the computer has featured a small number of truly innovative people. Names such as Turing, Licklider, Kay, Charles Babbage, and Grace Hopper should be better known. Perhaps more interesting would have been a text that concentrated closely on a select group of true innovators. The opportunity to examine these key innovators might have uncovered similarities in approach, background, or drive that could be insightful. As it is, this text is a serviceable history of computing, as viewed through a particular lens. Of course, one could argue that this is the real aim of the book; to tell the story of the development of the computer to readers who are most interested in people.

In the conclusion of the book, Isaacson wraps the narrative around to suggest how Ada Lovelace would consider the development of the computer thus far. This chapter begins with a slightly dismissive conclusion regarding what Turing referred to as the "Lovelace Objection" to the notion of "thinking machines," that machines will be able to originate thoughts of their own. This is part of a much bigger discussion, and it feels artificial, simply Isaacson's way of completing the circle through this history, rather than a meaningful conclusion. There is finally some comparative discussion about some of the innovators mentioned in the book, but it's too little, too late.

That does not diminish what it is in this text that is very welcome. All too often overlooked, the inclusion of people less well known in the popular understanding of the history of the computer is a valuable contribution. However, for a text that purportedly focuses on the innovators, there is too little exploration of the "why": Why these particular people? Throughout the work, despite the title, it is clear that the advance of the technology is the driving factor behind the narrative, more than the people behind the innovation.

While it is true that there are instances where the key innovator directly influenced the nature and direction of the technological development, it is equally true that for other developments, including the computer itself, it is not so clear that the history rests with a single individual, and a book myopically focused on this one mechanism to tell the story of technology seems to, at best, create problems in telling a coherent story. At the same time, there are many different pathways to the discovery of new information, and those that are drawn to the stories of people and personalities can use this text as a way to discover the interesting development of the computer as the ubiquitous information machine that continues to shape our lives.

Author Information

Nick Webb is Visiting Assistant Professor, Department of Computer Science, Union College. Email: webbn@union.edu.

Erik L. Stayton

Faxed: The Rise and Fall of the Fax Machine

By Jonathan Coopersmith, Johns Hopkins University Press. 320 pages, 2015

I have never had much interaction with fax machines. Despite having been born during the era in which the sales and use of fax were expanding rapidly — the chapter "The Giant Awakes" in Coopersmith's *Faxed* — I came of age in a house with not only a fax machine and copier, but a digital scanner and Internet-connected computer, against which the poor facsimile machine always seemed curiously antiquated. Like the advocates of digital communications technologies, I found myself blindsided, perplexed by the popularity of analog transmissions in an age that promised electronic, multimedia messaging. And the fax seemed old because it *was* old, its provenance coming from Scotsman Alexander Bain in the mid-19th century. Yet it was successful because it was simple to use and ubiquitous, and was ubiquitous because it had

become affordable, achieving after over a hundred years its moment to shine in the marketplace. As Jonathan Coopersmith (Texas A&M University) so expertly demonstrates, facsimile has a deep and complex history that defies conventional narratives about the technology, and provides an ideal landscape in which to explore key issues for technological development: developer push and user pull, and the dynamics by which technologies are invented and popularized, or ignored. A product of the same age of frenetic innovation that brought the telegraph and moving picture (quickly), radio and television (still at a reasonable pace), the facsimile machine, like the idea of Robida's "telephonoscope" that was only truly invigorated in a mass-market with the coming of Internet telephony, had a long and delayed journey to broad relevance and recognition.

Coopersmith, whose previous book *The Electrification of Russia, 1880-1926* focused on changes that occurred over less than half a century, has chosen to relate facsimile's whole journey, from its first patent to its "bureaucratic absorption" and replacement by computer-based communications. This long narrative arc, from 1843 to 2011, does *Faxed* credit, as it seeks to answer not only why the fax machine gained such popularity in the late 20th century, but why, despite consistent use in niche news and military markets since the First World War, the fax never previously experienced great success. Throughout this period, facsimile contended first with mail and telegraphy, then radio, and finally digital technologies like email, for market and relevance. This long technological history is one of the book's key strengths. Coopersmith's deep historical and archival research has left seemingly few technologies unmentioned or

unexplored, as far back as Alexander Bain and his contemporaries, and including the blossoming fax-related business of the 1970s and 1980s. This breadth of coverage alone makes *Faxed* an important contribution to the history of communications technologies, and provides a strong foundation for further work that digs deeper into particular time periods, devices, or markets.

The economic and market history component in Coopersmith's book is particularly strong, and takes center stage through much of the work, which reads as a nuanced application of technology-push and market-pull ideas from the likes of Schumpeter's economic theories of innovation. Coopersmith's coverage of Western Union's failed (and relatively tentative) Desk-Fax service, and the products developed by Graphic Sciences, Xerox, Qwip and others in the 1960s and 1970s, is particularly laudable in this regard. The text is sprinkled with fascinating stories of forward-thinking technologies and the circumstances of their demise. The Post Office's adventure with Speed Mail, its facsimile service that promised to deliver letters across the country in hours rather than days, makes for particularly interesting reading (and has surprised everyone with whom I have discussed the book). Opposed by Western Union, and incompetently managed by lead contractor ITT, Speed Mail overran its budget and was canceled by the Kennedy administration in August 1961 The "next step in mail," promised by Eisenhower's Postmaster General Arthur Summerfield to be "as revolutionary and as progressive as anything yet achieved," never came to fruition, as much for political reasons as technological ones.

Coopersmith's coverage of the ironies of analog and digital modes of operation is also astute, and *Faxed* explains not only that fax was originally an analog technology, but that even when digital faxing was technically possible, analog facsimile machines continued to dominate the market despite being "generally two decades out of date" as early as 1965. These issues — defined as Coopersmith does through the lenses of incremental versus radical invention, and of the telephone versus the digital network — represent

> ## The fax seemed old because it *was* old, its provenance coming from the mid-19th century.

an important part of the understanding of changes in media and communication technologies. Along with these technical distinctions, Coopersmith brings in an important dimension with the culturally specific reactions to facsimile in the United States and Japan.

Though the bulk of the book is primarily focused on the North American case, *Faxed* includes significant sections on the Japanese case as early as 1943, reflecting both the importance of Japanese manufacture to the use of fax machines in the American market as well as the unique advantages of facsimile reproduction compared to telegraphy for the transmission of *kanji*. The fax culture of Japan represents a unique sociocultural milieu, and one with which many Western readers will doubtless be unfamiliar. Despite being a relatively small component of the book in terms of length, it cleverly makes

the point that fax is not really one technology that is independent of locale or other factors, but that the technology looks different through different cultural lenses: as a manner of transmitting images or "original" signatures for users of the Latinate alphabet, but as a more precise manner of language transmission for logographic languages such as Japanese. The regionality of technology is well-understood in science and technology studies

> **The fax machine was successful because it was simple to use and ubiquitous.**

circles, but deserves repeating. Coopersmith's coverage of this culturally situated linguistic dimension connects to interesting questions about languages and alphabets in communication technologies, and suggests that further investigation of other language groups and their relationships to fax, and of Japanese-language users' changing relationships to analog and digital text-entry devices, may be productive avenues for related research.

Among these large-scale narratives are a number of little moments that make the history of facsimile come alive, and contribute to the richness of *Faxed*. AT&T's transmission of pictures to politicians via fax, gifts sent as part of an advertising campaign, is one such gem. Mentions of the early adoption of fax for railroad ticketing, and the informal and activist uses of fax in the

1980s and 1990s are others. However, by virtue of its historical scope and market focus, *Faxed* struggles with avenues it does not have the time or space to explore. Facsimile's cultural resonances are mentioned, but remain unexamined. The connection of the expansion of home faxing with the expansion of the working day beyond the office, and attendant changes in employee practices, is commented on but not fleshed out. Gendered dimensions of faxing show up occasionally — particularly excellent is an anecdote about an American corporation faxing information to its male board members but overnighting it to its female board members, assuming they did not have fax machines — but do not receive the deeper exploration they deserve, despite several photo plates showing women sitting on or operating fax machines that would seem to invite such commentary. Fax art — and fax's artistic resonance in the late twentieth and early twenty-first century — is mentioned briefly, but calls for deeper investigation in terms of its production and reception. The connection of faxing to science fiction gets a nod in Coopersmith's discussion of Hugo Gernsback and the "Radio Automated Facsimile and Reproduction" newspaper, but this avenue for investigating fax's cultural resonance is otherwise outside of the book's focus. These social and cultural connections are of primary importance to what faxing means to a culture, as well as to the lived experience of engaging with the fax machine.

Faxed, then, leaves the reader with a variety of open questions, for example: In what way are

dreams of faxed information fed by or displayed through science fiction? What were the relationships of women to facsimile machines, both in their use and in advertising? Several market-related and technical sections similarly deserve fuller coverage. Although it provides a detailed overview of the history of facsimile technology, and an important contribution to the history of media and communication technology, *Faxed* is by no means the final word on faxing. However, its oversights seem to come with the territory of entering into a technological discussion where prior synthesized work is scarce, and *Faxed* accomplishes what it set out to do: to provide a solid "first history" of the facsimile machine based on technical and market details. It would be a stronger and more complete work if lengthened by even a few pages to explain key statements and provide further insight into other dimensions of faxing, but *Faxed* remains a detailed and relatively accessible discussion of the history of the technology of facsimile, and lays the groundwork for deeper questions to be asked about facsimile in particular contexts and time periods, from gendered dimensions of faxing to the status of facsimile in the popular imaginary.

Author Information

Erik L. Stayton is a graduate student at M.I.T., where he currently researches automation paradigms and the media representations of self-driving cars. He also studies the material history of computing as a member of the Trope Tank, a creative computing laboratory at M.I.T. Email: estayton@mit.edu.

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