

History of Computing

Founding Editor

Martin Campbell-Kelly, University of Warwick, Coventry, UK

Series Editors

Gerard Alberts, University of Amsterdam, Amsterdam, The Netherlands

Jeffrey R. Yost, University of Minnesota, Minneapolis, USA

Advisory Board

Jack Copeland, University of Canterbury, Christchurch, New Zealand

Ulf Hashagen, Deutsches Museum, Munich, Germany

Valérie Schafer, CNRS, Paris, France

John V. Tucker, Swansea University, Swansea, UK

The History of Computing series publishes high-quality books which address the history of computing, with an emphasis on the ‘externalist’ view of this history, more accessible to a wider audience. The series examines content and history from four main quadrants: the history of relevant technologies, the history of the core science, the history of relevant business and economic developments, and the history of computing as it pertains to social history and societal developments.

Titles can span a variety of product types, including but not exclusively, themed volumes, biographies, ‘profile’ books (with brief biographies of a number of key people), expansions of workshop proceedings, general readers, scholarly expositions, titles used as ancillary textbooks, revivals and new editions of previous worthy titles.

These books will appeal, varyingly, to academics and students in computer science, history, mathematics, business and technology studies. Some titles will also directly appeal to professionals and practitioners of different backgrounds.

More information about this series at <http://www.springer.com/series/8442>

Thomas Haigh
Editor

Exploring the Early Digital

 Springer

Editor

Thomas Haigh
Department of History
University of Wisconsin–Milwaukee
Milwaukee, WI, USA

Comenius Visiting Professor
Siegen University
Siegen, Germany

ISSN 2190-6831

ISSN 2190-684X (electronic)

History of Computing

ISBN 978-3-030-02151-1

ISBN 978-3-030-02152-8 (eBook)

<https://doi.org/10.1007/978-3-030-02152-8>

Library of Congress Control Number: 2019931874

© Springer Nature Switzerland AG 2019

Chapter 4: © This is a U.S. government work and not under copyright protection in the U.S.; foreign copyright protection may apply 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

What the “early digital” does is rethinking the technologies of computation within a broader frame. The Springer History of Computing series very much welcomes the broadening of scope exemplified by the present volume. Mirroring the development of the history of computing as a scholarly field, the series has already expanded beyond histories of computer science, computer business and computer manufacturing to include analysis of the sociological and cultural dimensions of computing. In a broad sense, history of computing has come to cover the history of the practices of computing, and so too has this series.

Then does not a volume centered on early computing machinery imply a return to a narrower history of computing? Here is the secret of this book. It returns to some of the subjects familiar from the early days of the scholarly history of computing, to study them in a new light. The editor of the present book, Tom Haigh, has led the way this process in his previous work with Mark Priestley and Crispin Rope. Their perspectives on ENIAC (in the book *ENIAC in Action*) and Colossus (in a series of articles currently in press) have stripped away what seemed self-evident about these machines to earlier historians. Analysis by Priestley on Von Neumann’s *Routines of Substitution* is appearing as a SpringerBrief in the History of Computing series.

Liberated from the knowledge of what was “only natural” about those machines and unburdened by commitments to declaring which machines should count as computers, let alone be the “first computer,” they were able to present the ENIAC to the reader as an ensemble of practices of constructing and using computational devices. That object now stands before us in a fresh mode. A historian freed from the assumptions of the computer scientist can show how certain words and notions gradually evolved in relation to the use of those pieces of technology.

The scholarly goal of “decentering the computer” has been much discussed in the history of computing community. To me, decentering implies staying away from anybody’s definition or demarcation. It means looking at the historical pieces without assuming that they were a computer.

Now suppose a bunch of historians got together and took a similarly fresh look a set of historical objects which they had not necessarily deemed “computers” before.

This is what the authors for this book did. They further decentered the computer, by presenting it as one in a set of things, artifacts entangled with digitality.

By rethinking their trade, and decentering twice, historians have reached an interesting new intellectual point. They have also reached a new physical place: the German town of Siegen. Siegen University has been the venue of workshops and conferences initiated by Erhard Schüttpelz and his colleagues. This book is the outcome of not only conceptually combining ideas, it is the genuine product of bringing people together.

Scholars of media share an inclination to treat the technological side of media with overdue reverence. All of media studies? Those in the venerable German town of Siegen are welcome exceptions. The black boxes of the “inter” are opened. Computers, software, and networks are critically researched. If historians of computing are broadening their frame, these students of media are offering a proper setting for such broader scope. Welcoming Tom Haigh to Siegen has deepened and supported its intellectual endeavors. His diplomacy convinced an impressive crew of historians of computing to follow suit and enter dialog with an equally impressive media studies team for the cross fertilization of ideas. We are proud to present the resulting book as a contribution to the two series of Springer books.

Gerard Alberts
editor Springer Series History of Computing

The history and theory of computing and the history and theory of media were, for a surprisingly long time, separate fields of scholarship. There were some obvious historical reasons for this: computers were devised as computing machines and understood to have been derived from devices for calculating numbers, while the word “media” had been reserved for the “mass media” of communication and the public services of telecommunications. Of course, ever since the 1960s there had been predictions that telecommunications and computers would merge, and computers, automation, and artificial intelligence were from the beginning a speculative topic for media theory, for instance, in Marshall McLuhan’s writings. Thus, when computing and media did merge, for a moment it seemed that media theory would be well-prepared to develop theories about “the tele-computing-coordinated media” future (to use a retro-futuristic term that does not really exist), which has become our present and even our fate. But it seems, both computer science and media studies carried such a heavy theoretical load on their shoulders that the anticipated intellectual fusion had to be postponed, though the practical fusion quickly overwhelmed us. Computer science was not prepared for media theoretical discussions of networked computing and their media interfaces, and at least some media theoretical experts expected media to vanish in an all-encompassing hypertext reality or in a convergence of all past media on one platform. In many respects, particularly in Germany, media studies and computer history both remained hypnotized by the idea that a computer was first and fundamentally a Turing Machine, and not the strange amalgam of networks and nodes, of software and hardware, social relationships and

faddish interfaces, computerization movements and disillusioned bubbles, and simulations of old media and parasitic new practices that slowly emerged as the dominant reality of both media and computing. Thus, the history of computing had to find its own way, along the edges of more dominant fields, Science and Technology Studies (STS), library and information studies, business history, the history of science, cultural studies, and especially the research done by computer scientists and programmers into their own history. It is only recently and due to the relentless efforts of Tom Haigh, Gerard Alberts, JoAnne Yates, Rebecca Slayton, and their comrades-in-arms that the history of computing has been able to break out of its niche at the intersections of other fields and emerges as a possible disciplinary field in its own right.

The present volume is dedicated to this emerging synthesis. It will help to close the gap between media studies and the history of computing by making both strands meet in the historical reconstruction of digital computing devices, whether they were called media or computers or neither. Because once we are able to treat digital computing devices in their own right, the vexing questions of “are they computers?” and “when did they turn into media?” become secondary. And by becoming secondary, they can be answered much more efficiently, because this move makes it easier for scholarship to follow the symmetry standards set by science and technology studies: the big opposition between “internalist” and “externalist” descriptions is overcome; the successes and failures of innovations and projects may be explained and described with the same concepts; technical details, social organization, and cultural transmission turn out to be aspects of one seamless whole; and the different kinds and attributions of human and non-human agency involved in computing can be more easily acknowledged.

Luckily, at least one thing about digital computers seems to have withstood the test of time. Digital machines they remain, or at least some digital machines are what they are made of. And computerized media: digital machines they became, or at least a vital part is made of digital machines. Even if other digital machines were and are called neither “computers” nor “media,” this is the best common ground one can find.

Following digital computing devices through history, we can expect the liberating effect Gerard Alberts described so well in his generous and thoughtful preface to this volume: to work beyond a priori assumptions about media and computers. And to be honest, we do not have much of a choice. Because our digital computing devices today are ubiquitous and pervasive, it is a matter of great arbitrariness if they are now called “computers,” if they were historically called “computers,” if they are or were called “media,” if they are called “the software component,” “machines,” “instruments,” “control panels” or whatever. Computing has become ubiquitous, and somehow “the computer” as a clearly defined physical entity, from mainframe to desktop and beyond, is gone. But computing devices with their variable geometries and their physical and material effects still exist and proliferate. And media, though we have long expected their demise or final convergence, have not disappeared either, if only because we need devices to perform our long-cherished media practices. We know a smartphone is not a phone, but it is a phone

for us. And as long as we do the driving ourselves, we cannot escape the impression this bundle of computing devices, wheels and seats, glass and steel, is a car. But what about cashiers, hotel keys and locks, credit cards, and countless other devices? Whether things are called computers or media or neither does not give us a theoretical or historical clue what the computing device in its belly does. That's why we need a thorough history of digital computing devices to answer the questions of historical continuity: "How did we get here?" and "What to expect next?"

And concerning "what the future has in store," let me close with a personal remark. Actually, it may be a personal remark, but it concerns the professionalism of our universities worldwide. The scholars represented in this volume know how few experts in the history of computing field actually are able to meet their standards, and how fragile and tenuous the field still is. Because the experts in this field have to combine a profound technical knowledge with a versatile knowledge of changing historical circumstances in all scales, in the micro-scale of networks of computing experts, but also in the macro-scale of shifting economical, political, and social circumstances, in the guise of government sponsorship and guidance, of market supply and demand, and of professional career-opportunities. And speaking of career opportunities, the history of computing field is still on the verge of taking off. After all, digital media do rule the world, or rather, if you change the rules of digital media, in any of its numerous monopolies and cartels you are wielding enormous power. Economics, education, administration, and entertainment, the list is long, have all been digitalized and are being run with the help of digital algorithmic machines and their asymmetrical power relationships. Come to think of it, each and every major university in this world should have a professorship for the History of Computing, to teach our students (and not only the computer scientists among them) how it became possible that the world could be run by digital machines – and how it was possible to do without them. And how many professorships for the History of Computing do you think actually exist in this world, to take up that task? To whom it may concern.

Erhard Schüttpelz
(Collaborative Research Center
"Media of Cooperation," University of
Siegen and editor of the Springer Series
Media of Cooperation)

Acknowledgments

This book originated with two workshops held at Siegen University, in June 2016 and January 2017. My Siegen colleague Sebastian Gießmann, and his team, did a great job in putting these events together and handling all the logistics. Funding for the events came from SFB 1187: Media of Cooperation and from Siegen's School of Media and Information. Neither the workshops nor this book would have been possible without the support and encouragement of Professor Erhard Schüttpelz, who has been a tireless champion for the relevance of the history of computing to media studies.

I am also grateful to all those who have contributed to the book's development. Gerard Alberts, as editor of the Springer Series in *History of Computing*, encouraged us along the way. Other workshop participants, including Liesbeth De Mol, David Link, Pierre Mounier Kuhn, and David Nofre, provided input that helped to shape the final papers. Jeffrey Yost contributed detailed and helpful reviews of four chapters. Catherine Barrett Abbott helped to proofread most of the submissions. My family members, Maria, Peter, and Paul, supported the project with their willingness to spend summers in Germany and to manage without me during other travels for workshops.

At and for Springer, A. IshrathAra, Wayne Wheeler, Simon Rees, and Prasad Gurunadham saw the book through the editorial and production process with admirable speed.

Contents

1	Introducing the Early Digital	1
	Thomas Haigh	
2	Inventing an Analog Past and a Digital Future in Computing	19
	Ronald R. Kline	
3	Forgotten Machines: The Need for a New Master Narrative	41
	Doron Swade	
4	Calvin Mooers, Zatocoding, and Early Research on Information Retrieval	69
	Paul E. Ceruzzi	
5	Switching the Engineer’s Mind-Set to Boolean: Applying Shannon’s Algebra to Control Circuits and Digital Computing (1938–1958)	87
	Maarten Bullynck	
6	The ENIAC Display: Insignia of a Digital Praxeology	101
	Tristan Thielmann	
7	The Evolution of Digital Computing Practice on the Cambridge University EDSAC, 1949–1951	117
	Martin Campbell-Kelly	
8	The Media of Programming	135
	Mark Priestley and Thomas Haigh	

9 Foregrounding the Background: Business, Economics, Labor, and Government Policy as Shaping Forces in Early Digital Computing History 159
William Aspray and Christopher Loughnane

10 “The Man with a Micro-calculator”: Digital Modernity and Late Soviet Computing Practices..... 179
Ksenia Tatarchenko

Index..... 201