Think Piece

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Making History: New Directions in Computer Historiography

Twenty-two years after the *Annals*' first issue, browsing the library's QA76 range—the section of the Library of Congress catalog system where librarians place most books on the history of computers, mixed seemingly randomly with social commentaries and technical books—still takes only an hour or two. A few dozen books, plus the *Annals*, pretty well cover the field. Until the 1990s, this literature consisted almost entirely of memoirs by computer professionals, often tightly focused on the invention and design of particular machines or on the business history of early computer companies. A few important scholarly books, such as Williams' *A History of Computing Technology*,[1] attempted to cover the whole sweep of computer history. Even these, however, generally focused on the computer as a technological object, rather than on applications or (especially) on the evolving social role of computers and networks.

Only recently have substantial numbers of professional historians begun to make their mark on the field. In the past four years alone, several excellent books have created a rags-to-riches effect for those who, like myself, have been attempting to teach the history of computers to students who think computing began with the Apple II and believe that everything worth knowing can be surfed on the World Wide Web. These works include, among others, Campbell-Kelly and Aspray's *Computer: A History of the Information Machine*, Ceruzzi's *A History of Modern Computing*, and Abbate's *Inventing the Internet*. Unlike their predecessors, these books focus less on invention and design than on situating computers and their uses in their social context.[2]

These signs of a budding professionalization in our field strike me as signals to start reflecting on where the history of computing now stands, where it ought to be going, and how contributors to the *Annals* might help take it there. These are issues about how we collectively "make history": how we decide what stories to tell, how to tell them, and why they matter. This column regularly offers a series of such reflections.

This installment of "Think Piece" is essentially my personal manifesto for a new historiography of computers. An exploding field such as ours presents far more possibilities than we will ever be able to explore. Obviously, writers follow their own interests, and all kinds of contributions are valuable; the following idiosyncratic principles are intended only to provoke new thinking about why the history of computers is interesting, important, and relevant to the larger history of our times.

Why write history?

Historiography serves three main purposes. The first is description: laying out the facts, getting the story straight, and telling it well. A great deal of historical writing does no more than this; it is historiography's most basic and important goal.

The second is analysis: determining the causal structure of events, understanding why things happened as they did and not some other way. This can be a difficult job, since multiple forms of causality pervade all history, from the small decisions of individuals to huge institutional, economic, and political imperatives. To do it well, historians need to be conversant with theories of technological, economic, and social change. Even if those theories turn out to be irrelevant to our stories, they can provide essential frameworks for thinking about causes and actors. All stories contain implicit causal theories; by making such theories explicit, analysis can, and should, shape narrative.

A good example of very different causal theories of the same events can be found in comparing Hafner and Lyon's *Where Wizards Stay Up Late*, which tells the story of the Arpanet chiefly in terms of its inventors as individuals, and Abbate's *Inventing the Internet*, which focuses primarily on institutional goals of ARPA, the US Defense Department, and other institutional actors such as standard-setting bodies.

The final purpose, and ultimate responsibility, of historiography, is evaluation: the ethical and political questions of whether actors behaved well or badly, who benefited and who lost, and whether technological change helped or harmed individuals, groups, or society as a whole. For example, IBM won most of the antitrust lawsuits brought against it in the 1960s. Did these victories represent a correct legal and ethical judgment of IBM's actions or a miscarriage of justice won not on legal or ethical principles but by IBM's vast corporate resources? Few truly important stories lack an ethical and political dimension.

Why do computers matter? Some principles of historiography

Technological change can be interesting in itself, but ultimately what counts is what computers actually do: how, why, and for what people use them. The historical version

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of this question concerns change over time: how the uses and meanings of computers have evolved. The following principles can help focus attention on this basic issue.

Think outside the box. The "computer" is much more than the components inside the container, which could do absolutely nothing without software and the often complex knowledge, training, and social organization required to make computers do useful work. By itself, the history of hardware tells us very little that matters, because "the computer" in use is really a sociotechnical system. The history of any technology is ultimately about an inseparably linked set of material, economic, and social conditions, which make it useful, affordable, and valuable (or not). Both success and failure often have more to do with social conditions than with technological capabilities.

Think about functionality. Computers were invented to calculate with numbers. But computers really process symbols. Numbers are only one kind of symbol, and most programming has little to do with mathematics. Today, calculation is only one among many things computers do. Thinking about the functional purposes of computers can help guide understanding of their larger meaning. For example, communication, control, and simulation are among computers' most important uses. Email and microprocessor control matter to society at least as much as spreadsheets. Yet we know very little about the general story of how these capabilities evolved: how computers came to replace older communications and control technologies, or how they displaced analog simulation (model building). Nor have historians yet had much to say about the economic and social costs (as well as benefits) of computerizing those functions.

Think counterfactually. A basic historiographical exercise involves asking how things might have turned out differently. For example, how might computers have evolved if the Cold War (with its massive government investment in computer research and development) had never happened? What if the government resources devoted to digital computer research in 1945–1955 had been spent on general-purpose analog computing instead? What if IBM had lost its 1960s antitrust cases? We can never know the answers to these questions—and writing about counterfactuals rarely works—but contemplating them can help historians grasp the relative weight of causal factors and the relative importance of particular events.

Maintenance matters. Computer systems and software break down a lot, and they used to break down much more than they do now. Too much computer history has ignored the armies of system operators, technicians, and low-level programmers required to keep computers running, not to mention their enormous cost.

Hype about productivity increases has always been used to sell computers. Advertisements often depicted a single computer operator (usually female) replacing whole phalanxes of employees. The reality was usually quite different, yet few historians have explored the vital role of support staff in the success of computers. The key here, as James Cortada, Thomas Landauer, and others have shown,[3] is that corporate commitments to computers in the 1950s and 1960s, when the new technology's social role was being established, may have been based on false (or nonexistent) assessments of the new machines' cost-effectiveness.

Contemplate infrastructure and digital convergence. In the past two decades, computers have become the infrastructural technology of choice for most other, preexisting infrastructures. The business buzz phrase "digital convergence" captures the trend to digitize all preexisting media formats, enabling them to bridge previously separate media infrastructures such as television, radio, recorded music, books, and newspaper. Digital convergence will have major social impacts. Understanding how things turned out this way should be among our key historiographical aims.

Digitization is social work. Reality is primarily analog (so to speak). Until tabulating equipment and digital computers came along, so was most technology. Most control systems used gears, gyroscopes, and other analog devices. Scientific instruments typically produced data in analog form; converting these data into numbers involved human interpretation of noisy signals.

Over time, most technologies of information, communication, and control are becoming digital in order to take advantage of computer power. But this has been a long, slow process involving the conversion of sensors, effectors, and recording devices that can use and produce digital inputs and outputs. Until

rather recently, it also involved an enormous social effort in digitizing analog materials. For example, hundreds of thousands of hand-drawn weather maps were digitized—by hand—in order to develop databases for climate studies. These data are among the important sources of knowledge about climate change, one of today's major political issues. The wholesale conversion of analog sound recordings to digital compact discs represents another vast change in information formats. Very little has been written about the history of this huge social commitment to digital data.

Operating systems are infrastructural. One key to the infrastructural character of computing is the spread of standardized software. In the 1960s, most official software standards were developed at the level of programming languages. These standards made possible both the packaging of software and programming as a profession. But by the 1970s, standard operating systems proved even more important. OS/360, Unix, DOS, Windows, and the Macintosh OS all became basic computing infrastructures. The story of operating systems as infrastructure largely remains to be told.

Take a global view. Most historiography in English has focused on the United States. This is not unjustified, since American corporations and the US government played the dominant role in computer development during the critical period of 1940–1960. But European, Japanese, and Soviet computing have their own independent stories, as does computerization outside the developed world.

As computer networks link the entire globe, understanding the spread of computer technology and the contributions of lesser-known participants becomes increasingly crucial to a full grasp of computer history. This is a colossal and difficult task, beyond the reach of any individual. In the future, I hope we will see more team projects and edited volumes comparing, contrasting, and linking the history of computers and networks around the world.

As we enter a new millennium in which computers seem destined to become even more important than they already are, these principles seem to me particularly salutary. Many others could be articulated (and I would be interested to hear from readers who have developed their own).

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References

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3. J.W. Cortada, *Information Technology as Business History*, Greenwood Press, Westport, Conn., 1996; T.K. Landauer, *The Trouble with Computers: Usefulness, Usability, and Productivity,* MIT Press, 1995.

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