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Recognizing a Collective Inheritance through the History of Women in Computing

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Abstract: In her article "Recognizing a Collective Inheritance through the History of Women in Computing" Erika E. Smith engages with the following question: how might we create the space for women in the history of computing that is deserved? Even with the proliferation of social, political, and historical engagement with feminist theory and computing technology, there remains a lack of scholarship on the topic of women in the history of computing. Given the dearth of historical accounts on the role of women in computing, the task of delving into such history becomes necessary, although difficult. Smith's objective is to examine a spectrum of contemporary feminist theory as it relates to our inherited (hi)stories of women in computing. In charting these (hi)stories, Smith compares diverging feminist theories helpful in shedding further light on historical accounts of women in computing largely forgotten.

Erika E. SMITH

Recognizing a Collective Inheritance through the History of Women in Computing

In order to engage the ongoing (hi)stories of women in computing, we must first deconstruct the ways in which women's work with computers has been encoded over time. In endeavoring to do so, we work to recognize the many forgotten (hi)stories of women in computing by instantiating what Donna Haraway calls the inherited obligations that make us who we are (*The Haraway Reader* 1). As Marie Hicks shows, "attention to the historical specifics of the earliest computing labor contexts can help correct received images of computing as an inherently masculine field by explaining the gendered changes that developed as the field professionalized" ("Only the Clothes" 5). Certainly, in addition to images, signifiers and representations in language and metaphors of (ex)change become central to decoding our understandings of (gendering) the human, nature, and technology. Donna J. Haraway and Anne K. Mellor suggest that from a feminist perspective the most significant relationship between science and literature exists in metaphors of code (for instance in film and popular print) and that both define and are defined by technology: "The explanatory models of science, like the plots of literary works, depend on linguistic structures which are shaped by metaphor and metonymy" (89). Haraway takes up the monster, a metaphor that Nina Lykke sees as a feminist confrontation with science, in the representation of a cyborg in a modern-day attempt to revamp the monster as a powerful feminist metaphor. Evelyn Fox Keller and Sally Hacker write about the impacts of gender science that illuminate these points and relatedly, Haraway's notions of situated knowledge and the importance of successor science constitutes a reframing of our inherited obligations and attempts to re-contextualize issues of science and gender in the digital age. Such reworkings of a monster metaphor provide a powerful challenge to binary constructs of identity (male/female). The cyborg, then, promotes an acceptance of multiple, partial perspectives, which, for Haraway, results in more meaningful exchanges through vast networks and communities. By decoding these structures, we can see how historically women have employed their ability to communicate and, as Margaret Lowe Benston points out, use language as a means by which they could enter the male/scientific sphere.

Sadie Plant's vision of feminist agency contrasts that of Haraway. For instance, Haraway sees the homework economy as the feminization of economic systems of exchange, especially those that occur in the restructuring of full-time into part-time work that relies on the society's most vulnerable, feminized, and marginalized citizens. On the contrary, Plant's reading of the implications of labor argues that women have benefited from the shift from full-time to part-time work. Plant's style of analysis stands apart from other feminists who discuss the gender politics of science and technology because she engages with the material aspects of history and shows some alignment with difference feminism (for more on the dilemmas of equality versus difference in feminism see, e.g., Pilcher and Whelehan; Scott). In this regard, David Alan Grier's reflections on gender, divided labor, and women's contributions to computing via instructional literature provide further discussion ("The Computer"). Rather than emphasizing the newness of postmodern communities that combine and weave new connections by embracing fragments, Plant's inquiries underscore how many forms of weaving have always created important connections throughout history: "The yarn is neither metaphorical nor literal, but quite simply material, a gathering of threads which twist and turn through the history of computing, technology, the sciences and the arts" (11-12). She argues that this community and agency has been (and still is) present in other modes of communication that rely on economic, scientific, and linguistic exchange.

Like the ever-changing nature of digital technology itself, the definition of the word "computer" has morphed over time. But, as Plant notes "computer was a term applied to flesh and blood workers" where the "bodies which composed them were female" (37). Plant goes on to describe in detail the ways in which women have been integral to the development of computers: "Hardware, software, wetware — before their beginnings and beyond their ends, women have been the simulators, assemblers, and programmers of the digital machines" (37). Women have been integral not only in the development of digital technology, but also in their roles doing calculations or computations; during World War II, such women were often referred to as human "computers," the common term used to refer to those who performed the activity of computing and calculating (see, e.g., November's review in "When Women Were Computers" and Grier's discussion of "When Computers were Human"). In a literal sense, women have been defined as "computers": women "computers" were particularly important during World War II, when women were recruited to work for a variety of scientific and technical fields. As soldiers left their jobs at home in order to fight abroad, many women took up occupations that were never before available to them. For the first time, women were recruited to work in scientific and technological fields including areas of public health and industrial chemistry. They were now encouraged to work with science and technology and took new jobs in traditionally male-dominated areas that required specialized scientific and technical skills. Although these jobs were often classified as "women's work," Suzanne Le-May Sheffield notes that women did have a certain amount of (constrained) agency within these new workforces (149). There were a variety of new occupations open to women during the 1920s, 1930s, and 1940s. Many of them got jobs as nutritional consultants, X-ray technicians, pharmacists, and even as industrial chemists constructing bombs (Sheffield 142-47). Some bright young women who were strong in mathematics worked as "computers" for the United States military. These "computers" were women who developed firing and bombing tables that were needed, efforts that later led to the development of computing technology like that of the ENIAC: Electronic Numerical Integrator and Computer (Fritz 13). Indeed, historically women have made important contributions to the programming, the language, of computing. Adele Goldstine was one such woman. According to her husband Herman, himself an important pioneer in the field of computing and the head of the development team for the ENIAC during the early 1940s, most of the credit for ENIAC's success goes to Adele Goldstine (Greene 76). She created both a systematic method of programming, an extraordinary task that no one had ever accomplished before, and the program manual for the ENIAC (Greene 75-76). Like computing pioneer Ada Lovelace, lesser-known women like Adele Goldstine used their skills to not only gain a thorough understanding of the cutting edge technology of their time, but they also used their skills to communicate with others. They were involved in educating others about new technology and played a large role in imagining the applications of computers.

Women's efforts have been largely obscured from the history of computing in general and we can learn about women and their role in the history of computing if we take into consideration their demonstrated skill sets and abilities, perhaps especially in their ability to traverse the language of technology. Women brought much to the emerging computing fields, particularly through their work with the language of computing — they often worked with programming languages and software. Janet Abbate argues that examining female and male similarities and differences is important in accounting for the marginalization of women's roles in early computing and she illustrates that whereas men were the inventors of computer hardware, women have historically been involved with software initiatives during the birth of modern computing and who "brought skills in mathematics, language, organization, and interaction that were sorely needed in programming and computer science. By attending to women's experiences and their often unconventional paths into the field, we can better understand the profession itself…Women's historical involvement with computers has not been widely publicized, in part because historians of computing until recently have focused mainly on hardware. Men have been the inventors of machines through most of the history of computing, because women did not usually have access to the necessary training and resources … More recent work by historians of computing has highlighted software development, academic computer science, and applications, areas in which a greater number of women can be found" (4). Women offered a variety of skills to the emerging field of computing science, including linguistic, organizational, and technical abilities. Yet, it is interesting to note that women are often linked to the development of the language of this new technology — the software and programming languages, the applications of computers, and the academic areas of the field. These are clearly important contributions by women creating ways to translate the technical, hardware structures of computing developed by men into wider social and cultural studies, applications, and dispersals of this technology. Women's role in creating languages in programming ways to use computer hardware for different applications promotes overall human participation in and interaction through computers.

It is important to explore women's usage of the language of this technology in order to understand how women have been involved in the history of computing. By using this language, or what Haraway calls situated knowledge, women worked to bring traditionally elite, privileged, men's spheres of science to a wider and more diverse audience. Referring to Luce Irigaray, Plant relays the importance of language and women's ability to traverse many means of communication in the following quotation: "Woman's desire would not be expected to speak the same language as man's; woman's desire has …

been submerged by the logic that has dominated the West since the time of the Greeks" (Irigaray qtd. in Plant 140). Plant argues that whether women have contextualized or signified by weaving stories, textiles, or wires, have been an important part of emerging structures of communication. In some cases, women have created a "different alphabet" whether through programming languages or through situated knowledge, in order to rework and re-encode gender dynamics and power structures historically closed to them. Plant's rhetorical techniques, although not without flaws, draw together seemingly trivial histories which make up a more crucial whole. This emphasis on an examination of the material can bring forth greater feminist connection between language, technology, and agency. By using these same techniques Plant employs in her analysis, perhaps we may continue to delve into the realm of women in the history of computing as this (hi)story is told through two prominent historical figures: Ada Lovelace and Grace Murray Hopper.

Lovelace was a mathematician, writer, musician, and socialite. Her impact is noted by entries in historical sources such as the *Encyclopedia of Computer Science* and the *International Biographical Dictionary of Computing Pioneers*. Born in 1815, she was daughter of Lord George Gordon Byron and Baroness Anna Isabella Noel. As Benjamin Woolley notes, Lovelace "worked with some of the most interesting and important scientists of her day, figures like Andrew Crosse, a researcher into electrical power who was said to be a model for Mary Shelley's Dr. Frankenstein" (1). Not only did she take interest in the science of Crosse, but she also worked at making the language of mathematics and science more accessible and intelligible. It is no coincidence that Lovelace is now widely celebrated as a computing pioneer (see, e.g., Phillips). Much of Lovelace's fame came from her work with Charles Babbage, especially her work translating, annotating, and adding important explanatory notes to an article by L.F. Menabrea on the analytical engine. Lovelace became proficient in mathematics during an era when it was extremely rare for women to do so and more than a century after her death in 1852, a high-level universal computing language, "Ada," was named in her honor. Since the 1980s, Ada has been used to program the world's most powerful war machine: "when America went to war, its weapons were to be discharged in her name … It was in honour [of Lovelace's work on the analytical engine] that the US Department of Defense decided in 1980 to name the standard programming language it had adopted for its military systems 'Ada'" (Woolley 1-2).

Unfortunately, Lovelace's work and name were largely forgotten even when other computer designers working on projects such as the ENIAC could have benefited from her work (Greene 75). Throughout an historical account of women in computing, we see a continued theme of the gendering of science, of women as natural/emotional/ interpersonal/reproductive and men as mechanic/ scientific/objective/rational: in this case, the male scientist (Babbage) had the social and scientific connections necessary for the computing project, but Lovelace was deemed as the one with confidence who was "good with people" (Greene 18). She used her powers of language to translate mathematics and to traverse the social terrain of the science world. But Lovelace's success in early computing should not be chalked up to her linguistic and mathematical abilities alone. Lovelace was a figure full of hybrid aspects of identity — hybridity that gave her the flexibility to traverse through spheres that were traditionally separate, such as scientific and artistic, domestic, and economic. In his biography of Lovelace, *The Bride of Science*, Woolley states that "this was an age when social, intellectual and technological developments opened up deep fissures in culture, when romance began to split away from reason, instinct from intellect, art from science. Ada came to embody these new polarities. She struggled to reconcile them, and they tore her apart" (2). Indeed, this incongruity perhaps explains why computing scientists are still fascinated with her, often naming projects and programming languages in her honor. Biographers like Woolley and Doris Langley-Levy Moore play an important role in highlighting the details of Lovelace's life as it reflected and changed nineteenth-century Western culture. The work of biographers like Moore and Woolley is a crucial part of undoing or decoding the marginalization of women whose contributions have often been downplayed in the history of computing. It also lets us see how Lovelace embodied "new polarities" of her age, while also perhaps forecasting the twentieth-century preoccupation with understanding divisions, boundaries, and binaries that so concerned Lovelace throughout her life. Yet, what these purely biographical accounts fail to portray is what Lovelace represents to the greater historical spectrum of women in computing. This is the contextual spectrum that Haraway's notion of ongoing stories and inherited obligations describes. Plant sees such value in Lovelace as both a historical figure and as a part of a more complex, continuing story representing women in "the new technoculture" that her book *Zeros + Ones* is, in many ways, built on quotations and characterizations of Lovelace. Indeed, Plant chooses Lovelace as the voice that characterizes the tenuous but meaningful links between past and present, science and art, and man and woman. For Plant, Lovelace is the most appropriate figure to voice the greater narrative involved in a complex weaving of (hi)stories of women, machines, politics, and progress. What she points out is the greater literary, philosophical, scientific and social spectrum within which Lovelace belongs: a spectrum that could work to encompass or uncover narratives of many other women in the history of computing.

Lovelace was at once "very much afraid" of her genius, but she was also confident of the importance of her work with Babbage (Plant 8). She could be social then reclusive, cautious then reckless, confident then lacking self-esteem (Plant 32). This hybrid mixture of contradictory characteristics allowed Lovelace to traverse typically separate spheres of men and women. She used her understanding of social spheres to avoid clashes with the British government that would hinder her and Babbage's work. At the same time, she knew the mathematical ideologies behind Babbage's concepts and took these details to another level by understanding the importance of creating a type of programming language for this work. Lovelace also had a vision of the larger significance of the analytical machine. She used her many diverse abilities to move between the smaller, more detailed mathematical schemes and the larger ideological and social arenas within which their work might be accepted. In the context of recent postmodern feminist attempts to understand women who were confined historically to binary constructs of gender while also escaping such binaries of male/female or nature/technology, Lovelace's complexities and contradictions point us to the interesting possibilities that such historical hybridity allows.

The most compelling part of this understanding of Lovelace's role is how she might have employed (either directly or indirectly) a kind of difference feminism that distinguished her skills. Lovelace's diverse abilities with organization, writing, and mathematics makes her a clear precursor to other women who entered fields of science and technology and offered new skill sets which improved these areas. She holds an important place on the timeline of a collective feminist inheritance that embraces contradictions, because her diverse perspectives and her struggles symbolize what skills women in particular offered as they entered emerging realms of science and technology throughout the twentieth century. Through her particular interpersonal, metaphorical, and communication skills, Lovelace created an opportunity for herself in the sphere of science and mathematics. However, the limitations of her achievements become apparent when computing scientists all but marginalize and forget her contributions. This marginalization was easily compounded by her habit of only placing her initials A.A.L. on Babbage's papers so that, as a woman, she could not be "accused of bragging" (Greene 16). Woolley suggests that one of the reasons Lovelace wanted her initials on her work so that people could distinguish between her work and that of Babbage (278). In a historical context, having Lovelace's initials to distinguish her work is an important part of establishing that women did have a role in the evolution of modern computing. Initially, moves like Lovelace's created a place for women within the male dominated sphere of computing science; but, as equal rights feminism demonstrates, such spaces for women are often confined and subordinated. Haraway's image of the feminist cyborg of combining feminist rhetoric and embracing play, flexibility, and hybridity that women scientists like Lovelace practiced argues for both male and female capabilities. Hybridity and fluidity, characteristics that helped women like Lovelace resist male dominance, become important parts of circumventing categorization and, thus, the subordination of women in these fields.

Throughout the twentieth century, many other women in the history of computing science also used their strengths with metaphor and language to create a place for themselves in computing science. In *Women and the Machine* Julie Wosk explores many sides of these inspiring and confining dualities present in ads and images of women and machines from the twentieth century. Wosk explores both the possibilities and the limitations that women using technology faced (see also Hacker's work on women and the machine). Wosk notes, for instance, that prior to World War I, women did not often use machine tools (10). Classical images of women using tools and machines, especially early depictions of women automobile drivers, portrayed women as dangerous, inept, or dangerous users of new technology (Wosk 7-8). In addition, Wosk notes how some technologies like the sewing machine were crafted especially for women. The shift to promoting women in different economic roles during World War II overturned much of these earlier messages deterring women's use of most any machines and tools. Despite the fact that many technologies like the typewriter and the sewing machine were developed for women and supported the notion that women should only have a limited, controlled, or domestic usage of technology, women were still able to benefit in many ways from participating in these new areas of technology. Even women who worked in areas outside of science and technology used their language abilities in order to find a certain amount of agency. For instance, Plant points out how language has been a factor in women's work as secretaries. She cites women as the "interface" for their male bosses, often writing and speaking on behalf of these men (121). The shorthand that women used became a "private female code, 'another language, another alphabet'" (Plant 121). In addition to women's improvisation of and adeptness with business language, writing tools became designed for these women. For instance, the typewriter, introduced in 1874, was largely intended for women (Wosk 22). The marketing of technology specifically for one gender at first glance seems to reinforce a binary, limited view of gender roles and agency: machines like the typewriter did limit the kinds of work that women did and directed them into clerical careers where they usually worked as secretaries and aids to their male counterparts. However, the typewriter also helped women gain entry into respectable business jobs (Wosk 23). Further, women's literacy rates soared after the introduction of the typewriter, thus demonstrating that women's language abilities only grew stronger after they entered the workforce (Plant 121).

Women who were employed as "computers" during the two world wars learned valuable skills and were vital resources to their respective countries. Even if women's emergence in fields of science and technology during wartime was limited and fraught with gender stereotypes, the possibilities and problems involved with this agency is a crucial issue in the on-going story of women in computing. W. Barkley Fritz notes that the acknowledgement of women's efforts as "pioneers" of computing is long overdue (13) and draws a detailed picture of women's work in computing during World War II: "During the time period covered by this paper, 1942-1955, women were seldom involved in the design of hardware. However, both men and women were employed as computers (in this era, a computer was a person who did computing) … Many more women were employed as computers … The job of computer was critical to the war effort, and women were regarded as capable of doing the work more rapidly and accurately than men. By 1943, and for the balance of World War II, essentially all computers were women as were their direct supervisors**"** (Fritz 13). Teams of women who were able to do mathematics were employed as useful resources to the government through World War II and they interacted with each other through networks of communication that supported and facilitated their scientific and mathematical tasks. These women created a (programming) language through which they could literally "comment" (a term used in modern-day language to describe the process of including notes within programming work) on computing science. They used this language as a tool by which others could engage with and understand computer science. The language itself, then, became a technology, a medium by which women could both build and display their abilities and argue for their place in the realm of science.

Perhaps the most exemplary and well-known instance of a woman using language and metaphor as a kind of medium to expand the topography of women in computing science is Grace Murray Hopper. Like Lovelace, she has become a modern hero to women in science and computing fields who challenge boundaries and opposition based on their gender. Indeed, she holds a place in both the hearts and imaginations of feminists, historians, and scientists alike. Hopper was born in New York City in 1906 and became a student of mathematics at Vassar College and went on to influence the development of personal, business, and military computing technology winning several awards until her death in 1992. After earning her PhD from Yale University in 1934, Hopper became an assistant professor of mathematics at Barnard College in 1943. In late 1943, she joined the U.S. Naval Reserve and was soon assigned to the Bureau of Ordnance's Computation Project at Harvard University. Although Hopper did not have a desire to work with digits, during her time working on the world's first large-scale digital computer, the Harvard Mark I, she became a programmer. That is, she relied on her linguistic and communication skills to bring the world of hardwired computing technology into the realm of software applications and language manipulations. Hopper's work in many ways continued the legacy of women like Lovelace: both women represent the inherited the work of the cyborg, who symbolizes a desire to redefine the language and parameters of science that have been caught up in means of exclusion, of Othering. Hopper was fond of teaching and liked to challenge what she thought of as the establishment. Hopper and Lovelace hold the characteristics that define the nature of our feminist inheritance and in the importance of bringing forth the stories of women in science. Just as Lovelace worked to translate notes on Babbage's computing designs, Hopper worked to draw together the mimeographed notes about the Mark I in to a comprehensive manual. And just as Lovelace's role as the author of the influential writings on Babbage's machines was often obscured, Hopper's work on this highly successful and important manual was also marginalized. Hopper's work on the 500-page volume has been widely published and is influential because it explained how to set up the Mark I and detailed the operating principles of computing machines. Yet, despite Hopper's work as both the editor and a major contributor to the volume as it appeared in both the *Annals of the Harvard Computation Laboratory* and *Reprint Series on the History of Computing*, she is given no title page credit. She wrote about new areas of technology working with language in order to present these developments to a larger audience and to help people learn about and become interested in computing advancements (see Estrin; Gurer; Koss).

Hopper evolved as a computer pioneer throughout the 1950s and 1960s, particularly during her work on COBOL (Common Business Oriented Language), a significant development for computing in the field of business. The importance of Hopper's work on COBOL was her creation of a symbolic language, using mnemonics and English abbreviations rather than mathematic notation or formulas (Greene 79). She also predicted the importance of symbolic manipulation for future programming. This work is clearly an important part of the evolution of computer programming as we know it today. Further, Hopper's attempts to use language as a means of making computing easier to understand for people outside of scientific and mathematical spheres remains most relevant while at the same time, as she was making a more universal and accessible language of technology, she was working within military, academic, and commercial structures, all of which were decidedly male-dominated spheres. Her goal was for all people to use and program "society's newest tool" (Greene 80).

As the above examples demonstrate, women worked towards broadening the use and importance of computing and the aims of their endeavors was often to enable those outside of traditional, elite spheres to have greater access to these field. In addition to these accomplishments, an important part of Hopper's legacy is continuing her use of language and her valuing of accessible means of communicating and understanding technology. One of the most significant pioneering efforts by Hopper was her creation of a dialogue about computing. She was one of the first computer scientists to emphasize communication and bring people together through meetings to discuss ideas and share their concern (Greene 80). As a public spokeswoman for dialogue on and within computing, Hopper has been hailed as a woman who has "done more than any other person in computing technology to bring people together to share their knowledge" (Greene 80). Her legacy is certainly one tied up in both her scientific and linguistic abilities, which fostered a greater communication between those within and outside of traditional establishments and masculine technological spheres. Hopper's knowledge and insights into the world of computer science and commerce were progressive and innovative, but even in newer biographies, those who study women in the history of computing such as Marie Hicks point out continuing gaps. For instance, in Kurt W. Beyer's recent work on Hopper, Hicks states that the text "frequently alludes to, but leaves mostly unexplored, what he refers to as the 'gender tensions'" that Hopper faced (Hicks, "Grace Hopper" 117). Hicks critique is illustrative of the inheritance in question: although current works on Hopper continue to demonstrate how her abilities to collaborate and translate shaped computing innovations today, issues of gender often remain to be left untold in such histories.

Developments of both feminist theory and technology further reinforce not only the historical importance of women like Lovelace and Hopper, but also the important ways women might employ language as a tool and medium through which to challenge scientific constructs in a patriarchal system. Lovelace and Hopper are influential pioneers of computing whose legacies have become prominent in the minds and imaginations of computing scientists and feminists alike. Indeed, there are several biographies describing the importance of these women and describe their individual skills and genius. Yet, what these purely historical accounts fail to examine is how these stories fit into a larger narrative of women in science. For example, they do not compare the challenges Hopper faced to the larger circumstances of women working in the emerging field of computing during World War II.

This broader narrative of women in computing is what I link to Haraway's notion of a collective inheritance, a narrative that attempts to bridge these gaps between individual stories of struggles and successes, and those of women in general. Our inheritance ties the theoretical intentions of contemporary feminists to the more specific, often obscured (hi)stories of women who were computers or X-ray technicians or telephone operators or secretaries. It is through understanding how these broader narratives fit with the more specific history of women in computing that we can begin to open up discussion on our current ideas about science and gender. By exploring the ambiguities of the past, perhaps we can embrace lofty notions of science that opt less for binaries of gender and more for multiple perspectives of what it means to be man, woman, and human.

According to Haraway, the task of feminist cyborg stories involves "recoding communication" because the structures and grids of human interaction are encoded — written and parsed — in ways that open channels of power to some and close these channels for others (*Simians* 175). Hierarchies are built and defined by binary codes of gender, race, and class that perpetuate boundary-driven world-views, metaphors and codes of conduct. Our bodies, landscapes, and modes of communication are based on the language of code — metaphors of domination and submission — and on encoded systems of exchange. This analysis of the roles of women throughout the late nineteenth and twentieth centuries underscores myriad ways, linguistic and technical for instance**,** that women contributed to areas of science and technology despite their limited and constrained access to these fields. The latest discussions regarding innate versus constructed gender-science dynamics raise questions about the directions for women in fields of science and technology. Recent developments and progression of both feminist theory and women's work with technology reinforce not only the historical importance of women like Lovelace and Hopper, but also the important ways women may or may not continue to employ language as a tool and medium to challenge masculine scientific constructs today. During the 1990s, there appeared to be optimism for women in the field of computing science. In 1996 Amita Goyal argued that women preferred to enter the field of computer science since it was a relatively young industry that had perhaps avoided some of the gender stereotyping of other scientific fields (36). However, despite these encouraging elements of computing science as a new industry, Goyal noted that there is a "perpetual glass ceiling" for women working in this area. She demonstrated how there were still low numbers of women in computing science, and the arbitrary salary gap between men and women was cause for concern (36). This glass ceiling continues today as recent research shows that even young women who are at the forefront of information technology feel that it is a male dominated field and continues to leave women "out of the computer loop" (Margolis and Fischer 2). Linda Shafer makes plain this point about the decreasing representation of women in computing: "women are practically absent from the historical literature on computing" despite significant contributions (xi). It is promising that this collection of works itself aims to create a space by beginning to tell the stories of women in computing, though by all accounts there is a great deal more to be written (104). Lessons from our inherited past, particularly ones that demonstrate how language of technology may help in breaking down and working between barriers remain relevant today.

The relevance of acknowledging and recreating women's achievements, then, becomes ever more important in many of these contemporary discussions of feminism, nature, and technology. The Baconian division of body as female and mind as male continues to define scientific and cultural discourse in a way that places women outside of scientific discussion and often under-values their work. Indeed, the division of mind/body, organic/mechanic, male/female, high/low, humanities/ sciences, and difference/equal rights feminism seem only reconcilable in Haraway's theory of the cyborg and Plant's notions of materiality that embrace a more fluid (non-binary, non-linear) articulation of these items. The further we delve into the social and technological implications of these divisions the more far-reaching and irresolvable they seem to become. What also becomes especially clear is that women's achievements in science urge us to take responsibility for such divisions to imagine a movement between such binaries while also realizing the impossibility of forgetting them.

Note: The above article is an updated and revised excerpt from Erika E. Smith, *A Question of Evolution? Imagining a History of Women in Computing*. M.A. Thesis. Edmonton: The University of Alberta, 2005. Copyright release to the author.

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