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PEER-REVIEWED JOURNAL ON THE INTERNET

What the history of women and computing teaches us

by Valérie Schafer

Abstract

This paper aims to explore how an entry through the perspective of women and gender has revitalized and still revitalizes the history of computing, STEM, and digital technologies and to what extent this approach also aligns with current IT challenges as well as educational issues. It revisits key themes such as invisibility, intersectionality, embodiment, and inclusiveness, by drawing on significant works from recent decades.

Contents

1. Introduction

Since Jane Margolis and Allan Fisher’s (2003) book, *Unlocking the clubhouse: Women in computing*, seminal works have delved further into the sociological and historical dimensions of the declining presence of women in computing education and professions. This decline is particularly visible from the mid-1980s onwards. As suggested by the back cover of Tom Misa’s edited volume *Gender codes*: “The computing profession faces a serious gender crisis. Today, fewer women enter computing than any time in the past 25 years. This book provides an unprecedented look at the history of women and men in computing, detailing how the computing profession emerged and matured, and how the field became male coded” (Misa, 2010).

Beyond spotlighting the problem, scholars in the social sciences and humanities (SSH) offer complementary insights, unveiling a striking socio-technical construction throughout the history of computing, gender, and labor. This article aims to demonstrate how a focus on women’s perspectives revitalizes the narrative of computing history, but also informs gender studies and contemporary

discussions in STEM and digital technology. We follow the approach by Nathan Ensmenger in “Making programming masculine”, who noted that most of the literature first intended “to explore what the history of women in computing had to say about women — about their contributions, experiences, and abilities”, while he aims to “address instead the flip side of this question: namely, what has the history of women in computing had to say about *computing*.” [1]

Discussing notions such as invisibility, intersectionality, and inclusiveness, we draw upon the works of pioneering scholars like Janet Abbate (2012), Tom Misa (2010), Mar Hicks (2017), Thomas Haigh (2010), Corinna Schlombs (2023), and Nathan Ensmenger (2012, 2010a, 2010b), to name but a few. Their analysis intertwines with broader discussions on the reciprocal relationship between technology and gender studies and allows a new look at the so-called “golden age” in the 1960s, the influence of technical developments, economic and governmental measures, the glass ceiling and mid-career exodus women faced, or the impact of media coverage, representations, and recruitment policies. In a concluding part the focus then shifts to the practical implications of this historical re-evaluation, exploring avenues such as creating educational content.

2. Chicken and egg: The co-shaping of a gendered approach

As noted by Janet Abbate in her seminal book, *Recoding gender*, “Computing is a particularly good arena for examining the intersection of gender and technology. Employed as technical experts from the very beginnings of digital computing, women were inventing careers and professional identities at the same time that the field itself took shape. Their stories illustrate the power but also the mutability of gender roles.” [2] While the 2000s and 2010s witnessed increased attention to the decline of women in computing, this decline can be traced back to the 1980s, as highlighted by research that warned about gender disparities, especially in the growing field of personal computing (Terlon, 1985). Interest in gendered aspects of the history of computing is certainly related to the strong development of gender studies from the 2000s. However, we may also consider the questions raised by historians of computing themselves, particularly their desire to move towards a more socially oriented history of technology. They not only look more and more beyond major innovations to consider users, maintainers, and technicians, but also examine the social impact of computing. Concurrently, the development of science and technology studies (STS) also plays a role in questioning complex agencies, asymmetries, and the co-shaping of techniques. STS scholars highlight multiple and intertwined actors (both human and non-human), analyse how these various actors interact and influence each other, and show the co-shaping of technological developments. They also look at unequal power relations, access to knowledge and decision-making capabilities, to better understand the co-construction of technology and society.

As the history of computing rethinks its approach, there are indications of a desire to move away from a top-down, machine-centric narrative, with more attention being paid towards software, while the first narratives strongly focused on hardware: “In any case, the software developed for personal computers, which is inexpensive, often amateurish, and, in the early years at least, extremely limited, nevertheless provided a kind of power to computer users that was previously non existent.” [3] The expansion of the history of computing “to include more information-processing technologies opened up the field to a broader range of participants as well: Historians looking beyond the manufacturing of computers began asking questions about how computers were used, by whom, and for what purposes. They uncovered the crucial contributions made by nonelite actors like technicians, operators, and programmers, and in doing so rediscovered the significant presence of women in computing” [4]. The effect of digitization is also notable, as it broadens the scope. It underscores the importance of users, the issues of practices and daily uses (in the private and professional sphere, etc.). Finally, we can add the development of oral history, like the testimonies preserved at the Charles Babbage Institute, that allows for more complex narratives and for other voices to be heard, as well as a new approach to sources.

In “Masculinity and the machine man”, Thomas Haigh [5] delved for instance into the role of the Data Processing Management Association. He explained how masculinization aimed to elevate the status of computer professionals, conveying a specific vision of masculinity. As he demonstrated, this effort starting from the 1950s and 1960s was not “despite” the presence of women in the field but “because of it”. Nathan Ensmenger (2010b) echoed this analysis in his book *The computer boys take over*. He portrayed how programming was gradually depicted as highly complex, requiring unique talents, and how recruitment tests emphasized masculine traits. The latter heavily favoured mathematical skills, despite programming not necessarily relying predominantly on them. Furthermore, he highlighted biased personality tests in the 1970s (and the emerging stereotype that a good programmer was unsociable and solitary), which contributed to an underrepresentation of women in recruitment. Ensmenger (2010b) explored whether this attitude deliberately aimed to exclude women from recruitment or if it was a result of a self-perpetuating cycle. Moreover, he noted that professionalization and recognition in programming “necessitated” segmentation and stratification, often at the expense of women.

Some lack of recognition may still persist, particularly in evaluating women’s contributions. This issue goes beyond programming and perpetuates through time. For instance, Kristina Haralanova’s (2010) study on the contribution of women to the development of open-source software demonstrates that women participate in the field but are not involved in tasks deemed strategic, despite their equal importance. Of course, the issue is far from binary. Various factors may contribute to the exclusion of women, some being clearly political. Mar Hicks (2017) illustrated this phenomenon in *Programmed inequality: How Britain discarded women technologists and lost its edge in computing*, when studying the British context in the 1960s and 1970s. World War II created a demand for women’s participation and cheap labour, but this dissipated and the imbalance reverted in later years. There were also differences across companies, as shown by William Vogel (2014). He contrasted the attitudes of companies like Control Data and Burroughs. While Burroughs’ recruitment brochures predominantly featured white men, Control Data made efforts to attract women, organizing recruitment sessions with buffets, concerts, and fashion shows. Advertising has also played a significant role in shaping the perceptions of women in computing, especially during the development of microcomputers. Aristotle Tympas, *et al.* [6] conducted a study of 1,500 advertisements for computer products since the 1980s, revealing a stark contrast in the representation of women and men interacting with computers. Women were often depicted merely typing on a keyboard, while men were portrayed as more action oriented. The advertisement for the Samsung 840 EVO Series Solid State Drive in 2013 perpetuated these stereotypes. It features two men and one woman facing the product. While the male characters were depicted using their computers professionally, implying their understanding and mastery of the technical aspects, the woman was shown in her kitchen, using the computer to organize family photos. To accentuate this disparity, she reacted with naivety and incompetence to any slightly technical question posed to her.

Furthermore, intersectionality is crucial in studying the relationship between women and computing, considering for example class and gender intersections. The study on the British agricultural statistics department at the British Rothamsted Experimental Station (RES) by Guiditta Parolini (2015) highlighted how women were dismissed not only because they were women but as “invisible technicians”, a term coined by Steve Shapin (1989): “Gender was not the main element that contributed to the invisibility of the female assistants in the Rothamsted statistics department. It was the lack of authority to preside over scientific work that relegated these women to invisibility” [7]. The same may apply in some way to the past invisibility of the six ENIAC girls after World War II (WWII), that was highlighted by Jennifer Light (2003). When their pictures appeared in the press, no names were attached to them and sometimes they were even absent from the picture which had been cropped:

> “‘In the beginning, there was a general sense that the computer itself was doing the work, and building the computer was the really important thing’, says Janet Abbate [...]. ‘It took a few decades to really get to the point now, where we just take for granted that software is important’.” (Little, 2021)

This analysis is shared by Ensmenger (2010a, 2010b), who noted that while there is no doubt that the work

of the ENIAC "girls" was largely underestimated because they were women, their subordinate position also stemmed from the fact that they worked on software rather than hardware. Programming was considered a relatively trivial and mechanical activity.

3. On (in)visibility, the "golden age" and empowerment

While the role of the ENIAC girls has since been greatly appreciated, this valorization is double-edged. Indeed, it can lead to the obfuscation of other women, such as those women who worked as human computers during WWII at the University of Pennsylvania's Moore School on the Electronic Numerical Integrator and Computer (ENIAC) or on other tasks, in the shadows of the six pioneering women, remembered as the ENIAC girls, who were figuring out how to program the ENIAC:

> "The cliché that the machine was assembled by men but programmed by women is just not true. Dozens of women, employed as 'wiremen', 'assemblers', and 'technicians' worked shifts through 1944 and 1945 to build ENIAC, threading miles of wire through the machine and soldering approximately half a million joints." [8]

Furthermore, Haigh and Priestley considered the term "programming" as inadequate to describe the actual work of the ENIAC girls:

> "When programming developed as a distinct job, in the mid-1950s, it was generally separated from the work of operating the computer or any ancillary punched card units. Programmers sat with pencils and coding pads, writing instructions. These were punched onto cards by keypunch women, the data entry clerks of their day. Operators tended to the machine itself, preparing the computer and its peripherals for a job, loading the appropriate card and tape media, and extracting printed output." [9]

Haigh and Priestley underlined the risk of a "Matthew effect", which highlights only certain prominent figures, as seen in the case of Grace Hopper being the sole woman remembered for COBOL overshadowing the contributions of others. This overlooks the more discreet figures and a history also made up of "little hands", lesser-known figures, and daily routines, as highlighted by scholars like Mar Hicks and Corinna Schlombs in the context of punch cards. In *Programmed inequality*, Mar Hicks placed a strong emphasis on the labor force from the 1930s to the late 1970s. The book covered the period when women entered computing through code breaking and data processing during WWII and a time of "gendered war work" to the progressive decline of female presence in this field from the 1960s. The study deliberately focused on the labor force and "invisible workers". Hicks analysed the "masculinization" of the profession with the complicity of the government: "The process of rendering invisible certain categories of workers — and the importance of their work — was critical to the success of early large-scale computing projects aligned with the informational needs of governments." [10]

Interest in "invisible workers" is also to be found in a recent paper by Corina Schlombs (2023) on keypunch operators that were "doubly disadvantaged as women and as presumably unskilled employees" [11]. These studies also balance the idea of a "golden age" in the 1960s that would swiftly fade away. Indeed, in the April 1967 issue of *Cosmopolitan*, an article authored by Lois Mandel promoted potential career paths for "computer girls". Mandel described the vast opportunities available to women in the field of computing as

limitless. She emphasized the absence of discrimination within the industry, asserting that everyone had equal opportunities for career advancement. Drawing on a quote from Grace Hopper, Mandel linked programming to planning a dinner, stressing the need for patience and attention to detail. Hopper's analogy suggests that just as one plans for a dinner party, programming requires careful foresight to ensure everything runs smoothly. It is important to note that attributing this form of natural aptitude to women for programming could be criticized for promoting inherent abilities based on gender. This notion is not new; historical examples, such as women being assigned precision tasks based on supposed sewing skills, illustrate the continued presence of naturalistic arguments in characterizing women's work. The association of computers with typewriters in the 1970s perpetuated, for instance, the perception of computers as office machines, primarily for secretarial work traditionally associated with women. Analysing cases from West Germany, in the Allianz Insurance Company and Sparkassen savings banks, during the 1950s to 1970s, Schlombs revealed the essential role of manual data entry in early computing and noted:

> "Having emphasized women's roles as housewives and mothers in the 1950s, a decade later, Germans accepted women's work, particularly part-time, promising that women could integrate salaried employment with family duties. However, not all keypunch operations were part-time, and not all were short-term. Keypunch operations — albeit low-paid and routine — may have appeared suitable and even desirable positions for mothers since they offered work in a white-collar environment at respectable institutions. These positions may have been instrumental in drawing the silent reserve of women into the workforce during a time of labor scarcity in Germany." [12]

While there was a demand for women in computing during wartime, and many women were found in human computing, manual data entry, punch cards, and the emerging software companies, career advancement often stagnated. Many women faced glass ceilings and career interruptions due to maternity leave. It is crucial to avoid understating the presence of women, but equally the notion of a "golden age" for women in computing should not be exaggerated. The complexities and challenges women faced in navigating career opportunities were present even in this period. This is illustrated by the exceptional trajectories of the few women who at the time created their own companies. For instance, female entrepreneurs like Dina Vaughan and Stephanie Shirley who established their own businesses in U.K. are examples of strong empowerment in the face of inequalities (see Abbate, 2012). Dina St Johnston, formerly Vaughan, pursued a mathematics degree at the University of London. At the computer company Elliott Brothers she honed her programming skills and quickly proved to be talented, while facing the glass ceiling. In 1959, she left the company to establish her own venture, becoming the founder of Britain's first private high-tech company dedicated to programming. Specializing in software for automatic systems in air navigation and railway signalling, her company even developed computers, such as the Vaughan 4M. Three years later Stephanie Shirley also founded her own company. Initially working for the postal service in London in 1951, she also attended evening classes and obtained a mathematics degree in 1956. However, her interest and enthusiasm peaked when she discovered computer science. While working for the British Post Office on various computer-related projects, she encountered obstacles in receiving promotions, which happened again in a software development company. Thus, in 1962, she founded her own software company, Freelance Programmers. She focused on recruiting women who wanted to work part-time from home, allowing them to care for their children while working on a freelance basis. These examples (Abbate, 2012) are exceptional and must not obscure nuances within the realm of computing, encompassing a spectrum of occupations ranging from prestigious roles like systems analysis and programming to less recognized positions such as basic operator jobs. As noted by Thomas Haigh:

> "First, computing is not a single kind of work but a collection of hugely diverse jobs across many industries [...]. We should

> follow the advice of the late Mike Mahoney to look ‘at histories of computing(s)’ rather than a single ‘history of computing’. Thinking of computing as a single area of activity makes is hard to understand why women were inventing programming in the 1940s but made up only a small proportion of the corporate computing workforce a decade later. [...] Why would we expect the accountant in charge of an insurance company’s project to staff its electronic data processing department in the mid-1950s to be guided by the fact that participants in the experimental military academic ENIAC project believed female mathematicians to have an aptitude for translating mathematical methods into switch and wire configurations?” [13]

4. Beyond “women and computing”

So far, our journey that started during the Second World War with the ENIAC girls, and even a bit earlier with the punch card operators has focused on the workforce in computing science and the computer industry. However, the history of computing has also explored digital content produced, users and the way they engage with technologies, and representations of computing (in media, advertisements, discourses, etc.). These points are fundamental for understanding the significant decline of women in computing starting from the mid-1980s with the growth of personal computers. Indeed, personal computing became associated with a geeky universe creating a heavily gendered culture. The arrival of home computers is undoubtedly a turning point in the 1980s and 1990s that strengthens the gendered relationship with technology, as it has been demonstrated in several countries (in Norway by Haddon [1990], in the U.S. by Cassidy [2001], in France by Jouët [2003]). However, the analyses of content and users can be traced back to a time when computers were not yet widespread in households, for example, in the case of Joy Lisi Rankin’s (2018) analysis in her book *A people’s history of computing in the United States*. She questioned, among other things, “How computing went from male to masculine”. For instance, she described the emergence and development of PLATO, an early computing network developed at the University of Illinois, which allowed the use of bulletin board systems (BBS) and e-mail. She emphasized some steps in the production of an exclusionary computing culture — one example being the naming of the student ALGOL compiler with the acronym SCALP in 1962 [14].

Emphasis has also been put in the past years on the question of intersectionality, notably when it comes to Afro-American women. A widely known example is the film *Hidden figures* (2016) based on the book by Margot Lee Shetterly. While Venus Green (2001) had already highlighted issues in occupations in the phone industry, *Data feminism* (D’Ignazio and Klein, 2020) analysed the figure of Christine Darden who worked at NASA in the 1970s. *Algorithms of oppression* by Safiya Umoja Noble (2018) shed a further light on intersectionality and its very concrete implication for our digital life, content, and culture. Moreover, books like *Abstractions and embodiment* (Abbate and Dick, 2022) or *Your computer is on fire* (Mullaney, *et al.*, 2021) approached the topic by strongly reintroducing asymmetries, relations of power, as well as bodies and people into the history of computing. As Janet Abbate and Stephanie Dick asserted: “The question of who has a mind and who has a body — who will be remembered for their ideas and who will be remembered for their physical labor is always at once a historical, a technical, and a social question.” [15]

We may also refer here to the work by Lisa Nakamura from “Indigenous circuits: Navajo women and the racialization of early electronic manufacture” (2014) to *Racist Zoombombing* (2021). Indeed, the approach has also spread in communication studies, as the latter shows. The GamerGate controversy (Ferguson and Glasgow, 2021) and the MeToo movement proved that the question cannot only be understood from a

professional perspective but must be placed in a larger frame that reflects the usage of the Internet, Web, platforms and social networks, and their early steps. Two studies may exemplify these points and the need to fully integrate networked communications or practices and uses into the history of gender and computing. The first by Hannah Zeavin (2022) investigated mediated communication and BBS, before the Web was adopted. She paid attention to two digital channels on USENET: net.women and net.women.only: "Together they tell a story of gendered contest and elaborated digital norms in the 1980s." [16]. She "takes up a newly available USENET archive to complicate feminist digital historiography, which frequently draws a direct line from the 1970s offline to the 1990s online (to the start of the Third Wave), and to argue that these forums strategically looked backwards while moving into new media spaces" [17]. The second example is the research by Laine Nooney on videogames as well as her study of Sierra On-Line co-founder Roberta Williams. As she suggested:

> "The history of videogames has largely been imagined as a patrilineal timeline. Women, when they emerge as participants in the game industry, are typically figured as outliers, exceptions, or early exemplars of 'diversity' in the game industry. Yet the common practice of 'adding women on' to game history in a gesture of inclusiveness fails to critically inquire into the ways gender is an infrastructure that profoundly affects who has access to what kinds of historical possibilities at a specific moment in time and space. This contribution aims to shift the relevant question from 'Where are women in game history?' to 'Why are they there in the way that they are?'" (Nooney, 2013).

While it would be impossible to refer to the whole variety of literature and research which developed over the past two decades, notably in the field of game studies (see, for instance, Cassell and Jenkins, 2000), it must also be stressed that gender cannot be approached solely through the issue of women (and men) but has to deal with other narratives and figures. We may mention Whitney Pow's paper, "A trans historiography of glitches and errors", that analysed the approach by transgender programmer Jamie Faye Fenton, who created in 1978 the experimental video glitch art, *Digital TV Dinner*. We may also add two recent books: *The two revolutions: A history of the transgender Internet* by Avery Dame-Griff (2023) and *The digital closet: How the Internet became straight* by Alexander Monea (2022).

The broadening of the scope, shifting from "women and computing" to "gender and the digital", can understandably draw criticism for its intertwining of various temporalities, stakeholders, contexts, and power dynamics. It is essential, of course, to contextualize each case study, avoiding for instance the treatment of programming activity as static and unchanging. One must consider the different eras of computing, the variations between decades, as well as differences among countries and companies. It is important not to conflate the mainframe computers of the post-War period with personal computing in the 1980s or the networked computing that developed thereafter. Practices, users, professional and personal practices, as well as the relationship with digital technology have evolved profoundly. It is important to bear this complexity in mind: approaching the topic from WWII to the present allows more extended research discussion opportunities, and can prove operationally beneficial for presenting this history to broader audiences, particularly within educational settings, but this requires historical clarifications and precautions.

5. Concluding remarks: Learning and teaching through history and representations

Numerous initiatives have been developed, with varying degrees of success, to attract more women to the

field of computer science. They range from institutional policies within universities focused for instance on recruitment, to the desire to create safe spaces for women in education or workplaces, to efforts to change representations from a young age, as attempted by platforms like testit.uni.lu (https://testit.uni.lu) created at the Université du Luxembourg. Additionally, there are initiatives to create dedicated inclusion sessions at computer conferences, specific actions supported by gender representatives, and activities during Women's Day. Creative communication campaigns have been developed, such as "Why can't girls code" (Saujani, 2016), which play on stereotypes and humor, and associations and Internet users are also full of creative ideas. This was for example demonstrated with Feminist Hacker Barbie (https://computer-engineer-barbie.herokuapp.com), a Web site created in 2014 by Kathleen Tuite in reaction to the Mattel's *I can be a computer engineer* (Marenco, 2013; McMillan, 2014).

History seems to offer a powerful lever for addressing these issues and it also allows students in SSH (social sciences and humanities) to fully engage with the history of computing. For several years I have been teaching the history of computing to diverse audiences, including history and communication science students. It might seem daunting to them to delve into the intricacies of computer history, but the approach towards women and computing provides a tangible entry point into this complex narrative. It immediately adds a strong social and cultural dimension (which could be approached through other avenues such as the history of computing and environment), and intersects with labor history, societal representations, and technological uses. Moreover, there are parallels between the evolution of communication technologies and computing that may raise the interest of students and create a link or *fil rouge* through several time periods and ICTs — for example, by exploring the telephone switchboard operators or the history of the telegraph [18].

Over the past decade, my teaching has evolved along with the students and education practices themselves, shifting towards more collaborative learning experiences and projects-based learning. Among the most enriching approaches recently has been the creation of an anthology (Living book) on women and computing with a small group of Master's students in history at the Université du Luxembourg and with the support of two Ph.D. students, who were taking their first steps in teaching (Schafer, *et al.*, 2023). This format allowed students to engage with a wide range of sources and research texts, while fostering their own critical thinking and offering them the opportunity of a wide range of scientific reading. Moreover, it responds to students' interests by integrating topics such as the GamerGate controversy or the #MeToo movement. By intertwining these contemporary issues with historical narratives, students gain a deeper understanding of the societal impact of computing technologies and the ongoing struggles for inclusivity in the digital realm. This approach is also valuable for introducing students to the evolution of computing and networks, from early mainframes to today's digital era, in a different way. Instead of the "classic" *ex cathedra* presentation of the evolution of computing, which often generated only a very limited interest, this knowledge is integrated through their exploration of the state of the art (with some guidance and initial contextualisation of course). Initially, there was a greater interest from female students in the topic, while some male students exhibited scepticism regarding its importance. However, over the course of several weeks, everyone became engaged in the subject matter, the definition of an approach, a structure for the book, a timeline, the selection of sources and research texts. This approach broadened students' understanding by exposing them to different perspectives, bridging the gap between gender studies and computer science. Moreover, through discussions on gender issues in computing, students may discover intersections with other areas such as sociology, psychology, and ethics, enriching their understanding of the broader societal implications of technology. Introducing the notion of intersectionality through this approach is crucial, while students are also encouraged to question not only the visible narratives of history but also the less obvious ones. This opened the door to discussions about innovators, maintainers, the history of inventors, and biases within the main narratives surrounding technological history. Creating the anthology with them also provided a more accessible entry point into the topic compared to immediately confronting issues such as the glass ceiling or masculinization of the field via a teacher's lecture, which may come across as moralizing. By starting with a exploration of gender dynamics within computing, students gradually delved into deeper discussions about systemic biases and societal structures. Furthermore, this approach encourages critical reflection on historical methodologies and the importance of diverse perspectives in shaping our understanding of technological progress, while questioning traditional

narratives. The result of this experiment is a Living Book (Schafer, *et al.*, 2023) that explores historical sources, testimonies, as well as representations and the current state of the art. There are of course numerous other avenues within this realm to approach the topic, and particularly through cinema and fiction, juxtaposing fictional narratives with historical realities. This is exemplified by Thomas Haigh's examination of both Ellen Ullman's memoir, *Close to the machine*, published in 1997, and the television series *Halt and catch fire*. Similarly, fictional works such as *The Bletchley circle* (on this history see Burman, 2013), *Hidden figures*, or *The imitation game* offer alternative lenses through which to explore these themes and put them back in historical context. This could be extended to contemporary presentations of artificial intelligence (AI), as highlighted in some studies which analyse bias against women and girls in large language models (LLMs). The report "Challenging systematic prejudices: An investigation into bias against women and girls in large language models" (UNESCO, 2024) scrutinized stereotypes in popular generative AI platforms, revealing unequivocal evidence of gender bias in content generated by these models. Moreover, researchers warn that "Cinematic depictions of the scientists behind artificial intelligence over the last century are so heavily skewed towards men that a dangerous 'cultural stereotype' has been established — one that may contribute to the shortage of women now working in AI development" (Lewsey, 2023). There is certainly a continued imperative for sustained interest in the intricate relationship between gender and computing.

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Notes

1. Ensmenger, 2010a, in Misa, p. 121.

2. Abbate, 2012, p. 4.

3. Ensmenger, 2012, p. 765.

4. Ensmenger, 2012, pp. 759–760.

5. Haigh, in Misa, 2010, pp. 51–71.

6. Aristotle Tympas, *et al.*, in Misa, 2010, pp. 187–209.

7. Guiditta Parolini, in Schafer and Thierry, 2015, p. 115.

8. Haigh and Priestley, 2015, p. 25.

9. *Ibid.*

10. Hicks, 2017, p. 238.

11. Schlombs, 2023, p. 65.

12. Schlombs, 2023, p. 83.

13. Haigh, in Misa, 2010, p. 68.

14. Rankin, 2018, p. 46.

15. Abbate and Dick, 2022, p. 11.

16. Zeavin, 2022, p. 634.

17. *Ibid.*

18. Müller, in Schafer and Thierry, 2015, pp. 27–46.

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Editorial history

Received 12 November 2024; accepted 16 December 2024.

What the history of women and computing teaches us
by Valérie Schafer.
First Monday, volume 30, number 1 (January 2025).
doi: https://dx.doi.org/10.5210/fm.v30i1.13892