

Ada's Legacy

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Preface

Ada's Legacy illustrates the depth and diversity of writers, thinkers, and makers who have been inspired by Ada Lovelace, the English mathematician and writer. The volume, which commemorates the bicentennial of Ada's birth in December 1815, celebrates Lovelace's many achievements as well as the impact of her life and work, which reverberated widely since the late 19th century. In the 21st century we have seen a resurgence in Lovelace scholarship, thanks to the growth of interdisciplinary thinking and the expanding influence of women in science, technology, engineering, and mathematics. *Ada's Legacy* is a unique contribution to this scholarship. Here, the editors present work on topics previously unknown to coexist in print: Ada's collaboration with Charles Babbage, the development of the Ada programming language, Ada's position in the Victorian and Steampunk literary genres, Ada's representation in and inspiration of contemporary art and comics, and Ada's continued relevance in discussions around gender and technology in the digital age. With the 200th anniversary of Ada Lovelace's birth on December 10, 2015, we believe that the timing is perfect to publish this collection. Because of its broad focus on subjects that reach far beyond the life and work of Ada herself, *Ada's Legacy* will appeal to readers who are curious about Ada's enduring importance in computing and the wider world.

The idea for this book originated from the first academic conference of its kind, *Ada Lovelace: An Interdisciplinary Conference Celebrating her Achievements and Legacy*, which took place at Stevens Institute of Technology (Hoboken, New Jersey) on October 18, 2013, under the auspices of the Institute's College of Arts and Letters. The time was definitely right to bring this conference to Stevens, which was until 1971 a male-only school. By 1982, Stevens became the first major institute in the United States to implement a personal computer requirement for its students. Around this time, a pioneering technology project resulted in the networking of the entire Stevens campus, creating one of the nation's first intranets. Additionally, the recent development of undergraduate programs in the College of Arts and Letters, including

Gender Studies as well as Science and Technology Studies, which strongly anchors women in STEM, clearly made Stevens well positioned to host a conference celebrating Lovelace's achievements and legacy. The conference brought together international scholars from across the disciplines to coincide with the week celebrating Ada Lovelace Day. Tremendous interest circulated in advance of the conference, particularly among computing history specialists and 19th-century literary scholars, and it escalated immediately following the proceedings. Tom Misa, director of the Charles Babbage Institute and a featured speaker at the conference, numbered chiefly among those who caught this interest. He envisioned the possibility for a book project to develop concrete examination of ideas inspired by the proceedings. The conference organizer, Robin Hammerman, and Andrew Russell, director of the College of Arts and Letters Science and Technology Studies program, enthusiastically agreed to collaborate as editors for this interdisciplinary collection.

Many of the papers published in this volume first were presented at the conference in October 2013. We are pleased to acknowledge the supporters of that conference: Dr. Lisa Dolling, former Dean of the College of Arts & Letters at Stevens Institute of Technology, and Dr. George Korfiatis, Provost of Stevens Institute of Technology.

The editors are grateful to Thomas J. Misa, Series Editor for ACM's History of Computing, for skillfully overseeing the development of this project from its inception to completion. We also are happy to thank Diane Cerra, Executive Editor at Morgan & Claypool Publishers, for her kind and capable attention to the production of this volume. And we are delighted that Sydney Padua graciously agreed to create original illustrations for *Ada's Legacy*.

Introduction

Robin Hammerman, Andrew L. Russell

Augusta Ada Byron was born on December 10, 1815, in London, England. At first glance there is little to distinguish Ada from other children born to the elites of Regency society: her family was titled, she had unfulfilling relationships with her parents, and her illnesses and flights of fancy frequently troubled her friends and family. In at least two other ways, however, Augusta Ada Byron was exceptional. First, she was the only legitimate daughter of George Gordon, Lord Byron (1788–1824), the celebrity poet whose social infamy led to his permanent self-exile from England in April 1816. Moreover, by the time she entered her teens Ada demonstrated an unusual passion and aptitude for mathematics, and was fortunate to be tutored by a sequence of distinguished mathematicians, including William Frend, Mary Somerville, and Augustus De Morgan. Within a few years, Ada became a correspondent and collaborator with notable Victorians, including Charles Babbage and, later, Michael Faraday and Charles Dickens. Her nobility, her gender, her famous father, her mathematical acuity, and her famous friends and collaborators: these factors together form the setting for Ada's reputation and accomplishments in her own time, as well as for Ada's varied and enduring legacy after her death from uterine cancer in 1852 at the age of 36.

Ada was rediscovered in the final decades of the 20th century, following significant attention in 1953 to her renown with the publication of B. V. Bowden's *Faster Than Thought: A Symposium on Digital Computing Machines* (Sir Isaac Pitman & Sons, 1953). An elegant reproduction of Ada's image dominating the frontispiece visually orients readers to the volume's extensive collection of materials from her notes and correspondence. Consequently, Ada's life and work became the subject of several biographies and scholarly studies that advanced competing and at times wildly divergent representations. Several accounts—including some written for children and young adults—celebrated Ada as an icon of science and technology, as the “enchantress of

numbers,” a “prophet of the computer age,” the “bride of science,” the “computer wizard of Victorian England,” and the woman who “launched the digital age.”¹ But there were others that portrayed Ada in a far less flattering light. For example, Dorothy Stein pushed back against “fanciful” accounts by emphasizing Ada’s psychological struggles and gambling; and computer historian Allan G. Bromley dismissed altogether the notion that Ada might be the “world’s first programmer,” brushing away this “romantically appealing image” as “without foundation.”²

Beyond this technical and at times testy scholarly debate, Ada’s name also is invoked with increasing regularity in a wide variety of technological and social settings that constitute Ada’s *legacy*. This volume collects and juxtaposes accounts that link and locate Ada in these settings, including computer programming, literature, art, popular culture, social theory, and cultures of computing.

We have organized *Ada’s Legacy* in three sections, focused on computing, literature, and the digital age. The first section, “Ada’s Legacy in Computing,” begins with a chapter by Thomas J. Misa that assesses Ada’s contribution to computing. Misa introduces readers to historical debates around Ada’s mathematical work and her famous collaboration with Charles Babbage, designer of the Difference Engine (1822) and Analytical Engine (1834). Misa notes the passion and even enmity generated by scholars of the Lovelace–Babbage collaboration—to which he offers the helpful rejoinder, “the Lovelace–Babbage question is not a zero-sum game.” Misa’s close analysis highlights important dimensions of Ada’s legacy: collaboration, mathematics, the history and meaning of the term “computer program,” and the possibility for women to make germinal contributions in technical fields.

Chapter 3 reprints Lovelace’s famous translation of Menabrea’s “Sketch” that was first published in *Taylor’s Scientific Memoirs* in 1843. Readers may be astonished to see for themselves the sophistication with which Ada translated Menabrea’s words from the original French and, further—in the extensive notes that doubled the original manuscript’s length—moved well beyond Menabrea’s interpretation to advance her own vision of how Babbage’s machines could perform complex calculations. In these notes, historians have found ample justification for crediting Ada with a vision for

1. Betty A. Toole, *Ada, The Enchantress of Numbers: A Selection from the Letters of Lord Byron’s Daughter and Her Description of the First Computer* (Strawberry Press, 1992); Benjamin Wooley, *Bride of Science: Romance, Reason, and Byron’s Daughter* (McGraw-Hill, 2002); Lucy Lethbridge, *Ada Lovelace: The Computer Wizard of Victorian England* (Short Books Ltd., 2004); James Essinger, *Ada’s Algorithm: How Lord Byron’s Daughter Ada Launched the Digital Age* (Melville House, 2014).

2. Dorothy Stein, *Ada: A Life and Legacy* (MIT Press, 1985) (quote at page x); Allan Bromley, “Difference and Analytical Engines,” in William Aspray, ed., *Computing before Computers* (Ames: Iowa State University Press, 1990), 59–98 (quote at 88–89).

symbol processing and computation that was more expansive and creative than Babbage's. In Note A, for example, we see Ada's oft-quoted comment, "We may say most aptly, that the Analytical Engine *weaves algebraical patterns* just as the Jacquard-loom weaves flowers and leaves."³ We can read Ada's suggestion that "the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent," and her belief that "The Analytical Engine is an *embodying of the science of operations*, constructed with peculiar reference to abstract number as the subject of those operations."⁴ And we can see the most famous of her mathematical works in Note G, where Lovelace describes an algorithm for the computation of Bernoulli numbers. Several chapters in this volume take direct inspiration from these notes, such as Misa's detailed examination of Lovelace, Babbage, and the Bernoulli numbers in Chapter 2 and Amy Cunningham's multimedia project in Chapter 10.

Three additional chapters in the first section describe the creation and development of the Ada computer programming language. Chapter 4 is an interview first published in *Communications of the ACM* in 1984 with Jean Ichbiah, the late French computer scientist who was the principal designer of the Ada programming language. Ichbiah's work started when his employer, CII Honeywell Bull, won a contract from the U.S. Department of Defense to create a new programming language. The purpose was to overcome incompatibilities that arose with the proliferation of different programming languages in the 1960s and 1970s. Ichbiah explains the aims of this effort, to facilitate maintenance, emphasize clarity, and to define and standardize the language through an inclusive and international process. Work on the Ada programming language began in 1977, was proposed as a standard in 1980, and was published as an American standard in 1983 and an international standard in 1987.

Chapter 5 excerpts a selection of an oral history interview conducted in 2006 with Jean E. Sammet, who shortly after serving as President of ACM from 1974–1976 was involved with the Ada programming language for over ten years as part of her work at IBM. Sammet describes the process through which Department of Defense officials contacted Ada's descendants for permission to name the new programming language after Ada.⁵ Sammet, like Ichbiah, emphasizes the social and collaborative aspects of

3. Augusta Ada Lovelace, "Notes by the Translator," in L. F. Menabrea, "Sketch of the Analytical Engine Invented by Charles Babbage, Esq." *Taylor's Scientific Memoirs* 3 (1843): 696 (emphasis in original).

4. Lovelace, "Notes by the Translator," 694 (emphasis in original). For a general history of computer programming whose title features Ada's words, see Mark Priestley, *A Science of Operations: Machines, Logic, and the Invention of Programming* (Springer, 2011).

5. William Whittaker recalled that the language design group learned about Lady Lovelace from B. V. Bowden's 1953 book *Faster Than Thought: A Symposium on Digital Computing Machines*, and eventually

the Ada design effort, as well as its technical characteristics and potential. Chapter 6, by Ricky Sward, describes the “rise, fall, and persistence” of the Ada programming language. Sward, in 2010, provides examples where the Ada language fell short of expectations, as well as examples of persistent niche uses for high integrity, safety critical systems such as avionics, air traffic control, and robotics.⁶

The second section, “Ada’s Legacy in Literature,” elucidates how Ada Lovelace participated in the literary world of her time and how contemporary writers envision her. Collectively, the essays attest that writers amass a wealth of riches when they mine from what is known about Ada. Chapter 7, by Imogen Forbes-Macphail, situates Ada’s contributions to mathematics within the literary context of her Romantic and Victorian contemporaries and explores ideas concerning the origin and use of language. These ideas and the questions they raised were circulated simultaneously among mathematical scientists and writers in her circle of acquaintance. Ultimately, Macphail examines the implications of Ada’s thoughts concerning machines and poetic or artistic composition for both contemporary literary theory and current debates on artificial intelligence.

Chapters 8 and 9 complete the second section. These chapters explore the ways in which Ada’s nuanced identities came to life most notably and imaginatively in steampunk fiction, a sub-genre of science fiction that adapts past and future technologies powered by steam to Victorian-era themes and settings. Victoria Ludas Orlofsky contends in Chapter 8 that the first Ada Lovelace Day in 2009 marks a significant turning point in steampunk representations of women. To this end, Orlofsky presents a trajectory of emblematic ways authors depict women in steampunk culture and novels from 1990 to the present. The novels—all featuring prominent and sometimes problematical characterizations of Ada Lovelace—include *The Difference Engine*, *All Men of Genius*, *The Lazarus Machine*, *Angelmaker*, and *The Thrilling Adventures of Lovelace and Babbage*. In Chapter 9, Catherine Siemann examines fictional depictions of Ada Lovelace at the center of social concerns in *The Difference Engine* and *All Men of Genius*, respectively, first- and second-wave steampunk novels published twenty years apart. Both novels, according to Siemann, echo their Victorian forebears as social critiques of speculative science and the involvement of gender. Ultimately, Siemann argues, the

formed a general consensus to name the language to honor Ada. Correspondence from 1978 between U.S. defense officials and Ada’s direct descendent, the Earl of Lytton, is reprinted in William A. Whittaker, “ADA—the project: the DoD high order language working group,” in Thomas J. Bergin, Jr. and Richard G. Gibson, Jr., eds., *History of Programming Languages—II* (New York: Association for Computing Machinery, 1996), 173–232.

6. For a recent overview, see John Barnes, *Programming in Ada 2012* (Cambridge University Press, 2014).

novels reveal our own cautionary or optimistic preoccupations with gender and technology while demonstrating Lovelace's increasing importance as a cultural figure.

Ada is now a touchstone of the digital age. Three chapters in the final section, "Ada's Legacy in the Digital Age," illustrate the depth and diversity of scholarship, art, and activism that Ada's life and legacy have inspired. In Chapter 10, Amy Cunningham describes and documents her *Oracle* project, a "video song cycle" which features a mix of soprano voice and high definition video.⁷ Inspired by the critical and analytical cadences of Ada's work, *Oracle* utilizes off-screen, disembodied singing that evokes an awareness of her position across the margins and boundaries that surrounded her.

In Chapter 11, Jenny Ungbha Korn applies the conceptual tools of analytical feminism and muted group theory to explore how gender manifested within PLATO, a pioneering virtual community of the 1970s. Korn's discussion of the dynamics of online collaboration resonates with the collaborative group dynamics at work in the Ada programming language (Chapters 4–6), as well as in online communities that emerged with the adoption of the World Wide Web. In contrast to the earlier chapters, however, Korn utilizes a critical feminist approach to emphasize "the structural and patriarchal features of PLATO discourse that marginalized interactions by underrepresented populations." Korn's feminist analysis provides a fascinating contrast to Cunningham's artistic approach, thus highlighting the fluid and flexible nature of Ada's legacy: where Cunningham's work provides beautiful, haunting echoes of Ada's voice, Korn's work reminds us of the social circumstances that muffle and silence female voices.⁸

In the 21st century, Ada's is a significantly feminist legacy. In 2009, Suw Charman-Anderson created Ada Lovelace Day to draw attention to women who excel in technology. Ada Lovelace Day started with blog posts, but has since grown to include newspaper columns, global media coverage, a Wikipedia edit-a-thon, events to build Android apps and video games, and other grassroots events in Europe, North and South America, and, of course, in cyberspace.⁹

Ada's legacy in the digital age also lives on in the Ada Initiative—an organization co-founded by Valerie Aurora and Mary Gardner in January 2011. The Ada Initiative strives to "serve the interests and needs of women in open technology and culture who

7. Amy Cunningham, *Oracle*, HD video and stereo sound, 12 minutes, color, dimensions variable, 2012. [Extract available on vimeo: vimeo.com/amycunningham/oracle]

8. For related studies, see Jane Margolis and Allen Fisher, *Unlocking the Clubhouse: Women in Computing* (MIT Press, 2003); Thomas J. Misa, ed., *Gender Codes: Why Women are Leaving Computing* (Wiley-IEEE Computer Press, 2010); and Janet Abbate, *Recoding Gender: Women's Changing Participation in Computing* (MIT Press, 2012).

9. "History of Ada Lovelace Day," <http://findingada.com/about/history-of-ada-lovelace-day/> (visited June 28, 2015).

are at the intersection of multiple forms of oppression, including disabled women, women of color, LGBTQ women, and women from around the world.” Its activities help men and women develop practical skills for supporting women in open technology and to improve working environments for women. Additionally, its leadership makes frequent public and media appearances for National Public Radio, Wikimania, and many other outlets.¹⁰

Ada’s Legacy concludes with Valerie Aurora’s “Rebooting the Ada Lovelace Mythos.” This chapter is an adaptation from Aurora’s keynote lecture delivered at the 2013 conference on Ada Lovelace held at Stevens Institute of Technology. Aurora recalls the many incarnations of Lovelace, from her identity as Byron’s only legitimate child to her iconic status for women in STEM fields. Overall, Aurora suggests, the story of Ada Lovelace as arguably the first computer programmer is more complex and multidimensional than it has been represented to date—a similar conclusion to that drawn by Thomas Misa in the first chapter of this volume. Aurora’s purpose is not merely to comment (which she does with great insight) on the longstanding contest over Ada’s depiction in popular culture and by biographers. Aurora also highlights two defining issues for Ada’s legacy in the 21st century—the debate over Ada’s contributions to computer programming, and Ada’s position as an icon for women in computing. Aurora concludes by exhorting us to draw from Ada’s life and legacy as inspiration for new stories of our own imaginations.

Ada’s iconic status now resonates throughout and around cultures of computing. Her presence in the 21st century persists explicitly in a wide variety of scholarship, including literature, cultural studies, and the peer-reviewed periodical launched in 2012 titled *Ada: A Journal of Gender, New Media & Technology*.¹¹ More recently, Ada appears in the opening and closing chapters of Walter Isaacson’s *The Innovators*, and as a protagonist in Sydney Padua’s graphic novel *The Thrilling Adventures of Babbage and Lovelace*.¹² Padua’s characterization of Ada Lovelace is emblematic of her iconic status in the 21st century and the recent presence of Ada in the comics medium has widened the reach of her legacy to untold multitudes. The cartoon Ada is pictured

10. Ada Initiative, “What We Do,” <https://adainitiative.org/about-us> (visited June 30, 2015).

11. Ellen Moll, “A Network or a Line? Gender, Technology, and Cyberfeminist Figurations of Time,” *Rhizomes: Cultural Studies in Emerging Knowledge* 26 (2014), available from <http://www.rhizomes.net/issue26/moll.html> (visited June 25, 2015); Elizabeth Ho, *Neo-Victorianism and the Memory of Empire* (Bloomsbury, 2014).

12. Walter Isaacson, *The Innovators: How a Group of Hackers, Geniuses, and Geeks Created the Digital Revolution* (Simon & Schuster, 2014); Sydney Padua, *The Thrilling Adventures of Lovelace and Babbage: The (Mostly) True Story of the First Computer* (Pantheon, 2015).

and personified by Padua in exclusive drawings for the cover of this volume and in the head pages for each section. We are doubly pleased that select chapters in this volume introduce discussions of *Thrilling Adventures* to Ada scholarship.

The chapters in this volume illustrate key aspects of Ada's legacy, which expansively includes collaboration, feminism, technical excellence, creativity, and controversy. We hope that *Ada's Legacy* is not the final word on Ada's persistence in cultures of computing across the disciplines. Indeed, we are optimistic that the most compelling and generative aspects of Ada's legacy are still to come.