

Lady Lovelace and Charles Babbage

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This paper is centered on the correspondence that took place between Lady Lovelace and Charles Babbage, particularly during her writing of the extensive notes that accompany her translation of Menabrea's paper on Babbage's Analytical Engine. The material is selective. Her mathematical background and studies are given in some detail, while little mention is made of her other great interest, music. Her travels and family relationships are not mentioned except where they directly apply to her work or to her relationship with Charles Babbage. Most of the material has been gathered from original sources. Through the courtesy of the Rt. Hon. Earl of Lytton, O.B.E. (great-grandson of the Countess of Lovelace), and his son, Viscount Knebworth, access was granted to the Lovelace-Byron papers deposited in the Bodleian Library, Oxford University. The Babbage Correspondence in the British Library, London was another source. Also of value were the letters of the Somerville Collection owned by Lady Fairfax Lucy and deposited in the Bodleian Library.

Keywords and phrases: Analytical Engine, Charles Babbage, Lady Lovelace, L. F. Menabrea
CR category: 1.2

Augusta Ada Byron, later the Countess of Lovelace, was the first woman to make a substantial contribution to the computer field. She received surprised recognition at the time for her work among a small circle of intellectuals. Then her achievements lay buried for many years, and only in the late 1950s when the modern era of computers stimulated an interest in their history did her name begin to reappear in print. Since then knowledge of her achievements has been growing steadily, and now it has culminated in a new software language being named "Ada" in her honor.

Her fame lies in having written extensive notes on Charles Babbage's Analytical Engine that were appended to her translation of L. F. Menabrea's article on Babbage's machine (Menabrea 1842). Of most

interest in these notes is her description of the repeated use of a set of cards with a purpose similar to that of subroutines in today's computer programs. With the help of Babbage she worked out a nearly complete program to compute Bernoulli numbers—as complete as was consistent with the state of the design of his engine at that time. Because of this she has been called the first computer programmer.

Augusta Ada Byron was born in London at 13 Piccadilly Terrace on Sunday, December 10, 1815. She was the only legitimate child of Lord Byron, whose publication of the first two cantos of "Childe Harold's Pilgrimage" had brought him "immediate fame, surpassing that of any young poet" (twenty-four years old), and perhaps more than any other poet has been accorded "during his lifetime" (Marchand 1951). Her mother, Annabella Milbanke Byron, was noted as an upright and intelligent woman, hardly the type to be able to adjust to Byron's flamboyant life style. A little over a month after Ada's birth they separated, and shortly thereafter Lord Byron left England never to return. The circumstances of the marriage and subsequent separation were highly publicized, and throughout her life Ada was subjected to additional public scrutiny as Lord Byron's daughter.

Lord Byron did ask for news of his daughter through his letters, mentioned her in his poetry, and occasionally sent her presents. It was her mother, Lady Byron, however, who raised her and encouraged her in her studies. She grew up as a quiet scholar, preferring mathematics and music, and led a rather sheltered life amid her mother's circle of friends. As Lord Byron's daughter she was entitled to be presented at court; this took place on May 10, 1833, and was followed by several court balls. According to her mother's letters to her friend and medical adviser, Dr. William King, and to his wife, Ada took these in stride and enjoyed meeting the famous people; however, it was a party held less than a month later on June 5 that pleased her more.

Lady Byron's letter to Dr. King, dated June 7, 1833, is the first indication in the correspondence of Ada's meeting Charles Babbage.

... Ada was more pleased with a party she was at on Wednesday, than with any of the assemblages in the

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Authors' Note: In this paper the Lovelace-Byron papers are referred to by [L-B box number], the Babbage correspondence by [B volume number, folio number], and the Somerville collection by [S box number]. In copying the letters, the authors adhered to the original spelling. Questionable words and dates are marked by [?].

Editor's Note: Readers who want to understand the full context of these letters should consult the Moore (1977) biography.

grand monde—she met there a few scientific people—amongst them Babbage, with whom she was delighted—I think her power of enjoying such society is in a great measure owing to your kindness in conversing & reading with her on philosophical subjects. —Babbage was full of animation—and talked of his wonderful machine (which he is to shew us) as a child does of its plaything. . . . [L-B 309]

In a letter dated exactly two weeks later, also written to Dr. King, Lady Byron describes in detail her visit to Babbage with Ada to see his machine as promised.

. . . To-day I am going to Buelah Spa—and Ada is going to the Queen's Ball! —I am better pleased with my destination than she is with hers, tho' she has some pleasure in expecting to meet Babbage at the palace! —We both went to see the *thinking machine* (for such it seems) last Monday. It raised several Nos. to the 2nd & 3rd powers, and extracted the root of a Quadratic Equation. —I had but faint glimpses of the principles by which it worked—Babbage said it had given him notions with respect to general laws which were never before presented to his mind. —For instance, the Machine would go on counting regularly 1, 2, 3, 4 &c.—to 10,000—and then pursue its calculation according to a new ratio, which was, I think 10,002, 10,005, 10,009—but I am only certain that the numbers were no longer successive ones, and that their differences were neither in Arithmetical nor Geometrical ratio, as far as I could apprehend. —If this occult principle of change existed in the law according to which the machine was constructed, (for Babbage discovered it to be latent in the mathematical formula originally applied by him) it may be consistent with

the general laws of our solar system that the Sun shall not rise tomorrow. —He said, indeed, that the *exception* which took place in the operation of his Machine, & which were not to be accounted for by any errors or dearrangement of structure, would follow a greater number of uniform experiences than the world has known of days & nights: There was a sublimity in the views thus opened of the ultimate results of intellectual power. —I did not, however, *feel* the great man in Babbage himself, except when he uttered these facts. —He was *frivolous* about his furniture, and occupied with other trifles. —As an instance of a certain tendency to consider worldly means of attaining his ends he told me that when the Duke of Wellington visited him as Prime Minister, and extolled his Machine, he (Babbage) observed that it could do every thing but "compose country dances" some of which were lying on the table. —"I did this" added Babbage "because I knew that the Duke was in the habit of going to balls, and that such an association would be formed in his mind as would render it impossible for him to see dancing without thinking & speaking of my invention." . . . [L-B 309]

Sophia De Morgan, daughter of Dr. William Frend (one of Ada's early tutors who had tutored her mother in her youth) also described going to see Babbage's machine with Ada. (Sophia married Augustus De Morgan, another tutor of Ada's, to whom Ada owed much of her understanding of mathematics. The Frends and De Morgans were, in addition, close personal friends of Ada and her mother. William Frend had been a don at Cambridge University until he was dismissed because of his religious views. Augustus De Morgan was a professor at University College, London.) In her memoir of her husband Sophia De Morgan wrote:

While other visitors gazed at the working of this beautiful instrument with the sort of expression, and I dare say the sort of feeling, that some savages are said to have shown on first seeing a looking-glass or hearing a gun—if, indeed, they had as strong an idea of its marvellousness—Miss Byron, young as she was, understood its working, and saw the great beauty of the invention (De Morgan 1882).

The following year, 1834, a series of lectures on Babbage's machine were given at the Mechanics Institute by Dr. Dionysius Lardner. Lardner was a professor at University College, London, and a popular lecturer who had the gift of making obtuse technical subjects understandable to the layman. He was an enthusiastic supporter of Babbage's machine and did much to make it known to the public. Lady Byron, in a letter to Sophia Frend dated June 28, 1834, wrote:

Ada was greatly delighted with the first of Dr. Lardner's lectures on Babbage's machine at the

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Mechanics' Institute, where Lord Brougham spoke. She went with Mrs. King. The next is on Wednesday. I fear it would not be intelligible to you, as you were not at the first (De Morgan 1895).

At this period mathematics was occupying much of Ada's thoughts and time. Her mother also had a liking for mathematics and had been known as a mathematician in her younger days among her peers. (Lord Byron had called her during their courtship his "Princess of Parallelograms." After they were married he had changed his mathematical nickname for her to the less endearing term "Mathematical Medea.") Lady Byron had seen to it that Ada's education had included more mathematics than usual for young ladies at that time. In fact, it was generally not recognized that women of the upper classes needed to know anything other than the social graces, music, painting, and perhaps some foreign language, geography, and the use of globes.¹ Hence, it was perhaps just as well for her education that Ada never attended any school or university, but was educated through governesses and tutors and, later, considerable self-study.

When Ada was five her governess had written in her notebook: "She adds up sums of five or six rows of figures, with accuracy; she is deliberate and correct in the process, and takes an interest in the performance. . . . She appears to possess a mind well prepared to receive information—capable of digesting much and vigorously alive to every new impression. Her memory is uncommonly retentive. . . . She is brim full of life, spirit, and animation and is most completely happy. . . ." [L-B 118].

About this same time Lady Byron noted in a book she was keeping for her daughter that Ada had said she (Ada) was rather foolish in saying that she did not like arithmetic and to learn figures, when she did. She said she was not thinking quite what she was about [L-B 118].

At ten and a half Ada wrote to her mother that she was working hardest at Italian and arithmetic. A day later she wrote that she had trouble with a word problem: "If 750 men are allowed 22500 rations of bread per month, how many rations will a garrison of 1200 men require?" When she was not yet thirteen she was studying Hugo's geometry and confided to

her mother she was "a little afraid of the theorems, however, I must attack them boldly" [L-B 41].

Shortly after Ada turned thirteen her mother wrote Dr. William King with a proposal that he tutor Ada. Ada liked and respected Dr. King and not quite two weeks later, Lady Byron wrote him that Ada appreciated the advantages of working with him, and had said, "Dr. King is just the person to *work out my ignorance*" [L-B 77].

An exercise paper of Ada's dated February 10, 1829, contains exercises involving the order of evaluation of $2 * 5 + 3 * 4$ [L-B 175]. Sometime after this Arabella Lawrence, who later ran a school of her own, was hired as a tutor. Ada's letters to her during 1830, when Miss Lawrence had taken a leave for some months, indicate that Ada was eager for her return. Their friendship persisted, and in 1835 Ada wrote her, "You would be surprised what a studious person of nineteen has come out of the idle little girl of fifteen (you) knew at Hanger Hall. I think I should almost be worthy of a place in your school as one of the elder scholars" [L-B 172].

In 1834 an appeal was again made to Dr. King for help. Ada, now eighteen, was not sure just what she wanted to do, but she felt she needed a course of serious study. She wrote:

... I find that nothing but very close & intense application to subjects of a scientific nature now seems at all to keep my imagination from running wild, or to stop up the void which seems to be left in my mind from a want of excitement. . . . It appears to me that the first thing is to go through a course of Mathematics—that is to say—Euclid, and Arithmetic & Algebra; and as I am not entirely a beginner in this subject, I do not anticipate any serious difficulties, particularly if I may be allowed to apply to you in any extreme case. . . . [L-B 172]

Dr. King answered on March 15, 1834:

... I should recommend you a complete Cambridge course. Begin with Euclid, then Plane & Spherical Trigonometry, which is found at the end of Simpson's Euclid. Then Vince's Plane & Spherical Trigonometry—then Bridge's Algebra. . . . [L-B 172]

On March 24 Ada replied:

... I am getting on very well so far with Euclid. I usually do four new propositions a day, and go over some of the old ones. I expect now to finish the 1st book in less than a week. I use Lardner's Euclid, which is the one now I believe most approved by mathematicians. It has notes, which I also read. I also have Simpson's Euclid. — I do not consider that I know a proposition, until I can imagine to myself a figure in the air, and go through the construction & demonstration without any book or assistance whatever. . . . [L-B 172]

¹ In the schools for young ladies these were the only subjects taught. *The New Athenaeum* of London summed up the situation in the September 28, 1835, issue in an article on the education of young women: "The education of females is a mass of errors, absurdities, and cruelties. Of the moral and intellectual deficiencies of schools for young women, —or, to employ the accredited jargon, of 'seminaries for young ladies'— . . . they are a matter of sufficient notoriety."

About three weeks later she wrote:

... Euclid is going on very well. *Lardner's Euclid* is like going through 3 others—there are so many propositions & so much matter in the notes. I am in the 2nd book, & shall be very glad when I am fairly master of it. The deductions from it are so numerous & so similar, that it requires a good deal of repetition to retain them all distinctly. —Will you answer me the following question? —Can it be proved by means of propositions & deductions from the 1st book only, that *equilateral* triangles being constructed on the *sides* of a right angled triangle, and also one on the *hypotenuse*, the sum of the triangles on the sides is equal to the triangle on the hypotenuse? I think I have heard that this is capable of proof by the 1st book, but that the proof is a difficult one. It strikes me that it ought to be as demonstrable as when the figures are *four-sided* & *equilateral*. ... [L-B 172]

Dr. King soon realized that Ada was progressing so fast that he would not be able to help her. On April 24, 1834, he wrote:

You will soon puzzle me in your studies. When I was at College we had few problems deduced from Euclid. We got up a set of books and seldom went out of them, except the high men, i.e. the first 4 or 6 Wranglers, i.e. the men of the first class. I imagine all *similar* figures, on the sides of a right angled triangle, have the same property, that on the hypotenuse being equal to the other two. I sat down to think of it the other day but had not time to make it out. ... [L-B 172]

Ada's intense mathematical studies were interrupted for a period by a tour she took with her mother. Lady Byron was interested in the education of the working classes and planned a tour of manufacturing cities. Babbage's well-known book, *The Economy of Machinery and Manufactures*, may have had some influence on their decision to make the trip. As originally planned, however, the trip was not entirely successful. Ada described it thus in a September 1, 1834, letter to Dr. King:

... A tour of friends and of natural beauties, too, is the very perfection of a tour, so far as enjoyment is concerned, except perhaps that I could wish to add that it was also a tour of manufactures and machinery. This indeed our's has been *partly*, but only *partly*, from unavoidable circumstances.

This Machinery reminds me of Babbage and his gem of all mechanism. At the beginning of the *last Edinburgh Review*, there is a very clever article on this Machine, which you should read.² I can hardly judge whether it will be perfectly intelligible to one who has

never seen the original, or models; but I should think would to you. At all events a great part would. Pray get it. ... [L-B 172]

Among the friends they visited on this trip were Lady Gosford and her two daughters, Annabella and Olivia. Ada confided to Dr. King in this same letter that "I am endeavouring to induce one of them to take up Mathematics, but I have rather a difficult task there; however I do not despair."

Ada was so eager to share her own excitement in mathematics with her friend Annabella that after she returned home she continued to "tutor" her, filling her letters with page after page of explanations as she endeavored to lead her friend through the intricacies of what she, herself, had mastered. Her enthusiasm in her subject shines through such remarks as "It is a very pretty little Theorem—so neat & tidy—the various parts dovetail so nicely!" She enjoyed helping her friend and apologetically wrote, "I get so eager when I write Mathematics to you, that I forget all about handwriting & everything else! Your progress is the only thing I desire!" Perhaps it was her own gratefulness to the persons who were helping her that made her so eager to share the joy of what she was learning with her young friend. In her November 26 letter to Annabella, Ada wrote, "I am told I am going on myself as well as possible, and indeed I think I *am* making great progress. Mr. Babbage & Mrs. Somerville are very kind indeed to me. The latter generally enquires with interest 'how my pupil is going on?'" [L-B 168]

It was indeed fortunate for Ada's mathematical studies that she had met Charles Babbage and Mary Somerville when she was in her late teens. Their friendships were to have considerable influence on her, and both were to remain her friends throughout the rest of her life. Babbage was twenty-four years older than Ada, and Mary Somerville was thirty-five years older. Both were eminent, respected scientists. Babbage was well known for his writings on various subjects, as well as for his partially completed Difference Engine.³ Mary Somerville had written several well-received books. Letters between Babbage and Somerville indicate that they were the best of friends and that she, too, was interested in his engine. As early as June 14, 1828, he had written her about it. A letter dated December 14, 1833, inquires, "When will you come and give another day to the Engine?" [S 19].

³ A referee has pointed out that Babbage's daughter, Georgiana, who was nearly Ada's age and of whom he was very fond, died in 1834. Ada had never personally known her own father. Whether or not there was a father-daughter relationship involved in their regard for each other is a matter of conjecture.

² As a referee has pointed out, it is interesting to note that this article was written by Lardner, whose lectures Ada had attended.

At this period Babbage's Saturday evening parties during the London social season were very popular, and invitations to them were much prized. Babbage selected his guests carefully; a contemporary of his stated, "One of three qualifications were necessary for those who sought to be invited—intellect, beauty, or rank—without one of these, you might be as rich as Croesus—and yet be told, you cannot enter here" (Crosse 1890). In fact, his parties were so well known that persons sometimes referred to going to them as "doing our Babbage" (*Lady Morgan's Memoirs* 1843).

Ada attended his parties, often in the company of Mary Somerville. Her first reference to one of them was in a letter to Mrs. Somerville dated March 19, 1834:

I hope I may have the pleasure of meeting you on Saturday Evening at Mr. Babbage's. I am going with Miss Montgomery to dine at Mrs. Murchison's, & we shall be at Mr. B's for a short time in the evening. I have not seen him yet, but he sent a very respectful message through Mrs. Murchison, inviting Miss Montgomery & me to his Saturday parties. I am afraid this may be my only chance of seeing you for the next three weeks. . . . [S 17]

In several other letters to Mary Somerville, Ada mentions Babbage's parties, often inquiring if she might go with Mrs. Somerville because she was "at a loss for a chaperone." During this time Ada was a frequent visitor at the Somerville home, often staying overnight. Ada's continued interest in Babbage's machine is shown in another letter to Mary Somerville believed to have been written November 8, 1834:

... May I trouble you the first time you see either Mr. Babbage, or his son, to say how exceedingly obliged I am to the latter for his unexpected kindness in sending me the plates & account of the Machine, which is exactly what I was in want of; & is a very great help to me. . . . [S 17]

The earliest letter of Babbage to Ada in the collections seen by the authors was dated June 10, 1835. (The letter is reproduced on the next page.) In it Babbage was thinking of Ada primarily as a young, attractive addition to his parties rather than as a future collaborator.

My Dear Madam

I enclose cards for my two last parties this season. I hope you intend to patronise the "Silver Lady". She is to appear in new dresses and decorations.

I have been studying Turbans and have pinned up one which one of my fair friends has pronounced "not so bad as might have been expected." I suppose perseverance will do much for decorating the out as

well as the inside of heads, and perhaps next year I may succeed better.

I am

My Dear Madam
Very Faithfully Yours
C Babbage [L-B 168]

The "Silver Lady" was a dancing automaton that had fascinated Babbage in his youth and which he later acquired. It was a novel attraction at his parties, and being fond of it himself, Babbage may have overestimated its appeal. This was indeed the viewpoint of one of his young correspondents, Eulia Cameron. She wrote:

My dear Babbage

You know we were discussing the secret of making an "at home" successful. . . . Your parties I have always heard were the most charming in London, you say the secret was in having an automaton woman! I think the secret is in *having* talking men and I am *sure* it was. . . . [B 37200,200]

Much as she admired and liked Babbage, Ada had other things on her mind during June 1835. A few days earlier she had received another letter, this one from William King (no relation to Dr. William King, the family friend), telling her he expected to be in London on Friday, June 12, and hoped to see her and "be assured from your own lips that you do not repent of having made me the happiest of the living." Ada replied saying his letter had given her "an unexpected happiness." She indicated that she was also eager to see him for she wrote, "Four more *long* days must pass before Friday morning." By the end of the month their wedding day had been set. On June 28 Ada wrote William, "Sir George (Philips) was at Mr. Babbage's last night & says we (that is you and I) were *well* talked over by the philosophers etc." [L-B 165].

William was now the eighth Lord King, having been recalled from the foreign diplomatic service on the death of his father. Lord King and Mary Somerville's son, Woronzow Greig, had attended Cambridge University together and were good friends. The marriage took place at Lady Byron's home, Fordhook, on July 8, 1835.

For the first three years of her married life Ada was known as Lady King. Then in 1838 William was raised to an earldom and became the first Earl of Lovelace. It was stated that this was in recognition of the services he had rendered while in the Ionian Islands, but it is assumed that Ada's family connections led to his being included in the Coronation Honours for the young Queen Victoria. (Lord Melbourne, the prime minister, was Lady Byron's first cousin.)

To
The Hon^{ble} Mrs Byron

My Dear Madam
I enclose
card for my two last
parties this season.
I hope you visited the
favourite The Silver Lady.
There is the affair in green
dresses and decorations.
I have been studying
Tutbush and have found
it one which one of my
fair friends has pronounced
not so bad as might have been
expected. I suppose per-

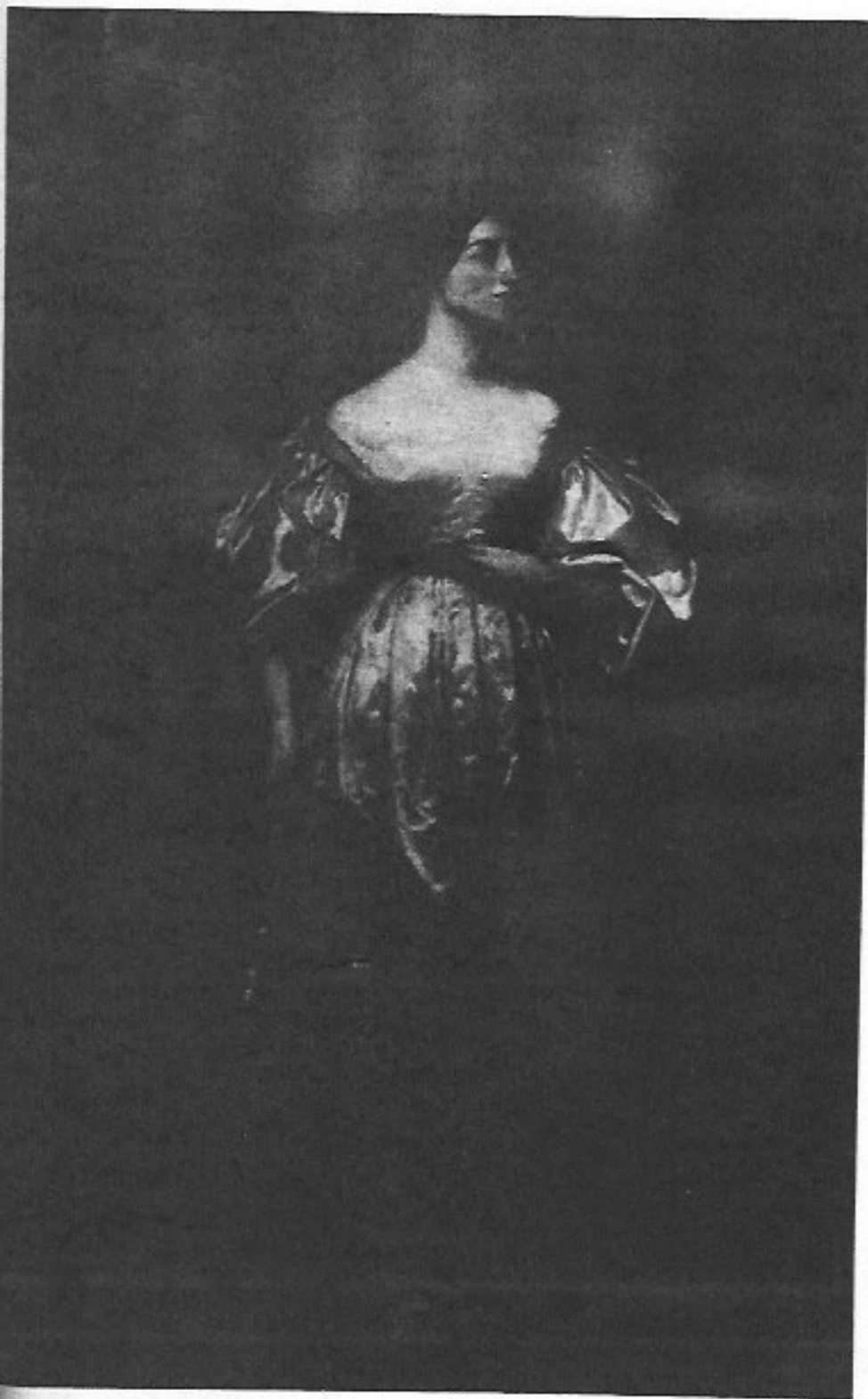
son will do much for
decorating the out as well
as the inside of heads
and perhaps what you
I may succeed at them.

I am My dear Madam

Very truly Yrs

C Babbage

Sot A R
10 June 1835



Lady Lovelace (then Lady King),
from the 1835 painting by
Margaret Carpenter that now
hangs in Bushy House, National
Physical Laboratory, England.
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Ada was described as beautiful, and the 1835 painting of her by Margaret Carpenter, which Lady Byron wrote was a striking likeness, bears this out. Ada, however, was not entirely pleased with this painting or with its painter. She wrote her mother, "I conclude she [Carpenter] is bent on displaying the whole expanse of my capacious jaw bone, upon which I think the word Mathematics should be written" [L-B 41].

She was dark haired with classical features and had a delicate build. Babbage often referred to her in fairy terms; she liked this reference and alluded to it in her letters to him. He also occasionally called her "Ladybird." (In her intimate family circle she was often referred to with such bird names as "Avis" and "Thrush." She and her mother affectionately called Lord Lovelace "Crow," and Lady Byron was "Hen" to both her daughter and her son-in-law.)

Along with calling her handsome and attractive, most of the notices of her day also described her as being eccentric. Indeed, her exceptionally brilliant mind must have made her appear so to most of her contemporaries of both sexes. Even if she did possess unusual intelligence, a young woman of the nineteenth century in England was not expected to make this fact obvious to others, particularly if she belonged to the upper classes. Young ladies could be given an education and be cultivated in the arts, but the most important role they were expected to fulfill was that of being a good wife. Any views a woman might have on science or current affairs should be relayed to the world only through her husband, if at all.

Among Ada's friends William particularly liked Babbage. Letters from him to Babbage, written during the next three years, invite Babbage to spend Christmas with them (Mary Somerville was to be there, too), to dine with them at various times, and also to dine at Lady Byron's at Fordhook. In one of these invitations William warned Babbage that "*Lady King* is anxious you should come. I fear but likely from disinterested reactions she has a lot of questions which she wants to be solved" [B 37189,319].

On January 18, 1836, Ada wrote Babbage thanking him for some minerals and puzzles he had sent her. Mary Somerville wrote him, too, about this same time, thanking him for puzzles and saying that she had been "successful in all except the one carried off by Lady King" [B 37189,298]. Ada also told him in her letter:

... I have got on delightfully with Lardner's Trigonometry, which as far as I have yet gone I think excellent. His book seems at all events to be the one most suited to my mind.

I have had quantities of formulae to work out myself, & have destroyed a great deal of paper. ... We both hope to see you here again before long. [B 37189,281]

Ada was finding it increasingly difficult to devote all the time she would have liked to her studies. As the wife of Lord King and the mistress of several family homes,⁴ certain things were expected of her such as "charitable pursuits," that, as she wrote her old teacher-friend, Dr. King, she enjoyed doing. Ada was very happy, and she wrote her former teacher, Arabella Lawrence, that she would not exchange the present for any of the past [L-B 172].

In May 1836, the Kings had a son, whom they named Byron Noel King. Lord King wrote Babbage of the event. A little over a year later, in September 1837, a daughter was born to them. She was named Anne Isabella and she was, like her grandmother, called Annabella during her younger years.

Ada's health was a matter of concern to her family and friends throughout her entire life. About six months after the birth of her second child she wrote Babbage:

... You may possibly have heard of the very tedious & suffering illness which has occupied so many months, since a Miss King has been added to our family. Though I am now to all appearance perfectly well again & am in fact most wonderfully improved, yet I am still quite far from being really strong. But for these untoward circumstances, Lord King or I myself should probably have written to you long ago, & have strongly urged a visit or visits to Ockham. ... [B 37190,386]

Less than two years after Annabella's birth, in July 1839, the Lovelaces' third and last child, Ralph Gordon King, was born. Thus, the never-strong Ada had three children in slightly over that many years. Nevertheless, in spite of ill health and family cares, Ada was determined not to give up her study of mathematics. In an undated fragment of a letter, she enlisted Babbage's help in finding "the right sort of person" to give her instruction [B 37191,87]. Babbage replied on November 29, 1839:

... I think your taste for mathematics is so decided that it ought not to be checked. I have been making enquiry but cannot find at present any one at all to recommend to assist you. I will however not forget the search. ... [L-B 168]

⁴Their homes were Ockham Park in Surrey, Ashley Combe by the sea in Somerset, a leased house in London (first one in St. James's Square and later in Great Cumberland Place). In 1846 Ockham Park was let and another Surrey property, East Horsley Towers, was renovated for the family use.



Right: Lady Lovelace (then Lady King), from a daguerreotype made about 1836. *Below right:* Lord Lovelace (then William Lord King), from a portrait (artist unknown) made about 1835. Both illustrations courtesy of the Rt. Hon. Earl of Lytton, O.B.E., and his son, Viscount Knebworth. *Below left:* Charles Babbage from an 1840 pencil drawing; courtesy of Donald Davies.



No one was found during the next few months and on February 16 1840[?], Ada reminded him of it. "I hope you are bearing me in mind, I mean my mathematical interests. You know this is the greatest favour any one can do me." In a footnote to this letter she adds, "I have always forgotten to tell you, what perhaps you may have already guessed, that in any inquiries for a mathematical Instructor, I do not wish my name to be mentioned" [B 37191,331].

By March 14, Ada was beginning to doubt that a teacher would be found and had decided that, "should there seem no chance after I go to Town, of the much desired *great Unknown* being found for me, I have some idea of having instead for this season some German lessons. I know a little of it already, & have always intended to know more. Indirectly I think it could bear on some of my objects" [B 37191,343].

On July 30 of that same year (1840) Ada wrote to her mother: "I have written to the professor twice and have read the tooth-cutting portion of Coombs book. . . . I think the professor suits me exceedingly" [L-B 41]. It seems certain that the professor alluded to was Augustus De Morgan, an eminent mathematician, as well as a man of quick wit and humor. De Morgan and Babbage were also friends, and De Morgan was one of Babbage's supporters.

Meanwhile, in 1840, Lord Lovelace was appointed Lord Lieutenant of Surrey, the highest social and political position in English county society during the first half of the nineteenth century. As such he was the leading figure in Surrey. Another honor was awarded Lord Lovelace on November 25, 1841, when he was made a Fellow of the Royal Society (Turner 1974). Now through him Ada had access to its books and papers, and according to her letter to Woronzow Greig some years later, it was entirely on her account that he had become a member [S 17].

Ada had lost her close association with Mary Somerville, since the Somervilles had gone to live in Italy for Dr. William Somerville's health. Babbage was planning on going to Turin to give a lecture on his Analytical Engine. Mary Somerville wrote him from their home in Siena: "I take it for granted my dear Babbage that you will come to Siena as soon as the meeting at Turin is over, for surely you could not be so near without coming to see us, and I need not say how happy it would make all the family. . . . I have a thousand things to ask you and to learn after living so long out of the world. . . . we accept of no excuse" [B 37201,470].

In November Ada wrote her friend Arabella Lawrence, "I have this summer resumed, what different circumstances had interrupted during the last 3 or 4 years, viz: mathematical studies" [L-B 172].

That same month she assured her mother there was "little danger of Mathematics being 'eclipsed' . . . I work on very slowly. This Mr. De Morgan does not wish otherwise. On the contrary he cautioned me against a wish I had at one time to proceed rather too rapidly" [L-B 41].

Ada was still thinking about Babbage's machine and on January 5, 1841[?], she wrote him:

My Dear Mr. Babbage . . .

I much wish to have you here, & talk with you over some of my own doings etc. Today, I have been working much at Mathematics. . . . I must show you a certain book called my Mathematical Scrap-Book.

But pray do not think of coming for so very short a time as only 3 nights. It would be shameful!

Some day or other, you will have to put me in possession of the main points relating to your engine. I have more reasons than one for desiring this.

Yours most sincerely

A. A. Lovelace [B 37191,532]

This same day Ada wrote in her notebook: "Imagination is the *Discovering Faculty*, pre-eminently. . . . Those who have learned to walk on the threshold of the unknown worlds, by means of what are commonly termed *par excellence the exact sciences* may then with the fair white wings of Imagination hope to soar further into the unexplored amidst which we live. Mathematical Science shows what *is*. It is the language of unseen relations between things" [L-B 175]. To be able to use her mathematical mind to soar into the unknown and discover new truths was Ada's lifelong dream.

On January 7, Ada received a letter from Dr. King telling her he was glad she had taken up mathematics again. Ada was very happy these days, and she wrote her mother:

Ockham

Monday night, 11th Jany

Dearest Mama . . .

I have had a *mathematical* week since I last wrote. On Friday we again expect company. This alteration of company & mathematics suits me astonishingly. It is wonderful how I enjoy company (which I never did in my life before) in consequence of the Mathematics. —The latter is now become in good earnest a very serious pursuit. I work well, & with a facility strange to myself. I have gained a strength of head & attention which I never expected; and I have made some curious observations as to the effects of the study. . . .

I cannot but reflect on the vast change 6 months have made in me; —a change perhaps not the least evident to any one else, but most deeply felt by myself. I see ground for any degree of hope for the future.

² Note that six months corresponds to the amount of time that she had been studying with De Morgan.

Those sort of changes & improvements continue (the same Causes operating) in an increasing Ratio.

I go on most delightfully with Mr. De Morgan.

What can I ever do to repay him? I sometimes think with scruples on the subject. He is certainly most kind, & does what no one else I believe could do so well for me. —No two people ever suited better. I am not likely either to trouble him less, at present. I have some hard & dry work & much of it, before me; but the greater the difficulty, & the less immediately inviting the subject, the more doggedly does that large Concentrativeness of mine, backed by Firmness, set about the matter. . . . [L-B 42]

On January 12, 1841[?], Ada wrote Babbage offering him her services at some future time:

Ockham
Tuesday 12th Jany

My Dear Mr. Babbage. If you will come by the *Railway* on Friday, we will send the carriage to meet you at *Weybridge*, for the Train that leaves Town about 4 o'clock & arrives at *Weybridge* a few minutes before 5 o'clock.

Bring warm coats or cloaks, as the carriage will be probably an open one.

If you are a *Skater*, pray bring *Skates* to Ockham; that being the fashionable occupation here now, & one I have much taken to.

I am very anxious to talk to you. I will give you a hint on *what*. It strikes me that at some future time (it might be even within 3 or 4 years, or it might be many years hence), my *head* may be made by you subservient to some of your purposes & plans. If so, if ever I could be worthy or capable of being *used* by you, my head will be yours. And it is on this that I wish to speak most seriously to you. You have always been a kind and real & most invaluable friend to me; & I would that I could in any way repay it, though I scarcely dare so exalt myself as to hope however humbly, that I can be intellectually worthy to attempt serving you.

Yours most sincerely
A. A. Lovelace

You must stay some days with us. Now don't contradict me. [B 37191,543]

That same month Ada wrote their friend Woronzow Greig that she had ten days of good hard math work because she had papers from De Morgan that required studying and answers. She felt she was beginning an occupation for a lifetime, and she wanted to turn to the utmost account the powers she had been given. Ada was now happier than ever, since she felt she was studying, preparing herself to do this [L-B 171].

In February Ada was discussing Taylor's theorem with De Morgan. She had become even more convinced that she and Babbage could work together to the advantage of both.

Ockham Park
Monday, 22nd Feby

My Dear Mr. Babbage . . .

I believe I shall perhaps pass Sunday Evening with Mr. & Mrs. De Morgan, but this is not yet quite fixed, & if it should not take place, will you come & spend it in St. James' Sqre. —You see I am determined to celebrate the Sabbath *Mathematically* in one way or other. —

I have been at work very strenuously since I saw you, & quite as successfully as heretofore.

I am now studying attentively the *Finite Differences*. . . . And in this I have more particular interest, because I know it bears directly on some of your business. . . .

I think I am more determined than ever in my future plans; and I have quite made up my mind that nothing must be suffered to interfere with them. —I intend to make such arrangements in Town as will secure me a couple of hours daily (with very few exceptions), for my studies.

I think much of the possible (I believe I may say the *probable*) future commission between us; and it is an anticipation I increasingly like to dwell on. I think great good may be the result to both of us; and I suspect that the idea, (which by the bye is one that I believe I have long entertained, in a vague & crude form), was one of those happy instincts which do occur to one sometimes so unaccountably & fortunately. At least, in my opinion, the results may ultimately prove it such.

Believe me

Yours most sincerely

A. Ada Lovelace [B 37191,566]

On February 24, 1841, Ada reported to her mother (now in Paris) that:

. . . The Mathematics & Mr. De Morgan going on very well indeed. You would be much pleased to see the *heap* of papers of my writing, which have now accumulated into honorable & substantial evidence of my steady industry for some months past. —And by the bye, it is a very strange thing, that so disorderly as I generally am about papers & such things, there is yet never any disorder in any part of my mathematical papers or proceedings. This is a curious phenomenon! [L-B 42]

Three days later Ada received an upsetting letter from her mother in Paris informing her that Medora Leigh, the daughter of Augusta, Ada's aunt after whom she had been named, was really Lord Byron's daughter, and hence Ada's half-sister. Although Ada had heard about her father's unconventional life, including his alleged romance with his half-sister, she had never suspected that Medora was his daughter.⁶ Lady Byron's disclosure was a shock to the sensitive

⁶ In time, Lord Lovelace, who was a very level-headed person, came to disbelieve the Medora story emphatically. Many biographers agree with him.

Ada. She wrote her mother that she would like to compensate to mankind for her father's "misused genius." "If he has transmitted to me any portion of that genius, I would use it to bring out great truths & principles. I think he has bequeathed this task to me. I have this feeling strongly; & there is a pleasure attending it" [L-B 42].

By 1842 Lady Byron had become disenchanted with the demanding Medora, and Ada became involved in trying to help her mother extricate herself from the affair. There were court actions and threats of others, causing annoyance and time-consuming responses by Ada and her husband. Her mother's and her own ill health added to the problem.

The math instruction under Augustus De Morgan, which had been carried on extensively during the latter half of 1840 and January and February 1841, seems to have temporarily come to a halt during the upsetting period when Ada was first informed about Medora. In July 1841 the letters were again resumed, with Ada writing him as many as four letters a month. These continued through November. Some letters were also exchanged in 1842, but seemingly not on a regular basis. This may have been due to the personal problems referred to earlier.

Babbage had his personal troubles, also. In November 1842 he received a letter from H. Goulburn, the chancellor of the exchequer, stating that Sir Robert Peel and Goulburn had jointly and reluctantly come to the conclusion that it was the duty of the government, on the ground of expense, to abandon further construction of the Difference Engine.

In October 1842 a publication appeared in the *Bibliothèque Universelle de Genève* that was to be very important to both Charles Babbage and Lady Lovelace. Luigi Federico Menabrea, an Italian mathematician and officer in the Military Engineers, who later became prime minister of Italy, had heard Babbage's talks on the Analytical Engine in Turin in 1840. He wrote a paper about the engine dealing primarily with the analytical view, as Henry Babbage (Charles's son) phrased it, explaining "how analytical laws can be so arranged and combined so as to bring every branch of that vast subject within the grasp of the assumed powers of mechanism" (Babbage 1889). Charles Babbage had had extensive correspondence with Baron M. Plana before the Turin meeting and had expected the baron to write an account of the engine. This did not happen, but fortunately Menabrea took over the project.

In October 1841, while at Florence, Babbage wrote Plana:

I have much regretted that we could not meet at Florence, as I had hoped I should have had more

leisure than at Turin, to discuss the principles of the Analytical Engine. If you had made a report on the subject to the Academy of Turin during last year it might have been of especial service to me in the discussion of the question with my own government. It is I must be content with the description drawn up by M. Menabrea with which I am well satisfied because he seems to have penetrated completely the principles in which it rests. . . . [B 37191,645]

Menabrea's paper was in French, so Ada decided to translate it into English. (Her French instruction had begun when she was five, and she was quite proficient in it.) Babbage was naturally pleased when she informed him of this. In his autobiography Babbage described it thus:

The late Countess of Lovelace informed me that she had translated the memoir of Menabrea. I asked why she had not herself written an original paper on a subject with which she was so intimately acquainted? To this Lady Lovelace replied that the thought had not occurred to her. I then suggested that she should add some notes to Menabrea's memoir: an idea which was immediately adopted.⁷

We discussed together the various illustrations that might be introduced: I suggested several, but the selection was entirely her own. So also was the algebraic working out of the different problems, except indeed, that relating to the numbers of Bernoulli, which I had offered to do to save Lady Lovelace the trouble. This she sent back to me for an amendment, having detected a grave mistake which I had made in the process (Babbage 1864).

Ada added her comments with such enthusiasm that her notes, in Babbage's words, extended Menabrea's paper to "about three times the length of the original memoir." Then, in rare praise for him, he added, "Their author has entered fully into almost all the very difficult and abstract questions connected with the subject." Babbage went on to say that the memoirs of Menabrea and Lady Lovelace "taken together furnish, to those who are capable of understanding the reasoning, a complete demonstration—That the whole of the developments and operations of analysis are now capable of being executed by machinery" (Babbage 1864).

⁷ Some scholars have pointed out that it was inconceivable that Babbage did not know Ada was translating the Menabrea article until she had completed it. Due to this and other questionable statements in his autobiography the authenticity of Babbage's recollection in this passage has been questioned. All through Ada's letters she talks of expecting to make great scientific contributions some day. The authors believe this included the possibility of writing original papers, but, at the time of the translation, they doubt that she felt herself ready for this.

The opportunity to work with and for Babbage had presented itself to Ada and she had seized it immediately. Their new relationship seems to have begun in February 1843, for among Babbage's papers are the notes he made prior to meeting with Lady Lovelace:

CB to Lady Lovelace
Tuesday 7th Feb 43
accept invitation
long since we met,
begin under new circumstances [B 38192,237]

During the ensuing months many letters and notes were exchanged between Babbage and Lady Lovelace. Often these bear only the day of the week, making it very difficult to place them in proper sequence. There are also notable gaps in the correspondence. Some gaps can undoubtedly be accounted for by meetings in person that made correspondence unnecessary.

Following is an undated letter from Ada:

My Dear Babbage

I have read your papers over with great attention; but I want you to answer me the following question by return of post. The day I called on you, you wrote off on a scrap of paper (which I have unluckily lost), that the *Difference Engine* would do . . . (something or other), but that the *Analytical Engine* would do . . . (something else that is absolutely general). Be kind enough to write this out properly for me; & then I think I can make some very good Notes.

I have been considering about Prince Albert; but I much doubt the expediency of it. However there is time enough to consider of this.

I am anxious to hear how you are.

Ockham
Thursday mornng [B 37192,357]

Yours ever
A. A. L.

The note concerning Prince Albert referred to whether or not a copy of the paper and notes should be sent to him, as Babbage had suggested.

On Thursday, March 16, Babbage made the following notes:

CB to Lady L.
Thursday 16 March 43
Have kept Tuesday
Talk over notes to Menabrea
Woven picture Jacquard [B 37192,278]

On May 13 Babbage wrote Ada:

My Dear Lady Lovelace

What are your commands for today? I am going into the City and return to dinner at home unless you wish otherwise. . . .

Let me know that you have passed a good night. Don't bore yourself with writing—a verbal answer by my messenger or a visit from your own Lady-bird will be sufficient.

Ever truly yours
C. Babbage [L-B 168]

In a letter dated "Thursday 6 o'clock" Ada asked Babbage to come on Saturday. She wanted to know something about how to manage the "imaginary quantities." She also wanted to know what wholly new and valuable things were likely to be developed by the engine [B 37192,370].

In another letter (reproduced on the next page), dated simply "Monday," Ada wrote:

Ockham
Monday

My Dear Babbage. I am working very hard for you; like the Devil in fact; (which perhaps I am).

I think you will be pleased. I have made what appears to me some very important extensions & improvements. . . .

It appears to me that I am working up the Notes with much success; & that even if the book be delayed in its publication, a week or two, in consequence, it would be worth Mr. Taylor's while to wait. I will have it well & fully done; or not at all.

I want to put in something about Bernoulli's Numbers, in one of my Notes, as an example of how an implicit function may be worked out by the engine, without having been worked out by human head & hands first. Give me the necessary data & formulae.

Yours, ever
A. A. L. [B 37192,362]

This seems to indicate that she intended to work out the program for computing the Bernoulli numbers. As stated earlier, Babbage wrote in his autobiography that he had worked it out and Lady Lovelace had detected an error in it, sending it back to him for an amendment. Thus it appears that Ada conceived of illustrating the operation of the Analytical Engine by working out a program to compute Bernoulli numbers, and Babbage helped work out the details.

By June 30 the notes were well along toward completion. Note D had been written and Babbage was well pleased with it.

My Dear Lady Lovelace,

I am delighted with Note D it is in your usual clear style and requires only one trifling alteration which I will make. This arises from the circumstance of our not having yet had time to examine the outline of the mechanical part—

Only three kinds of Variable cards are used
1st Those which give off a Variable from the Store to the Mill and leave zeros on the variable itself.

228
Berkham
Monday

My Dear Babbage - I am
working very hard for
you, like the devil in
fact; (which perhaps I am).
I think you will be
pleased. I have made
what appear to me some
very important extensions
& improvements. Why I
am here is to say you

Microfilm copy of letter from Lady Lovelace to
Charles Babbage [B 37192.362-363]. The original
was dated only "Monday." The "1843" and "10
July" were added later, the last being clearly
wrong because earlier dated correspondence [L-B
168] mentions "the Bernoulli Note." Reproduced
by permission of the British Library.

will send down to the
Lancaster tomorrow
carrying books. I must
also the Report of the
Royal Society on your
machine. I suppose you
can get it easily; & I
particularly want to see
it, before I see you in
Wed or Thurs.

It appears to me
that I am working up the
Note with much success;
but even if the book
be delayed in its
publication, a week on

two, in consequence, it will
be worth Mr Taylor's while
to wait. I will have it
well & fully done; on that
at all.

I want to put in
something about Bernoulli's
Numbers, in one of my
Notes, as an example of
how an implicit function
may be worked out by
the engine, without having
been worked out by a
human head & hands.
Give me the necessary
data & formulae.
Yours, ever
L. A. L.

2nd Those which give off a Variable from the Store to the Mill and at the same time (or in the same turn of the hand) retain the same variable in the same place.

3rd Those which order any Variable on which only zeros exist to receive a result from the Mill.

I propose to omit one paragraph which I have marked in pencil and the rest is quite correct, as however I suppose you will wish to see the change I return you the sheet.

I have not yet received a proof and shall enquire about it tomorrow.

I enclose a copy of the integration. I am still working at some most entangled notations of Division but see my way through them at the expense of heavy labor, from which I shall not shrink as long as my head can bear it—I have been somewhat impeded however for the last few days. Your latest information was the most agreeable.

Ever My Dear Lady Lovelace
Sincerely Yours
C Babbage

Dorset Street
30 June 1843 [L-B 168]

Ada continued to work extremely hard at the notes; a letter, probably written the following day, says:

Satdy
6 o'clock

My dear Babbage. I have been hard at work all day intending to send you the Diagram & all, quite complete.

Think of my horror then at just discovering that the Table & Diagram, (over which I have been spending infinite patience & pains) are seriously *wrong*, in one or two points. I have done them however in a beautiful manner, much improved upon our *first* edition of a Table & Diagram. But unluckily I have made some errors.

I send you all this *final* note H, excepting the said Table & Diagram. I also return you Note C, in which (for a wonder), I can discover nothing to alter or mend.

Note F, I still retain; since I find I *have* (as I suspected) put into it one or two things that are inconsistent with what I have *subsequently* written.

The sheet of Note D I return, having pinned over the effaced part, the alteration I wish to make in it in lieu of altogether omitting the passage.

I pray you to send me by my servant, (who will call in the morning for your orders), the other sheets of this Note D, as I wish to alter one or two passages in consequence of your information of this morning.

I also beg for Note A, in which I remember a wrong passage about *Variable*-cards. Now *pray* attend strictly to my requests; or you will cause me very serious annoyance.

I shall be up [?] tomorrow morning, & finish off the Table & Diagram; so as to send it to you by post;

together with the amendments in what my servant shall bring me down tomorrow morning from you.

You will have therefore a [?] on Monday morn; and I intend to go to Town myself on Monday, for a few hours, in order to run over a few things with you finally. Be so kind as to be in the Square at two o'clock.

I fear you will find me *detestably persevering*.

Yours ever,
A. L.

Let me know how you like my finishing up of H. Mind you *scrutinise* all the *n's* very carefully. I mean those of Sheets 4 and 5. [B 37192,401]

The following day Babbage replied, praising particularly her Bernoulli Note and Note A.

My Dear Lady Lovelace

If you are as fastidious about the acts of your friends as you are about those of your pen, I much fear I shall equally lose your friendship and your Notes. I like much the improved form of the Bernoulli Note but can judge of it better when I have the diagram and Notation.

I am very reluctant to return the admirable and philosophic view of the Anal. Engine contained in Note A. Pray do not alter it and do let me have it returned on Monday. I send also the rest of Note D. There is still one trifling misapprehension about the Variable cards—A Variable card may order any number of Variables to receive the *same number* upon them at the *same* instant of time—But a Variable card never can be directed to order more than *one* Variable to be given off at once because the mill could not receive it and the mechanism would not permit it. All this it was impossible for you to know by intuition and the more I read your notes the more surprised I am at them and regret not having earlier explored so rich a vein of the noblest metal.

The account of them stands thus

A Sent to Lady L.	F Retained by Lady L.
B With C.B.	G Where is it gone??
C Ditto	H With C.B.
D Sent to Lady L.	
E With C. B.	

I have not seen Mr. Wheatstone and am ashamed to write until I can positively put the *whole* of the notes in his hands.

I will attend your commands tomorrow—and am

Dorset St.
2 July 1843 [L-B 168]

Ever Most Truly Yours
C Babbage

This letter was undoubtedly sent by messenger because Ada replied that same day. She was anxious to get the paper finished; even Lord Lovelace was helping her. A meeting was planned on the morrow and Babbage was to bring all the Notes with him. At this point only Note F was retained by Ada.

Ockham
Sundy 6 o'clock

I have worked incessantly & most successfully, all day.

You will admire the *Table & Diagram* extremely.

They have been made out with extreme care & all the *indices* most minutely & scrupulously attended to. Lord L- is at this moment kindly *inking it all over* for me.

I had to do it in pencil.

You must bring *all* the Notes with you tomorrow, as I have observations to make on each one; & especially on this final one H.

There never *was* a Note G. I do not know why I chose H instead of G, & thus insulted the latter worthy letter.

I cannot imagine what you mean about the Variable-Cards; since I never either supposed in my own mind, that one Variable-card *could give off* more than one Variable at a time; nor have (as far as I can make out) expressed such an idea in any passage whatever.

I cannot find what I fancied I had put in Note A; so I return it whole & sound, for your speedy relief.

I send back Note D. You will find the only alteration I wished to make pinned over; in the upper part of Sheet 2.

So I now retain nothing but Note F, which I shall give you tomorrow.

Lord L- has put up, I find, in a separate cover, all that belongs to Note H. (He is quite enchanted with the *beauty & symmetry* of the *Table & diagram*). No—I find I can put in Note D *with* H. [B 37192,337]

The operation and variable card explanations in Note G were giving trouble, and Ada found a mistake they had made in applying "circumstances which related to [sic] the Operation cards to the Variable cards." She wrote Babbage:

Ockham
Tuesday morn

My Dear Babbage. I now write to you expressly *on three* points; which I have very fully & leisurely considered during the last 18 hours; & think of sufficient importance to induce me to send a servant up so that you may have this letter by half after six this evening. The servant will leave Town tomorrow morning early, but will call for anything you may have for me, at *eight* o'clock in the morning before he goes.

Firstly: the few lines I enclosed you last night about the connexion of (8) with the famous Integral, I by no means intend you to insert, unless you *fully* approve the doing so. . . .

Secondly: Lord L- suggests my *signing* the translation & the Notes; by which he means, simply putting at the end of the former: "*translated by A. A. L.*", & adding to each note the initials A. A. L.

It is not my wish to *proclaim* who has written it; at the same time that I rather wish to append anything

that may tend hereafter to *individualise & identify* it, with other productions of the said A. A. L.

My third topic, tho' my last, is my most anxious & important.

I have yesterday evening & this morning very amply analysed the question of the *numbers* of Variable-Cards, as mentioned in the final Note H (or G?). And I find that you & I between us have made a *mess* of it; (for which I can perfectly account, in a very natural manner). I enclose what I wish to insert *instead* of that which is now there. I think the present *wrong* passage is only about eight or ten lines, & is I believe on the *second* of the three great sheets which are to *follow* the diagram.

The fact is that if my own exposition about the Variable-Cards in Note D, had been strictly followed by myself, in Note H; this error would not have occurred. The confusion has arisen simply from the circumstance of applying to the Variable-Cards, facts which relate to the Operation-Cards.

In Note D, it is very well & lucidly demonstrated that *every* single Operation, demands the use of at least *three* Variable-Cards. It does not signify whether the operations be in *cycles* or not. A million successive additions +, +, +, etc., etc., etc. would each demand the use of three new Variable-Cards, under ordinary circumstances. In Note H, the erroneous lines are founded on the hasty supposition that the cycle, or recurring group, of Operation-Cards (13 . . . 23), will be *fed* by a cycle, or recurring group, of Variable-Cards.

I enclose what I believe it *ought* to be. If already gone to the printer, we must alter that passage in the proofs, unless you could call at the printers & there paste over the amendment.

I can scarcely describe to you how *very* ill & harassed I felt yesterday. Pray excuse any abruptness or other unpleasantness of manner, if there were any.

I am breathing *well* again today, & am much better in all respects; owing to Dr. L's remedies. He certainly does seem to understand the case, I mean the *treatment* of it, which is the main thing.

As for the *theory* of it, he says truly that *time & Providence* alone can develop that. It is so *anomalous* an affair altogether. A Singular Function, in very deed!

Think of my having to *walk* (on occasion *run*), to the Station, in *half an hour* last evening; while I suppose you were feasting & flirting in luxury & ease at your dinner. It must be a very pleasant merry sort of thing to have a *Fairy* in one's service, mind & limbs! I envy you! I, poor little Fairy, can only get dull heavy *mortal*, to wait on me!

Ever Yours
A. L. [B 37192,342]

Babbage made note:

C B to Lady L
Wednesday July 43
Return sheet with 2 corrections
Right about card 21
requiring new Variable [B 37192,354]

Ada's letter also illustrates Lord Lovelace's liberal-for-his-time attitude toward his wife's work. Not only was he very supportive of her, but he also wanted her to have recognition from others, and hence suggested that she initial the translation and notes. In the mid-nineteenth century this was not in accordance with convention; it was considered unfeminine and in bad taste for any woman, particularly one of Lady Lovelace's rank, to sign any scientific or literary work. This attitude is shown clearly in Weld's *History of the Royal Society* (Weld 1848). Weld mentions that Menabrea's article had been translated "with copious original notes . . . by a lady of distinguished rank and talent," and in a footnote he states that he is "authorized by Lord Lovelace to say that the translator is Lady Lovelace." Ada was very uncertain, nevertheless, as to whether she should sign them or not, and succeeding letters show her vacillating back and forth—should she initial both the notes and the translation, or only the notes, or neither? In the end she initialed the notes only, putting them under the general heading "Notes By The Translator." Footnotes to the translation read, "Note By Translator."

The explanations about the cards continued to give trouble, and Ada sent an amended passage.

Ockham Park
Weddy 5th July

My Dear Babbage. I am much obliged by the contents of your letter, in all respects. Should you find it expedient to substitute the amended passage about the Variable-Cards, there is also one other short sentence which must be altered similarly. This sentence precedes the passage I sent yesterday by perhaps half a page or more. It is where I explain that for every B after B5, operations (13 . . . 23) have to be repeated; & I believe it runs as follows:

"Not only are the Operation-Cards precisely the same for this repetition, but the Variable-Cards as well with the exception of one new one necessary to introduce B5 instead of B3 for Operation 21 to act upon."

I should wish to substitute what I enclose.

"Why does my friend prefer imaginary roots for our friendship?"—Just, because she happens to have some of that very imagination which you would deny her to possess; & therefore she enjoys a little play & scope for it now & then. Besides this, I deny the *Fairyism* to be entirely imaginary; (& it is to the *fairy* similes that I suppose you allude).

That brain of mine is something more than merely mortal; as time will show; (if only my breathing & some other etceteras do not make too rapid a progress towards instead of from mortality).

Before ten years are over, the Devil's in it if I haven't sucked out some of the life-blood from the mysteries of this universe, in a way that no purely mortal lips or brains could do.

No one knows what almost awful energy & power lie yet undeveloped in that tiny little system of mine. I say *awful*, because you may imagine what it *might* be under certain circumstances.

Lord L. sometimes says "What a *General* you would make!" Fancy me in times of social & political trouble, (had *worldly* power, rule, & ambition been my line, which it now never could be). . . .

I am doggedly attacking & sifting to the very bottom, all the ways of deducing the Bernoulli Numbers. In the manner I am grappling with this subject, & connecting it with others, I shall be some days upon it.

I shall then take in succession the *other* subjects that have been suggested to me during my late labours, & treat them similarly. . . .

Yours *Fairy* for ever
A. A. L.

This being the Rent-day, I cannot see Lord L. to speak to him about the initials. Time enough I suppose. [B 37192,349]

A Friday note tells of the trouble she was still having with the Bernoulli numbers. To help clear her mind she was "going out on horseback." Riding was her favorite sport and one that she shared with Lord Lovelace. Both were keen lovers of horses, and deeply attached to their animals. In a letter to Mary Somerville Ada once described riding as for her "the finest of all medicines" [S 17].

My Dear Babbage. I am in much dismay at having got into so amazing a quagmire & botheration with these *Numbers*, that I cannot possibly get the thing done today. I have no doubt it will all come out clear enough tomorrow; & I shall send you a *parcel* up, as early in the day as I can. So do not be uneasy. (Tho' at this moment I am in a charming state of confusion, but it is that sort of confusion which is of a very *bubble* nature). . . .

Yours puzzle-pate [B 37192,382]

Ada frequently went to their London house, sometimes to stay overnight, in order to confer with Babbage. It was from St. James's Square that she wrote him on a Tuesday at five o'clock.

I find that I do not come up on Friday next.

But if you will give me Monday Evening (I shall stay the night), it will be desirable.

Meanwhile I shall get on with the corrections & send the papers back to you as early as possible; only hoping that nothing in them will oblige me to have your assistance. I do not think this likely.

I hope you will attend carefully to my criticisms about the Preface. I think them of consequence. If Lord L. suggests any further ones, you shall hear. Perhaps he may.

Ever yours
A. L. [B 37192,364]

Incidentally, the published translation had no section labeled "Preface." There was a lengthy introduction by the editor covering what had been published on the Analytical Engine previously, as well as a bibliography for the Difference Engine. Babbage made the following note:

C. B. to Lady L.
Tuesday 11 July 43
Bernoullis numbers
Diagram
Proof of translation
Post answer [B 37192,366]

Concurrently with finishing the notes Ada was correcting the printer's proof of the translation. On Thursday she sent part of it together with four footnotes.

Ockham
Thursdy

My dear Babbage. I send you the first sheet all corrected. I have taken much pains with it, & I think it very much improved.

The printer has made one or two *paragraphs* where none ought to exist; & has also *not* put some words in *Italics* that ought to be so expressed. I have endeavoured to indicate all this, as I best might.

I send you four Foot-Notes, which are referred to in the proper places. I think you will like them, especially the first one about Pascal's machine.

I hope to send you the remainder of the translation tomorrow.

My plans are again all altered. I go on Monday for the day only. Will you come at three o'clock.

I do not suppose that the notes will take half of the corrections which the translation does. I took so much more pains with them. I hope not, for it is damnably troublesome work, & plagues me.

Pray let me know if my corrections are intelligible. . . .

Yours
A. L.

P. S. I mean to put A. A. L. to all the Notes, but to leave the translation without. [B 37192,355]

In a Saturday letter, sent by special messenger with an additional shilling promised for immediate delivery, Ada is very annoyed at Babbage for having altered her Note.

Ockham
Satdy 3 o'clock

P. S. I have been *very* suffering, & more *ill* than ever yet. But today I have rallied considerably. Hang the whole affair!

My Dear Babbage. I send you all excepting four pages which I cannot get done today, as they necessitate one or two troublesome alterations. You will perceive

therefore that the two parts of what I send do not follow. I shall send the rest by post tomorrow.

You ought to get this tonight, & an additional shilling is promised upon *immediate* delivery. I must now explain one or two things. I am much annoyed at your having altered my Note. You know I am always willing to make *any* alterations myself, but that I cannot endure another person to meddle with my sentences. I disapprove therefore, I hope I may be able to alter in the *revise*, supposing you have sent away the proof and notes.

Then I cannot agree to your not having effaced the *paragraphs*. In one instance, at any rate, if not in all, it is very necessary that the paragraph *should* be effaced; as it makes a division in the sense where there should be perfect continuity.

In short I am somewhat disturbed about the matter altogether.

I want to make a slight alteration too in one of the *smaller* Notes which I sent; the one relating to the substituting zero for a number that has been packed off to the mill. . . .

Yours
A. A. L. [B 37192,366]

On Tuesday Ada wrote to Babbage telling him how she had handled the variations in the variable and operation cards referred to in Note G dealing with Bernoulli numbers.

My Dear Babbage. I hope you will approve of what I send. I have taken *much* pains with it. I have explained that there would be, in this instance & in many others, a recurring group or cycle of *Variable* as well as of *Operation* cards, & I have (I think very judiciously & easily) touched on the only departure from *perfect* identity which *could* exist during the repetitions of (13 . . . 23), & yet have not *committed* myself by saying if these departures would require to be met by the introduction of one or more new *cards*, or not; but have simply indicated that as the variations follow a regular rule, they would be easily provided for. I think I have done it admirably & diplomatically. *Here* comes in the *intrigante* & the *politician*!

Ockham
Tuesdy [B 37192,348]

Ever yours
A. L.

Annoyed at Babbage again, this time for his carelessness, Ada wrote:

Weddy night

My Dear Babbage. It is quite evident to me that you have been looking over the *superceded* sheet 4, instead of the *corrected* one. All your remarks seem to apply to the former; & the latter is passed over without notice. Pray be with me at *half past nine o'clock* tomorrow morning, if you can; as I am exceedingly disturbed about it. Lord L. is so vexed too at everything not being done, that I am half beside myself.

He is pressing me in several ways just now, most unfortunately. And amongst it all, I really *shall* be a long time, & shall lose my head for everything. Pray look carefully over the *real* papers. I send them together (& the *superadded* one I have put separately).

I really *cannot* believe it to be incorrect, for nothing can exceed the care with which I have gone over it. But the fact is I *am* plagued out of my life, just now.

P. S. I have made out a list of the operations which calculate *each* co-efficient for each variable, & have subjoined it to your own memorandum. Look over it carefully. [B 37192,379]

In another Tuesday letter Ada wrote:

Ockham
Tuesdy Mornig

My Dear Babbage. The bearer will I hope deliver this by nine this evening. He is to return here as early tomorrow as you can let him have an answer. —What I want to know is this: Can you be with me in Town at four on Thursday, in order that I may read over aloud, with you, all the Notes. For I cannot feel satisfied (on re-perusing them), I find; without going over them *with* you; before they are finally printed off.

Notes 5 & 6, I have not sent you; for I cannot quite please myself about them.

I must either send them to you by post tomorrow; or take them on Thursdy.

Can you afterwards give me Thursday evening, to go to the Opera.

If my servant can have a reply from you *tonight*, he will be off by daylight tomorrow morning. If not, he must come as early as he can tomorrow.

I keep back your note; wishing to consider it a little more. I think it unobjectionable, as far as I have yet considered it. Pray take care that the printing is so managed as to separate distinctly the *translator's* notes, from either *your* note, or one there is of Menabrea's own (see page 36).

I shall not put my initials to my notes but I wish them to be *Translator's* Notes.

There are some blanks left in two or three places, for pages referred to, that I cannot put the numbers in for until I have the proofs.

Yours ever A. L. [B 37192,386]

A Wednesday note of Babbage reads:

Weddy. 26th July

Home late

Parcel & note B. [B 37192,391]

Another Babbage note with the same date reads:

Send revise of Preface. B. [B 37192,392]

On the following day Ada wrote that she expected to have the first writing of the Notes all done by Monday.

Ockham
Thursdy Mornig 27th July

My Dear Babbage.

I cannot get on satisfactorily with either the proofs or the revise, unless I have my own manuscripts for the former, & the corrected proofs for the latter.

Pray therefore get both forthwith, & let them be in St. James' Sqre before four tomorrow.

I am happy to find that the Notes will require very little correction indeed.

To say the truth, I am rather *amazed* at them, & cannot help being struck quite *malgré moi*, with the really masterly nature of the style, & its superiority to that of the Memoir itself.

I have made Lord L.— laugh much by the dryness with which I remarked, "Well, I am very much satisfied with this first child of mine. He is an uncommonly fine baby, & will grow to be a man of the first magnitude & power."

I approve your alteration in the preface, excepting that I think the word "*so*" comes in both awkwardly & superfluously. Pray efface it, & let it stand, "*of the money to be expended*." That little word spoils it.

You will be amused, & somewhat triumphant perhaps, when I own that I entirely approve your alteration of my Foot-note to page 622, & only find the insertion of one single word (& that not in the part you muddled with), to be a desideratum.

Altogether I think things are doing very well. I expect to have all the Notes done by Monday; & the subsequent *Revise* of them, will probably be but a very trifling matter.

Lord L.— seems pleased beyond measure, with the very *learned & knowing* aspect of my baby's physiognomy which he has glanced at.

Yours
A. L. [B 37192,393]

The simile of comparing her article to a baby intrigued her and she also used it in a letter to her mother probably written the same day.

... My *first-born* is characterised chiefly by *strong sense*; & a union of the most minute & laborious accuracy. . . . He will make an excellent *head* of (I hope) a *large* family of brothers & sisters; to whom he will impart a certain *staid & solid* character, for which they will be much indebted to him, (altho' probably no one may ever perceive or acknowledge his quiet & insensible influence). . . . [L-B 42]

Now to Ada's annoyance part of Note G was missing; in a hurried marked-over letter she wrote:

St. James' Sqre
Friday, 5 o'clock

The beginning of Note G (by which I mean the Table & all that *precedes* it) never has been returned into my hands; a small part of the remainder *was*, but that I speedily gave you back, & thus it is, now printed.

The missing part *must* be either at your house or at the printers; & it seems to me *very* unlikely that you should have retained it. So altogether I would wager almost anything that it is at the *office*; or that if lost, it has been lost *there*.

At the same time, I have always fancied you were a little harum-scarum & inaccurate now & then about the exact *order & arrangement* of sheets, pages, & paragraphs etc.; (witness that paragraph which you so carelessly *pasted over*!)

I suppose that I must set to work to write something *better*, if I can, as a substitute. The *same precisely* I could not recall. I think I should be able in a couple of days to do something. However I should be decidedly inclined to *swear at you*, I will allow.

I desire my messenger to wait; as it is possible you may have something to communicate more agreeable.

I go soon after seven. I believe I shall *not* be in Town myself on Monday as I expected.

Yours
A. L. [B 37192,399]

Babbage made note:

Friday 28 July
Part of Ms lost
Note G with its beautiful
Table is missing.

In another note also dated "Friday 28 July" he wrote:

Notes on Menabrea's
Paper
Will obey summons
here for earlier hour. [B 37192,398]

A happy note was made on the next day:

Sat 29 July. Missing Mss found. [B 37192,404]

The month of July had been one of intensive activity on Ada's part. She frequently went to London, usually by rail, from their Ockham estate. In addition, letters and notes flew back and forth between her and Babbage, with their servants often serving as messengers. Occasionally a letter was received and a reply sent on the same day. In these days of telephones, copying machines, and typewriters, it is difficult to assess the extra energy and time needed to write everything out in longhand. Often not feeling well and with family cares in the background, Lady Lovelace was understandably upset when others' carelessness added to her burdens. A Sunday, July 30, letter tells of her vexation at the printer's mistakes, and she requests Babbage to see about it immediately.

I am beyond measure vexed to find that instead of inserting my *corrected* Table in the *Revise* . . . they have left it exactly as it was before. Pray see about it immediately. It is exceedingly careless & annoying.

Out of *several corrections* made, not one is inserted, neither are the Upper Indices added; nor the little Foot-Note. I send you back all the latter part of the *Revise*, & the corresponding *proofs*, that you may look to the matter forthwith. I cannot account for such negligence. . . .

I find myself in some distress for the *original Memo* which you should have sent me back.

I do not think you possess half my forethoughts, & powers of foreseeing all *possible contingencies* (*probable & improbable*, just alike). —

I am glad to see the sheets I return so *clean* on the whole.

Tomorrow I expect to send you up the rest of the *Revise*, & Note A by my governess, in the middle of the day, & more by post.

I will work most diligently, but I wish to revise the *Notes* myself. You might send some one down here the moment you get them; & I would attend *immediately* & send them back by the same or some other special messenger. —

I have begun your *examples of the Calculus of Functions*, appended to Herschel's *examples of Finite Differences*. This will familiarize me a little with the subject; but I must get various other papers, *referred to* by you at the end of the examples.

The paper of Murphy's I want is entitled, "Elementary Principles of the Theory of Electricity."

How *very* careless of you to forget that Note; & how much *waiting on & service* you owe me, to compensate.

I am in good spirits; for I hope another year will make me *really* something of an *Analyst*. The more I study, the more insatiable do I feel my genius for it to be.

I do *not* believe that my father was (or ever could have been) such a *Poet* as I shall be an *Analyst*, (& Metaphysician), for with me the two go together indissolubly.

Yours
A. L. [B 37192,404]

The next afternoon she was still feeling elated at her accomplishment.

Monday afternoon

There is not much correction for Note A; (I send you the whole of it), and of these the chief part I think are merely *paragraphs to be effaced*, & *stops to be inserted or altered*. I cannot refrain from expressing my amazement at my own child. The *pithy & vigorous* nature of the style seem to me to be most striking; and there is at times a *half-satirical & humorous dryness*, which would I suspect make me a most formidable reviewer. I am quite thunder-struck at the *power* of the writing. It is especially unlike a *woman's* style surely; but neither can I compare it with any *man's* exactly.

It is my intention at some future time, when I have knowledge enough, to review Whewell's works. —

Do you not pity him? And yet the beauty of it would be that I should never say one single *ostensibly* cutting, or harsh, or condemnatory thing.

By the way, I want to ask your advice about a more immediately practical matter. I wish to review Ohm's little work. I have much to say upon it. My review however would not be a very long one.

Could it be put into the Philosophical Magazine, do you suppose? I do not know if they review books at all, in that publication.

I shall not probably begin the review just yet. But I am likely to have it done sometime this autumn; or within the year. Of course I shall submit it to you, & also perhaps to some others. I don't yet know quite enough to be sure always of the *solidity* or *appositeness* of all my views.

By the way, there is a thing which must be seen to in the Notes & Translation; owing to the former not having been yet properly *paged* I am unable to give the correct numerical references to the pages in various places, as they ought ultimately to be.

Likewise the Notes should have A. A. L. appended to them. I do not mean the Footnotes, only Notes A, B, C, D, E, F, G, the illustrious *seven*!

You have now the whole of the *Revised*.

I trust that *all* of Note G was found. There is but a very little bit of it indeed, yet sent to me.

I can correct the *proof* of it in an hour or two, when I get it.

Expect a parcel from me tomorrow, with the remaining proofs of the Notes.

A. A. L. [B 37192,339]

Apparently these reviews, if actually done, were not published.

At first cross, then conciliatory, on Tuesday Ada wrote Babbage:

Ockham

Tuesday afternoon

I am half beside myself with hurry & work. I could not get anything done in time to send by coach this morning, & now I am obliged still to retain *one* sheet; which however I hope to send you by an occasion tomorrow afternoon.

Note B has plagued me to death; altho' I have made but little alteration in it. Such alterations as there *are* however, happen to have been very tiresome & to have demanded minute consideration & very nice adjustments.

It is a very excellent Note.

I wish you were as accurate, & as much to be relied on, as I am myself.

You might often *save* me much trouble, if you were; whereas you in reality *add* to my trouble not infrequently, and there is at any rate always the anxiety of *doubting* if you will not get me into a scrape; even when you don't.

By the way, I hope you do not take upon yourself to alter any of my corrections.

I must beg you not. They all have some very sufficient reason. And you have made a pretty mess & confusion in one or two places (which I will show you sometime), where you have ventured in my *M.S's*. to

insert or alter a phrase or word; & have utterly muddled the sense.

I could not conceive at first in one or two places what had happened to my sentences; tho' I soon saw they were *patch-work* & not my own; and found it so on referring to the *M.S.*

I fear you will think this a very *cross* letter. Never mind. I am a good little thing after all.

Later P.S. It is impossible to send you anything but Notes B and C; (& this partly owing to some wrong references & blunders of your own). —

Do not be afraid, for I will work like the Devil early tomorrow morning. [B 37192,414]

The next day at four o'clock she wrote him:

Ockham

Weddy, 4 o'clock

After working almost incessantly since 7 o'clock this morning, until I am *forced* to give in from sheer inability to apply longer, I find only the sheet I enclose quite completed. I shall however send a servant up tomorrow morning by a ten o'clock train, to take you all the rest, so that you will have it almost as soon as this letter.

You cannot conceive the trouble I have had with the trigonometrical Note E! —

In fact no one but me, I really believe, would have doggedly stuck to it, as I have been doing, in all its *necessary* minutiae.

I am very uneasy at not hearing from you as I have expected to do both yesterday & today, & fear some disaster or other. I hope *all* of Note G is forthcoming; & I also hope you have received all my communications safely.

I think *you* had better do the *second revise* of the translation for me. If you will compare it carefully with my *first revise*, it can hardly be necessary I think for me to go over it again.

I suppose I ought to take it for granted that *no news* is good news, but I am in a sad fidget.

Yours ever
A. L.

Turnover

I have sent you, since Satdy, the whole of the revised translation, and the corrected proofs of Notes A, B, C. I send with this a portion of Notes D and E. Tomorrow morning, I shall send you the remainder of these two, & all of Note F.

The very little bit I have of Note G I shall retain till I get the remainder.

I hope they are getting on with all that is already sent back. [B 37192,388]

By ten o'clock that night she had to give up getting it all done.

Wednesday Evening

10 o'clock

I send you what I have done of Note E, which is not *nearly* all. So you must not judge of it, as it is. I am becoming sadly *overworked*, & have scarcely brains left for anything. —

I wonder how you will like my further addition to the upper indices. I half fear *not*. But I can cancel it, if you disapprove. No more tonight, for I can neither talk, write, nor think common sense. And yet I feel more like a fairy than ever. (But I suppose *that* idea is uncommon & not common sense).

Yours
Addlepace [B 37192,390]

The work was nearly finished and on Saturday Babbage wrote:

My Dear Lady Lovelace

I send you back the revise and its alterations. You had better return this by post to
Mr. Taylors Printing Office
Red Lion Court
Fleet St.

I shall send the final revise of the Trans. tonight so that they will then commence putting it into pages—I have suggested two amendments—

I send in another cover the last of the notes, and the great Notations. I waited with some anxiety for a communication from you yesterday.

Today I saw Wheatstone and proposed to him a plan which will fulfill *all* your conditions and some of mine—He approves of it and thinks it will be adopted. If it is I shall write by Monday's post.

Sat. Evg. Ever truly yours
5 Aug [L-B 168] C B

Babbage was very pleased with Ada's Notes. Apparently, at this point, he felt that Ada should withdraw the paper and prepare another version under her own name. He was annoyed by her refusal to do so and wrote a somewhat hurt reply:

My Dear Lady Lovelace

I leave the Mss. and also the proofs of the Notes I recd last night and promised to send this evening.

I will write to Printer to say you will send them up by post direct to them.

This direct communication will save time and there is very little to spare for the Number *ought* to be out in the course of a very few days.

I have nothing to add at present except that you did me an injustice in supposing I wished you to break any engagement with the Editor. I wished you to ask him to allow you to withdraw from it. Had the Editor been in England I believe he would at my request have inserted my defense⁸ or forborn to have printed the

paper—As it stands I have done all I can at present do to defend myself and having failed in the most important part shall make the best I can of the rest.

Ever Truly Yours
C Babbage

2 1/2 P.M.
Tuesday
Dorset St.
8 Aug 1843 [L-B 168]

Ada's view of the disagreement is given in a letter she wrote to her mother the same day Babbage had written the above letter to her. To add to Ada's vexations during this hectic period, her mother had again involved her in the Medora affair. Misunderstandings developed and Ada wrote:

St. James' Sqre
Tuesday 8th Aug

... I must tell you that another reason why I have not been writing to you (as I did not perceive immediate call for it), is that I have been harassed & pressed in a most perplexing manner by the conduct of Mr. Babbage. We are in fact *at issue*: & I am sorry to have come to the conclusion that he is one of the most impracticable, selfish, & intemperate persons one can have to do with. I do not anticipate an absolute alienation between us; but there must ever be a degree of coolness & reserve I fancy in future. I have had in W's [Lord Lovelace] absence, to act quite unadvised in the matter; but I am happy to find that W- & Wheatstone entirely approve my conduct & views. I declared at once to Babbage, that no power should induce me to lend myself to any of his quarrels, or to become in any way his *organ*; & that I should myself communicate in a direct manner with the editors on the subject, as I did not choose to commit a dishonorable breach of engagement, even to promote *his* advantage (if it were to his advantage which I doubted).

He was *furious*; I imperturbable & unmoved. He will never forgive me. I had tried to conciliate & quietly to *advise & suggest*, until I found that it was necessary to be very determined & explicit. Pray forgive my forcing on you at *this* moment, these painful circumstances in another matter.

I only want you to understand that all my *time & my energy* have been miserably absorbed the last few days; for what between Babbage & the editors, both pressing hard in different directions, I have been torn to pieces; & as I heard nothing more from *any* one, of the E. L. [Medora] affair I really endeavoured to *forget* for a few days all its tortuous & villainous implications. ... [L-B 42]

The next few days were filled with corrections and discussions with the printers, but at last the paper was finished. Ada wrote Babbage a twelve-page letter, much marked over, in which she tried to explain her position to him.

⁸ Presumably, the "defense" mentioned referred to Babbage's problems relative to financial support by the government. Probably this was the statement published in the *Philosophical Magazine*, September 23, 1843. It explained that "The rules prescribed for the publication of the Foreign Scientific Memoirs prevented the Editor from inserting ... facts connected with the history of Mr. Babbage's Calculating Engines."

Ockham Park
Monday 14th August 1843

My Dear Babbage. You would have heard from me several days ago, but for the hot work that has been going on between me and the printers. This is now all happily concluded. I have endeavoured to work up everything to the utmost perfection, *as far as it goes*; & I am now well satisfied on the whole, since I think that *within the sphere of aims* I set out with, & in accordance with which the whole contents & arrangement of the Notes are shaped, they are very complete, & even admirable. I could now do the thing far better, but this would be setting out upon a wholly different basis.

I say you would have heard from me before. Your note (enclosed on Monday with my papers etc), is such as demands a very full reply from me, the writer being so old & so esteemed a friend, & one whose genius I not only so highly appreciate myself but wish to see fairly appreciated by others. . . . [B 37192,422]

Ada knew that Babbage felt that she had misunderstood him just as so many others had done during his lifetime, and that he was hurt by this. She still felt, however, that she had no right to withdraw the article, or even, as he had put it, to ask the editor to allow her to withdraw it. The fact that he was her friend and wished it was no real reason for her to do so. She did not claim that her views were "higher, juster, & wiser" than his. It was merely that she must stick to her moral standard, "such as it was," as long as it was hers. She acknowledged that her way of seeing things might be as far from the truth as his. Due to that, as well as the futility of it, she would not try to change his views.

It was important to Ada, nevertheless, that Babbage believe that she sincerely felt that, by allowing the article to appear, she had done him more good than she would have if she had taken any of the courses he had suggested. She felt she had a right to expect from him the belief that she had "sincerely & honestly taken this view."

Then, as if she were certain that they would remain friends, she went on to discuss what she should do in the future. In vague terms she outlined a proposal to Babbage for her services.

I must now come to a practical question respecting the future. Your affairs have been, & are, deeply occupying both myself and Lord Lovelace. Both our thoughts as well as our conversation have been earnest upon them. And the result is that I have plans for you, which I do not think fit at present to communicate to you; but which I shall either develop, or else throw my energies, my time & pen into the service of some other department of truth & science, according to the reply I receive from you to what I am now going to state. I do beseech you therefore deeply & seriously to ponder over

the question how far you can subscribe to my conditions or Not. I give to you the first choice & offer of my services & my intellect. Do not lightly reject them. I say this entirely for your own sake, believe me. . . .

She then went on to lay down three conditions for her working with him:

Firstly: All I want to know whether if I continue to work on & about your own great subject, you will undertake to abide wholly by the judgement of myself (or of any persons whom you may now please to name as referees, whenever we may differ), on all practical matters relating to whatever can involve relations with any fellow-creature or fellow-creatures.

Secondly: Can you undertake to give your mind wholly & undividedly, as a primary object that no engagement is to interfere with, to the consideration of all those matters in which I shall at times require your intellectual assistance & supervision; & can you promise not to *shut & hurry* things over; or to mislay, & allow confusion & mistakes to enter into documents, etc.?

Thirdly: If I am able to lay before you in the course of a year or two, implicit & honorable propositions for *executing your engine*, (such as are approved by persons whom you may now name to be referred to for their approbation), would there be any chance of your allowing myself & such parties to conduct the business for you; your own undivided energies being devoted to the execution of the work; & all other matters being arranged for you on terms your own friends should approve.

You will wonder over this last query. But, I strongly advise you not to reject it as whimsical. You do not know the grounds I have for believing that such a contingency may come within my power, & I wish to know before I allow my mind to employ its energies any further on the subject, that I shall not be wasting thought & power for no purpose or result. . . .

It is intriguing as to just what Ada had in mind. Even more intriguing is Babbage's own reaction to the conditions. Although his subsequent answer would seem to indicate that he had been entirely won over by her letter, at the top of her letter, in what appears to be Babbage's handwriting, is the penciled note:

Morning 15
Saw AAL this morning and refused
all the conditions.

We do know from Ada's letter of August 15 to her mother that she had come to London that day, but there is no mention of a meeting with Babbage.

Ada wanted all to be clear between herself and Babbage. No doubt she was thinking of their recent

disagreement when she wrote in the same letter quoted above:

At the same time, I must place the whole of your relations with me in a fair & just light, our motives, & ways of viewing things, are very widely apart; & it may be on various questions for you to decide how far the advantages & expediency of enlisting a mind of my particular class in your service, can over-balance the annoyance to you of that discrepancy on perhaps many occasions. My own uncompromising principle is to endeavour to love truth & God before fame & glory or even just appreciation; & to believe generously & unwaveringly in the good of human nature, (however dormant & latent it may often seem).

Yours is to love truth & God (yes, deeply & instantly), but to love fame, glory, honour, yet more. You will deny this; but in all your intercourse with every human being (as far as I know & see of it), it is a practically paramount sentiment. Mind, I am not blaming it. I simply state my belief in the fact. The fact may be a very noble & beautiful fact. That is another question. . . .

After admitting that she also had ambition she added:

I wish to add my mite towards expounding & interpreting the Almighty, & his laws & works, for the most effective use of mankind; and certainly, I should feel it a small glory if I were enabled to be one of his most noted prophets (using the word in my own peculiar sense) in this world. And I should undoubtedly prefer being known as a benefactor of this description to being equally great in fact, but promulgating truths from obscurity & oblivion.

At the same time, I am not sure that 30 years hence, I may put even so much value as this, upon human fame. Every year adds to the unlimited nature of my trust & hope in the Creation, & decreases my value for negotiations with mankind *excepting as His minister*; & in this point of view these relations become greatly more interesting to me. Thro' my present relations with man, I am doubtless to become fit for relations of another order hereafter; perhaps directly with the great Power Himself. Of course, my view respecting every even casual social contact & intercourse, takes a corresponding colour; & will do so increasingly if that view should become more confirmed. . . .

Now it was for Babbage to decide, but he must recognize that their principles did not entirely accord at present. She concluded her letter with a request for a visit:

Will you come *here* for some days on Monday. I hope so. Lord L. is very anxious to see & converse with you; & was vexed that the Rail called him away on Tuesday, before he had heard from yourself your own views about the recent affair.

I sadly want your *Calculus of Functions*. So Pray get it for me. I cannot understand the *Examples*.

I have ventured inserting to one passage of Note G small Foot-Note which I am not sure is quite tenable. I say in it that the engine is remarkably well adapted to include the whole *Calculus of Finite Differences* & I allude to the computation of the *Bernoullian Numbers* by means of the *Differences of Nothing*, as a beautiful example, for this principle. I hope it is correctly the case.*

This letter is sadly altered & corrected. Never mind that however.

I wonder if you will choose to retain the lady-fairy in your service or not. Yours ever most sincerely,

A. A. L. [B 37192,422]

The next day Ada wrote her mother from St. James's Square, where she had traveled that morning from Ockham Park.

St. James' Sqr.

5 o'clock, Tuesday, 15th August

... W- said that if I had time, I might as well write you a line from Town. I think he said he had not mentioned to you in his this morning, that I was unexpectedly summoned by the printers, who needed a further supervision; & as it is actually to be out I understand tomorrow, there was no time for post-communications.

No one can estimate the trouble & interminable labour of having to revise the printing of mathematical formulae. This is a pleasant prospect for the future; as I suppose many hundreds & thousands of such formulae will come forth from my pen, in one way or another.

You will receive a few copies (amongst a hundred that are printed separately for me). But where & how shall I send them. . . .

I am uncertain as yet how the Babbage business will end. He has written *unkindly* to me. For many reasons however, I still desire to work upon his subjects & affairs, if I can do so with any reasonable prospect of peace. I have written to him therefore, very explicitly, stating my own conditions, without which I positively refuse to take any further part in conjunction with him, upon any subject whatever. He has so strong an idea, I suspect, of the advantage of having my pen as his servant, that he will probably yield; tho' I demand very strong concessions.

If he does consent to what I propose, I shall probably be enabled to keep him out of much hot water; & to bring his engine to a consummation, (which all I have seen of him & his habits the last 3 months, makes me scarcely anticipate it ever will be, unless some one really exercises a strong co-ersive influence over him). He is beyond measure careless & desultory at times. I shall be willing to be his Whipper-in during the next 3 years, if I see fair prospect of success. Much of this is W's suggestion; (altho' W- thinks B's conduct to me has recently been very blameable). . . . [L-B 42]

* This footnote was left in the published paper.

In another undated letter to Babbage she wrote, "I am reflecting much on the work & duties for you & the engine, which are to occupy me during the next two or three years I suppose; & I have some excellent ideas on the subject" [B 37192,335].

The quoted excerpts indicate that she did hope to help him bring his engine to completion. She and Lord Lovelace felt he needed someone to keep him at it, or it would never be completed. She was apparently willing to dedicate herself to this for a few years, and they seemingly felt she had a fair prospect of succeeding. Unfortunately, apparently nothing came of her resolve. Although they remained good friends, if they did collaborate again on any scientific projects, it did not result either in any known publication or in Babbage completing his machine.

An August 18 note from Babbage to her indicates that she had asked him for drawings of his engine.

My Dear Lady Lovelace

I much fear the drawings will not be very intelligible. They were never published and only a few proofs were taken. I will endeavour to find a complete set and bring them with me on Monday.

The three papers you mention were all published in the Phil. Transactions. I have been to see if Maynard the Math. Bookseller can procure them for you. I have no copy except those of the two first papers interleaved, with which I will trust you with, hoping it may be returned.

18 Aug. 1843
Dorset St. [L-B 168]

Ever most truly yours
C. Babbage

Ada's letters to her mother indicate that her relationship with Babbage was getting back on a friendly basis. On Tuesday, August 22, she wrote, "Babbage is here; kind & cordial. All right!" On the next day, Wednesday, she elaborated, "Babbage & I are I think more friends than ever. I have never seen him so agreeable, so reasonable, or in such good spirits" [L-B 42].

This letter also reveals her plan to go on working and writing, as well as their pride, especially Lord Lovelace's, in her work. (Anna Jameson, to whom Ada had sent a copy of the paper, was a family friend and a popular author, especially noted for her writings on art.)

Ockham
Weddy 22nd Augst¹⁰

Dearest Mama. . .

The "publication" named by Mrs. Jameson is of course the translation & Notes. Since no particular secret has been made about it, & no one has been

particularly desired not to mention it, & in fact W- & I have treated it quite as a matter of course, not worth either making a mystery of or particularly proclaiming. I think it very natural that many persons must be acquainted with the fact that I have been writing something or other.

And we are by no means desirous of making it a secret, altho' I do not wish the importance of the thing to be exaggerated & over-rated.

As this publication will be followed up by others, (on probably various subjects), & as I am now completely tied down & committed to the scientific & literary line, we are rather desirous than otherwise that there should be an impression of such being the case. William especially conceives that it places me in a much juster & truer position & light, than anything else can.

And he tells me that it has already placed him in a far more agreeable position in this country. Besides the many other motives which concur to urge me on to perseverance & success in a studious & literary career, I must name how very important an addition it is to their might that I see W- looks to it as what is to place him (even more perhaps than myself) in the most advantageous & natural position, from its various indirect effects.

Oh dear! How mercilessly he carried off my proofs & revises to some of his friends who came here; despite my remonstrances as to their blotted & unintelligible state!— . . . [L-B 42]

Regardless of Lord and Lady Lovelace's willingness to have her acknowledged as the author of the Notes, the use of the initials led to considerable speculation at the time as to just who A. A. L. was. A letter of Prince Camille de Polignac, son of the minister of Charles X of France, reveals that Menabrea was one of those who puzzled over it. He wrote, "General Menabrea himself was very much surprised to find his memoir not only accurately translated, but with interesting scientific commentaries added to it, by an unknown author whose initials he could not connect with any of the mathematicians of the day. After diligent enquiries he was informed that the author was Lady Lovelace, Lord Byron's only daughter" (Moseley 1964). In 1911, at the age of eighty, the prince wrote Lady Lovelace's daughter, then Lady Anne Blunt, asking if it were indeed true that her mother had written it. She proudly replied that it was. The prince then wrote again, thanking her for helping him confirm something of such scientific interest, and gallantly added, "Be assured that I have a keen appreciation of the filial sentiments so handsomely expressed in your letter, and trust that your kind instrumentality will help to revive before the scientific world the merits of your departed mother, and shed a new lustre on her memory" (Moseley 1964).

¹⁰ This was actually August 23, 1843.

Ada in another comment on her own work wrote: "This engagement has been in some respects arduous & troublesome; & it will probably bring me in but little return of reputation or fame (which were indeed no part of my motive when I undertook it); for there is more of *quiet patient labour & industry* in it, than of brilliancy or attractiveness. . . . But I am glad to have got *launched*, in however *humble & dry* a form" [L-B 173].

Lord Lovelace's pride in his wife's accomplishment is further revealed in a letter he wrote her.

Ashley Combe Sunday mg

Dearest bird . . .

In the afternoon Eb-n & I took a walk along the Ashwater path. . . .

As he was speaking and enquiring after you this mg. I told him a little the reasons why you went so little into any society—health— & pursuits which latter I said were of such a nature as rather to exclude the world in its ordinary way—even if you had health which would at all admit of your entering into its pursuits—which was not the case. The conversation insensibly led me to mention what you had been occupied about and it ended by my telling him the analytical engine had been the subject and I gave him a copy of the translation—I was glad to do this on another Acct. I saw that he partook of the erroneous impression common to others respecting Babbage which the latter complained of—and I told him there was in the copy a full account of the state of the matter as far as the govt & public had been concerned in a pecuniary point of view. He seemed quite astonished when I told him of the expense at which Babbage was now promoting the engine at his own expense from his own monies—and I caused him fully to comprehend this because though Babbage may be blameable from his inflexibility and pique—he ought to have the credit which he deserves, of pursuing science for its own sake, & with posthumous views rather than any hope of present distinction while he denies himself every gratification for its sake. My dearest I hope I have not done amiss in letting so much be known about you—I did not parade the information—but I did not wish either to be mysterious with him about you. I believe him to be very discreet and careful, & there is at the same time a high mindedness about him which grows upon me. I think too you will admit that it is desirable that some of our & his less discreet but very worthy relatives should know a little the reason why they can know & understand you so little & that it is well to take such opportunities as may occur for allowing such information to ooze out. . . .

No letter from you today but one from the hen which I answer. L. [L-B 339]

In a letter to his mother-in-law, Lady Byron, Lord Lovelace wrote: "We had a neighbour or two to dine

latterly—and last Evg. the sweet sounds of the harp were heard too—to my (scarcely less than their) delight."¹¹ I am very glad that there has been this little intercourse with the one or two neighbours we boast of for besides their being as they must be struck with the grandeur & nobleness of her intellect—she has but to be natural to be as much loved as she is to be admired & wondered at—" [L-B 339].

On August 25 Charles Wheatstone sent Ada the following letter:

I called yesterday at the printers and was informed that a separate copy of your paper had been forwarded by post to Ockham and the new number of the Scientific Memoirs sent to St. James' Square.

I made no stipulations whatever with Mr. Taylor when he sent Menabrea's paper for translation, and the only arrangement made since has been that you should be allowed to have for the mere expense of paper and print 100 copies and Mr. Babbage 50. He is desirous of knowing what to do with the remaining 99 copies.

If you have made up your mind not to undertake the translation of Seebeck's memoir in the Transactions of the Berlin Academy, the volume which I sent for the purpose had better be returned to Mr. Taylor.

I have so much on my hands at present that I am unable to leave home, but should you remain at Ockham over next week it will give me great pleasure to pay you a visit on the ensuing Saturday (Sept 2d). I fear however, from what I hear, that you will have left before then for the Coast of England. [L-B 175]

As noted in the above, Ada had another paper from Wheatstone for translation, which she apparently had decided not to do. (Among Ada's papers the authors noted a sheet on Seebeck in rough draft.) Also in another undated letter to Lord Lovelace, which must have been written a short time previously, Ada wrote:

Wheatstone has been with me a long while today, & has taken my translation away with him, after reading it over with me. I hope to receive the *proofs* of it for correction, by & bye; as I trust Taylor will not reject it. I am now translating a beautiful Italian scientific paper. . . . [L-B 165]

Alfred W. Van Sinderen, a private collector of Babbage materials (Van Sinderen 1980), has sent us a copy of a letter in his possession, dated simply "Wed.—6th Nov.," from Lady Lovelace to Charles Babbage. In it reference is made to an article she had written and hoped to have published in the *Quarterly*. Apparently this article was never published; no other mention of it has been found.

¹¹ Lady Lovelace was proficient on the harp.

On September 9 Babbage sent a very friendly note:

My Dear Lady Lovelace

I find it quite in vain to wait until I have leisure so I have resolved that I will leave all other things undone and set out for Ashley taking with me papers enough to enable me to forget this world and all its troubles and if possible its multitudinous Charlatans—everything in short but the Enchantress of Numbers.

My only impediment would be my Mother's health which is not at this moment quite so good as I could wish. . . .

Farewell my dear and much admired Interpreter.

Ever Most Truly Yours,
C. Babbage [L-B 168]

Ada received congratulatory letters from many of her friends, among them Mary Somerville and Augustus De Morgan. Mrs. Somerville congratulated her in the highest terms, but was concerned about her health. She wrote:

A thousand thanks my dear Lady Lovelace for your kindness in sending me a copy of your publication on Babbage's machine the whole of which but especially the notes I have read with the greatest interest and most sincerely congratulate you on the proficiency you have made in the highest branches of mathematics & the clearness with which you have illustrated a very difficult subject and I am sure Mr. Babbage must be truly gratified in having such a commentator. I only fear you have been working too hard as I hear from all our mutual friends that you are thin and not in very strong health. I hope you will take care of yourself & remember that to be able to work long you must take it in moderation. . . . [L-B 174]

Ada respected and loved Mary Somerville, so to receive such praise from her was very pleasant, but it was the letter from De Morgan that especially pleased her. So happy was she that she could not resist sharing his letter with Babbage, telling him that she had never expected that De Morgan would view her crude young composition so favorably. Babbage replied:

My Dear Lady Lovelace

I enclose the letter of De Morgan. I hope to be able to bring with me a final proof of the Statement in which the dates of every fact are clearly set out.

It is gratifying to me also; for you know I had arrived at the same conclusion. You should have written an original paper.

The postponement of that will however only render it more perfect. . . .

I have been making vast resolutions of unbounded work during my visit; but in preparing the materials I

find indications of the necessity of repose after a long period of excitement. Ever my fair Interpreter¹²

Your faithful slave

C Babbage

Dorset St.

Tuesday 12 Sep. 1843 [L-B 168]

De Morgan, like Mary Somerville, worried about Ada working too hard and overtaxing her frail strength. Her mother very wisely saw the good effects that Ada's success had on her and on January 2 wrote De Morgan:

I find both from your letter to Lady Lovelace & from Mrs. DeM's to-day, that you are most kindly anxious to prevent Lady L. from injuring herself by mathematical study—but I feel apprehensive that this caution may be carried too far—I have at all times observed that she was the better for pursuits of that description—and if she would but attend to her stomach, her brain would be capable even of more than she has ever imposed on it—notwithstanding the very annoying circumstances which attended her Babbage pubn—(I mean the quarrelling, & the pressure as to time) I thought the effects on the whole beneficial to her.—I certainly have never known her in so satisfactory a state of mind as since that time, though I should not wish so equal an effort to be frequently demanded of her. After the weeks which I passed with her at Bristol, it is impossible for me to share in the extent of apprehension entertained by some friends who judge from report instead of observation. The consciousness of making progress in science seems to me an essential element in her happiness, & appears not less desirable to Lord Lovelace than to myself. . . . [L-B 67]

De Morgan was not entirely convinced. He believed in the popular theory of the time that a woman was not physically strong enough to endure intense concentration of the mind. He was particularly well suited to judge Ada's abilities, having guided her studies for several years immediately prior to her writing the Notes on Babbage's engine.

My Dear Lady Byron

I have received your note and should have answered no further than that I was very glad to find my apprehension (of being a party to doing mischief if I assisted Lady Lovelace's studies without any caution) is unfounded in the opinion of yourself and Lord Lovelace, who must be better judges than I am, on every point of the case but one, and may be on that one. But at the same time it is very necessary that the one point should be properly stated.

¹² Note that in Babbage's September 9 letter to Lady Lovelace he used "Interpreter." One wonders what caused him now to write "Interpreter."

I have never expressed to Lady Lovelace my opinion of her as a student of these matters: I always feared that it might promote an application to them which might be injurious to a person whose bodily health is not strong. I have therefore contented myself with very good, quite right, and so on. But I feel bound to tell you that the power of thinking on these matters which Lady L. has always shewn from the beginning of my correspondence with her, has been something so utterly out of the common way for any beginner, man or woman, that this power must be duly considered by her friends, with reference to the question whether they should urge or check her obvious determination to try not only to reach but to get beyond, the present bounds of knowledge. If you or Lord L. only think that it is a fancy for that particular kind of knowledge, which, though unusual in its object, may compare in intensity with the usual tastes of a young lady, you do not know the whole. And the same if you think that desire of distinction is the motive, science one of many paths which might be chosen to obtain it. There is easily seen to be the desire of distinction in Lady L.'s character: but the mathematical turn is one which opportunity must have made her take independently of that.

Had any young beginner, about to go to Cambridge, shewn the same power, I should have prophesied first that his aptitude at grasping the strong points and the real difficulties of first principles would have very much lowered his chance of being senior wrangler, secondly, that they would have certainly made him an original mathematical investigator, perhaps of first rate eminence.

The tract about Babbage's machine is a pretty thing enough, but I could I think produce a series of extracts, out of Lady Lovelace's first queries upon new subjects, which would make a mathematician see that it was no criterion of what might be expected from her.

All women who have published mathematics hitherto have shewn knowledge, and power of getting it, but no one, except perhaps (I speak doubtfully) Maria Agnesi, has wrestled with difficulties and shewn a man's strength in getting over them. The reason is obvious: the very great tension of mind which they require is beyond the strength of a woman's physical power of application. Lady L. has unquestionably as much power as would require all the strength of a man's constitution to bear the fatigue of thought to which it will unquestionably lead her. It is very well now, when the subject has not entirely engrossed her attention: by and bye when, as always happens, the whole of the thoughts are continually and entirely concentrated upon them, the struggle between the mind and body will begin.

Perhaps you think that Lady L. will, like Mrs. Somerville, go on in a course of regulated study, duly mixed with the enjoyment of society, the ordinary cares of life &c &c. But Mrs. Somerville's mind never led her into other than the details of mathematical work: Lady

L. will take quite a different route. It makes me smile to think of Mrs. Somerville's quiet acquiescence in ignorance of the nature of force, saying "it is dv/dr " (a math. formula for it) "and that is all we know about the matter"—and to imagine Lady L. reading this, much less writing it.

Having now I think quite explained that you must consider Lady L.'s case as a peculiar one I will leave it to your better judgment, supplied with facts, only begging that this note may be confidential.

All here pretty well; I hope your house is free from illness and remain

Dear Lady Byron
Yours very truly
A De Morgan

69 G. S.
Janry. 21/44 [L-B 339]

It is not known if Lady Byron showed this letter to Ada, and, if she did, how seriously Ada took it. In a letter to Sophia De Morgan, written December 21, 1844[?], Ada described how she had been very ill:

... *Many causes* have all contributed to produce the past derangement; & I shall in future avoid them. *One* ingredient, (but only one among many) has been too much *Mathematics*.

I need hardly say that since I returned here I have been *utterly unable* to think even of my Studies.

I yesterday resumed them; but for sometime I must only give from $\frac{1}{2}$ an hour to an hour a day. Pray tell Mr. De Morgan all this; (he must wonder at not having heard from me).

But say that I hope to have at least *something* to trouble him with when I go to Town next week. ... [L-B 171]

Throughout her life Lady Lovelace carried on scientific discussions on varied subjects with, in addition to Charles Babbage, Mary Somerville, and Augustus De Morgan, such well-known scientists as Michael Faraday (who pleased Ada by admiring the "elasticity" of her intellect) and Sir John Herschel. Charles Wheatstone so respected her intellect that he felt that through her Prince Albert could be encouraged to help the cause of science. Several of Lord Lovelace's letters note that she was popular among scientists, and Albany Fonblanque, editor of *The Examiner*, noted in his memoir of her that she enjoyed associating with persons who "were distinguished in science, art, and literature" (Fonblanque 1852). Thus in assessing Ada's mathematical ability it is clear that she had an unusually fine mind and was respected for her ability by her contemporaries.

Babbage's own opinion of the value of Ada's Notes on his Analytical Engine is further shown by a letter he wrote her eldest son, Viscount Ockham, five years after Lady Lovelace's death.

My Dear Ockham

The Messrs. Scheutz the inventors of the Swedish Difference Engine have expressed to me a wish to offer copies of their Tables of Logs. to those of my friends who had sympathised with me in the difficulties I encountered in the discussions arising from my own Diff. Engine.

I have selected a very small number for this honor. Amongst my departed friends the late Countess Lovelace would have had the highest claim to such a mark of respect.

In the memoir of Mr. Menabrea and still more in the excellent Notes appended by your mother you will find the only comprehensive view of the powers of the Anal. Eng. which the mathematicians of the world have yet expressed. This little book may give you additional motive to cultivate industriously the faculties you possess and that I could convey to you the strong conviction of my own mind that the happiness of each individual is most promoted by employing his faculties in that line which on the whole will contribute most to the happiness of his race.

I am my dear Ockham
Always truly yours
C B

14 June 1857 [B 37197,215]

Wheatstone's plan for her to influence Prince Albert is revealed in a letter Ada wrote to Lord Lovelace on November 29, probably 1844.

My Dear Crow . . .

I have had Wheatstone with me the last 5 hours. . . .

He will visit me at Ockham in Jan'y. He has given me much important information, & still more important advice. He is anxious I should take such a position as may enable me to influence Prince Albert, who is (he knows) a very clever young man. . . .

The Prince's whole & sole desire was to be at the head of a scientific circle in England, & he has expressed his utter mortification at the opposition & cold water which have been thrown on all his desires in this respect.

Wheatstone says none but some woman can put him in the right way, & open the door to him towards all he desires; & that a woman can say that which any man would get into a scrape by doing. Wheatstone does not wish me to think of doing anything immediate.

By no means. But he says it would occur in the natural course of things that if I can take a certain standing in the course of the next few years, the Prince would on some occasion speak to me about science; and that in that case, if I happily seize the moment; I may do for science an inestimable benefit; for that all the Prince wants is a sensible adviser & suggester, to indicate to him the channels for his exercising a scientific influence. . . .

The plan for my writing on Babbage's subject clearly won't do. Don't be vexed at this; a subject is

fixed on instead, so it will make no difference, & I can as easily do the one as the other. . . . [L-B 166]

Apparently no such opportunity to help the cause of science presented itself to Ada. Lord Lovelace, in a letter to Lady Byron dated June 25, 1850[?], wrote:

Dearest hen . . .

I rather wish with you that a gt Lady [Queen Victoria] saw more or rather something of Ada—the gt Ly would be all the better for the genuineness of the truths she might have to hear—but it seems as if the links of the court circle are accidentally formed & yet firmly closed against casual admissions from without. . . .

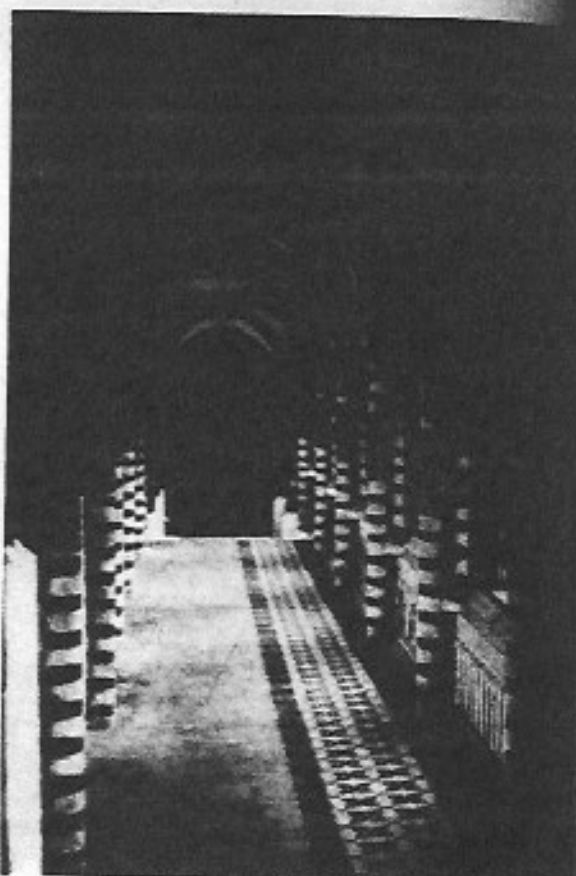
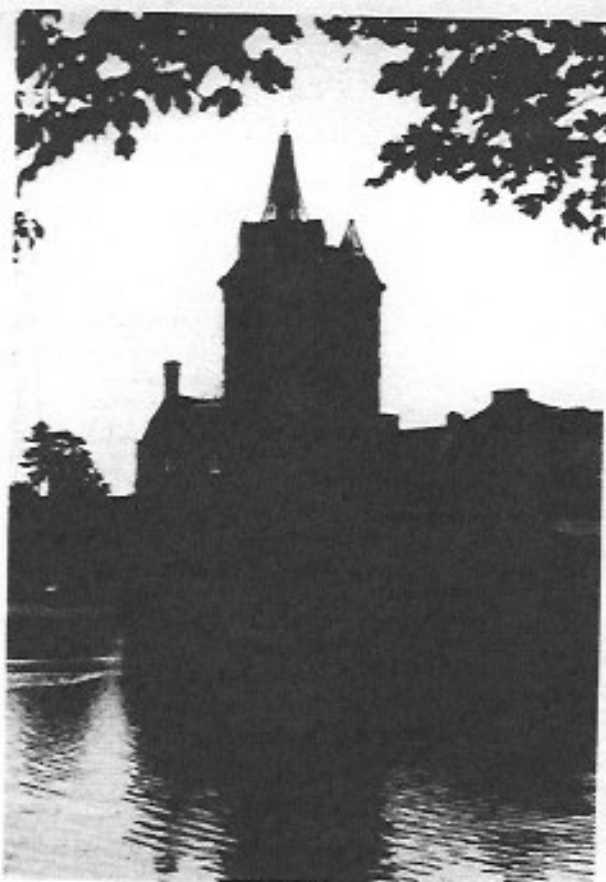
Ever your aff. son
L [L-B 373]

The Lovelaces and Babbage remained close family friends. Letters show that he visited Lady Byron to see the Lovelace children, and he was often called upon to do various errands for them in town or to escort Lady Lovelace to places like the Crystal Palace. He also was a frequent visitor at their homes, and they had corridors at both Ashley Combe and Horsley Towers which they referred to as the "Philosopher's Walk." "The philosopher" was their affectionate term for Babbage when writing to each other.

The Lovelaces still continued to push Babbage's cause. Lord Lovelace in a letter to Ada, probably written in 1849, urged her to do what she could to help Babbage: "If you find an opportunity of being presented to the D. of Wm [Duke of Wellington] by all means use it—& speak to him at once about Babbage, but I do not think any of the others would quite do. . . . We owe it to Babbage not to promote his cause by inferior means" [L-B 373]. In another letter to Ada, Lovelace showed a feeling of discouragement. "I hope Babbage may succeed—but one is in a minority when one advocates the philosopher who seems condemned to an orbit of his own— and this too by men who have met him at our house & have been struck with his genius" [L-B 368].

Some writers believe that Lady Lovelace and Babbage did collaborate in gambling on horse racing, evolving a system for so doing. It is true that gambling was among the myriad subjects on which Babbage wrote, but there is no concrete evidence to connect him with the gambling fever that in her later years plagued Lady Lovelace. At first Lord Lovelace also participated in the betting. When he perceived the "system" was not working he stopped betting, and apparently expected his wife to do likewise. Ada, however, could not give up.

Ada's compulsion led her to pawn the family jewels twice. Twice she asked her mother to redeem them



East Horsley Towers (*left*). The original house was designed by Sir Charles Barry (designer of the British Houses of Parliament). In 1840 the house was acquired by the Earl of Lovelace, who designed the towers and made other extensive additions, including the "Philosopher's Walk" (*right*). Photographs by H. D. Huskey, courtesy of the Electricity Council.

for her and in both instances Lady Byron complied. The cost to Ada's happiness was considerable. The close family relationship of her, her mother, and her husband was destroyed. Lady Byron blamed Lord Lovelace for not looking after his wife better and preventing her from gambling. He was angry that he had not been told about the pawning of the jewels. To add to all the problems, Ada's health had deteriorated to the point where she often had to stay in their London home to be near the doctors. The letters between her and Lord Lovelace reveal her unfailing optimism and belief that she was getting better. In mid-1852, however, when she was thirty-six, Ada's illness was definitely diagnosed as terminal cancer.

Ada sent word to Babbage to come to her, which he did at once. Now sixty, he was full of grief at the suffering of his "enchantress of numbers." At this meeting Ada tried to make him her executor, with full power to dispose of all papers and property deposited by her with him, as he might think proper after full examination. She also asked him to distribute some money for her. Babbage gives this account of the meeting:

On the 12 of Augt 1852 I called in Gt Cumberland Place where the late Lady Lovelace placed these papers

in my hands; we had some conversation on the subject and I entreated her to put on paper (in words however short) her private direction to me as to the distribution of this money.

I had previously explained to Lady Lovelace that the direction to apply to Lady Noel Byron could have no effect except in so far as her Mother chose to comply with it. Also that the application to Drummonds [banker] would not only be improper but as far as I knew illegal without the sanction of Lord Lovelace. Lady Lovelace immediately expressed in the fewest words her most unhesitating conviction both her Mother and her husband would comply with her last wishes. [L-B 138]

Contrary to what Ada said, her mother did not agree to this. In fact, Lady Byron banned Babbage from the Lovelace home after August 16, even though Ada's doctor had expressly written Lord Lovelace a letter stating that it would be cruel to prevent Lady Lovelace from seeing her special friends, such as Babbage. Distraught by Ada's sufferings and the revelation of her gambling losses, as well as worried by financial problems and threatened by "scoundrels" with whom Ada had unaccountably become involved, Lord Lovelace evidently felt her mother's presence was good for Ada so he permitted Lady

Byron to take over the running of the household. Babbage was not permitted to visit Lady Lovelace again.

The authors have found no letters that would clearly indicate the reason for Lady Byron's behavior toward Babbage. Biographers have advanced a number of theories for her action. It is true that Lady Byron liked to dominate people and felt wronged if anyone disagreed with her. In the two years prior to Ada's death her relationship with her mother had become strained, and they were only fully reconciled after Ada became very ill. Lady Byron broke completely with Lord Lovelace after Ada's death, and despite his overtures never became reconciled with him. Lady Byron and Babbage also remained very bitter toward each other.

After months of suffering Lady Lovelace died on November 27, 1852. She was buried six days later next to her father, as she had requested, in the Byron family vault at Hucknall Torkard Church in Nottinghamshire.

The Byron family vault, which dates from 1638, was opened on June 15, 1938, with the permission of the England Home Office and the approval of the Rev. Lord Byron. Lady Lovelace's coffin lay within a foot of that of her father, Lord Byron. On the head of her oak coffin lay a coronet, symbol of her rank. The passage of time had taken its toll and the luster of the coronet was dimmed. No matter—with the advent of the computer age, just as Prince de Polignac had hoped nearly seventy years ago, "a new lustre" has been shed on the memory of Augusta Ada, Countess of Lovelace, as the first woman to have made her mark in the computer field.

Acknowledgments

We are deeply indebted to the Rt. Hon. Earl of Lytton, O.B.E., and his son, Viscount Knebworth, for permission to study the Lovelace-Byron Papers deposited in the Bodleian Library, Oxford University. Special thanks are due Mary Clapinson, of the Department of Western MSS at the Bodleian, for her general helpfulness. Of great value was the Babbage Correspondence in the British Library, London. We are grateful to Lady Fairfax Lucy for permission to quote from the Somerville Collection deposited in the Bodleian Library and acknowledge the help given to users of the collection by Mrs. Elizabeth Patterson's catalog. We appreciate the help of librarians at the Bodleian, British, Science Museum, and University of London libraries. We are grateful to Mrs. Peggy Aldridge for her help in obtaining illustrations of the Earl and Countess of Lovelace.

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