in the Soviet Union.

The survey covers activities from the mid-1960s to the late 1980s; includes tables of machine features.

Xerox

4545 Dessauer, John H. *My Years with Xerox.* New York:

These are the memoirs of the director of research who, in the 1940s, was instrumental in getting xerographic products designed at Haloid Company, predecessor to Xerox.


This is a lauditory history of the firm by two journalists focusing primarily on the 1980s and on Xerox's efforts to be successful in the copier market.


These accounts of Xerox's laboratory at Palo Alto, California, include memoirs by Pake, its first research director; articles cover the period 1950s-1960s.


The authors argue that Xerox developed a micro called the Alto in 1973, and that it elected not to market the machine. It chose instead to invest in an office computer system that did poorly in the market.


This pamphlet contains a chronology of Xerox's history and list of all its products.


This is a brief, well-illustrated history of Xerox.


At the time competition between the two was heating up; the article is a contemporary analysis of the issues in the U.S. market.
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