sadie plant

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zeros + ones

DIGITAL WOMEN + THE NEW TECHNOCULTURE

thing was there for the taking then. We paid no attention: it was all for free. It had been this way for tens, thousands, millions, billions of what were later defined as years. If we had thought about it, we would have said it would go on forever, this fluent, fluid world.

And then something occurred to us. The climate changed. We couldn't breathe. It grew terribly cold. Far too cold for us. Everything we touched was poisonous. Noxious gases and thin toxic airs flooded our oceanic zone. Some said we had brought it on ourselves, that all our activity had backfired, that we had destroyed our environment by an accident we had provoked. There were rumors of betrayal and sabotage, whisperings of alien invasion and mutant beings from another ship.

Only a few of us survived the break. Conditions were so terrible that many of those who did pull through wished they had died. We mutated to such an extent that we were unrecognizable to ourselves, banding together in units of a kind which, like everything, had been unthinkable before. We found ourselves working as slave components of systems whose scales and complexities we could not comprehend. Were we their parasites? Were they ours? Either way we became components of our own imprisonment. To all intents and purposes, we disappeared.

"Subtly, subtly, they become invisible; wondrously, wondrously, they become soundless—they are thus able to be their enemies' Fates."

Sun Tzu, *The Art of War*

ada

In 1833, a teenage girl met a machine which she came to regard "as a friend." It was a futuristic device which seemed to have dropped into her world at least a century before its time.

Later to be known as Ada Lovelace, she was then Ada Byron, the only child of Annabella, a mathematician who had herself been dubbed Princess of Parallelograms by her husband, Lord Byron. The machine was the Difference Engine, a calculating system on which the engineer Charles Babbage had been working for many years. "We both went to see the thinking machine (for such it seems) last Monday," Annabella wrote in her diary. To the amazement of its onlookers, it "raised several Nos. to the 2nd & 3rd powers, and extracted the root of a quadratic Equation." While most of the audience gazed in astonishment at the machine, Ada "young as she was, understood its working, and saw the great beauty of the invention."

When Babbage had begun work on the Difference Engine, he was interested in the possibility of "making machinery to compute arithmetical tables." Although he struggled to persuade the British government to fund his work, he had no doubt about the feasibility and the value of such a machine. Isolating common mathematical differences between tabulated numbers, Babbage was convinced that this "method of differences supplied a general principle by which *all* tables might be computed through limited intervals, by one uniform process." By 1822 he had made a small but functional machine, and "in the year 1833, an event of great importance in the history of the engine occurred. Mr. Babbage had directed a portion of it, consisting of sixteen figures, to be put together. It was capable of calculating tables having two or three orders of differences; and, to some extent, of forming other tables. The action of this portion completely justified the expectations raised, and gave a most satisfactory assurance of its final success."

Shortly after this part of his machine went on public display, Babbage was struck by the thought that the Difference Engine, still incomplete, had already superseded itself. "Having, in the meanwhile, naturally speculated upon the general principles on which machinery for calculation might be constructed, *a principle of an entirely new kind* occurred to him, the power of which over the most complicated arithmetical operations seemed nearly unbounded. On reexamining his drawings . . . the new principle appeared to be limited only by the extent of the mechanism it might require." If the simplicity of the mechanisms which allowed the Difference Engine to perform addition could be extended to thousands rather than hundreds of components, a machine could be built which would "execute more rapidly the calculations for which the *Difference* Engine was intended; or, that the *Difference* Engine would itself be superseded by a far simpler mode of construction." The government officials who had funded Babbage's work on the first machine were not pleased to learn that it was now to be abandoned in favor of a new set of mechanical processes which "were essentially different from those of the Difference Engine." While Babbage did his best to persuade them that the "fact of a new superseding an old machine, in a very few years, is one of constant occurrence in our manufactories; and instances might be pointed out in which the advance of invention has been so rapid, and the demand for machinery so great, that half-finished machines have been thrown aside as useless before their completion," Babbage's decision to proceed with his new

machine was also his break with the bodies which had funded his previous work. Babbage lost the support of the state, but he had already gained assistance of a very different kind.

"You are a brave man," Ada told Babbage, "to give yourself wholly up to Fairy-Guidance!—I advise you to allow yourself to be unresistingly bewitched . . ." No one, she added, "knows what almost *awful* energy & power lie yet undevelopped in that *wiry* little system of mine."

In 1842 Louis Menabrea, an Italian military engineer, had deposited his *Sketch of the Analytical Engine Invented by Charles Babbage* in the Bibliothèque Universelle de Génève. Shortly after its appearance, Babbage later wrote, the "Countess of Lovelace informed me that she had translated the memoir of Menabrea." Enormously impressed by this work, Babbage invited her to join him in the development of the machine. "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."

Babbage and Ada developed an intense relationship. "We discussed together the various illustrations that might be introduced," wrote Babbage. "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."

"A strong-minded woman! Much like her mother, eh? Wears green spectacles and writes learned books . . . She wants

to upset the universe, and play dice with the hemispheres. Women never know when to stop . . .”

William Gibson and Bruce Sterling, *The Difference Engine*

Babbage’s mathematical errors, and many of his attitudes, greatly irritated Ada. While his tendency to blame other bodies for the slow progress of his work was sometimes well founded, when he insisted on prefacing the publication of the memoir and her notes with a complaint about the attitude of the British authorities to his work, Ada refused to endorse him. “I never *can* or *will* support you in acting on principles which I consider not only wrong in themselves, but suicidal.” She declared Babbage “one of the most impracticable, selfish, & intemperate persons one can have to do with,” and laid down several severe conditions for the continuation of their collaboration. “Can you,” she asked, with undisguised impatience, “undertake to give your mind *wholly and 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 *slur & hurry* things over; or to mislay & allow confusion & mistakes to enter into documents &c?”

Ada was, she said, “very much *afraid* as yet of exciting the powers I *know I have over others*, & the *evidence* of which I have certainly been *most unwilling to admit*, in fact for a long time considered quite fanciful and absurd . . . I therefore carefully refrain from all attempts *intentionally* to exercise unusual powers.” Perhaps this was why her work was simply attributed to A.A.L. “It is not my wish to *proclaim* who has written it,” she wrote. These were just a few afterthoughts, a mere commentary on someone else’s work. But Ada did want them to bear some name: “I rather wish to append anything that may tend hereafter to *individualize it & identify* it, with other productions of the said A.A.L.” And for all her apparent modesty, Ada knew how important her notes really were. “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.” Her work was indeed vastly more influential—and three times longer—than the text to which they were supposed to be mere adjuncts. A hundred years before the hardware had been built, Ada had produced the first example of what was later called computer programming.

matrices

Distinctions between the main bodies of texts and all their peripheral detail—indices, headings, prefaces, dedications, appendices, illustrations, references, notes, and diagrams—have long been integral to orthodox conceptions of nonfiction books and articles. Authored, authorized, and authoritative, a piece of writing is its own mainstream. Its asides are backwaters which might have been—and often are—compiled by anonymous editors, secretaries, copyists, and clerks, and while they may well be providing crucial support for a text which they also connect to other sources, resources, and leads, they are also sidelined and downplayed.

When Ada wrote her footnotes to Menabrea’s text, her work was implicitly supposed to be reinforcing these hierarchical divisions between centers and margins, authors and scribes. Menabrea’s memoir was the leading article; Ada’s work was merely a compilation of supporting detail, secondary commentary, material intended to back the author up. But her notes and Jacquard's loom, which gathered itself on the gathering threads of weavers who in turn were picking up on the threads of the spiders and moths and webs of bacterial activity.

on the cards

Until the early eighteenth century, when mechanisms which allowed looms to automatically select their own threads were introduced, it could take a weaver "two or three weeks to set up a drawloom for a particular pattern." The new devices used punched-paper rolls, and then punched cards which, when they were strung together in the early nineteenth century, made the loom into the first piece of automated machinery. It was Joseph Marie Jacquard, a French engineer, who made this final move. "Jacquard devised the plans of connecting each group of threads that were to act together, with a distinct lever belonging exclusively to that group. All these levers terminate in rods" and a "rectangular sheet of pasteboard" moves "with it all the rods of the bundle, and consequently the threads that are connected with each of them." And if this board, "instead of being plain, were pierced with holes corresponding to the extremities of the levers which meet it, then, since each of the levers would pass through the pasteboard during the motion of the latter, they would all remain in their places. We thus see that it is easy so to determine the position of the holes in the pasteboard, that, at any given moment, there shall be a certain number of levers, and consequently parcels of threads, raised, while the rest remain where they were. Supposing this process is successively repeated according to a law indicated by the pattern to be

executed, we perceive that this pattern may be reproduced on the stuff."

As a weaving system which "effectively withdrew control of the weaving process from human workers and transferred it to the hardware of the machine," the Jacquard loom was "bitterly opposed by workers who saw in this migration of control a piece of their bodies literally being transferred to the machine." The new frames were famously broken by Luddite rioters to whom, in his maiden speech in the House of Lords in 1812, Lord Byron offered his support. "By the adoption of one species of frame in particular," he said, "one man performed the work of many, and the superfluous laborers were thrown out of employment. Yet it is to be observed that the work thus executed was inferior in quality; not marketable at home, and merely hurried over with a view to exportation. It was called, in the cant of the trade, by the name of 'Spider-work.' "

Byron was concerned that his peers in the Lords would think him "too lenient towards these men, & *half a framebreaker* myself." But, unfortunately for both his argument and the handloom weavers who were thrown out of work, the fabrics woven on the new looms soon surpassed both the quantity and quality of those which had been made by hand. And the Spider-work did not stop here. These automated processes were only hints as to the new species Byron's daughter had in store.

***"I do* not *believe that my father was (or ever could have been) such a* Poet *as* I shall *be an* Analyst."**

Ada Lovelace, July 1843

Babbage had a long-standing interest in the effects of automated machines on traditional forms of manufacture, publishing his research on the fate of cottage industries in the Midlands and

North of England, *The Economy of Manufactures and Machinery,* in 1832. The pin factory with which Adam Smith had illustrated his descriptions of the division of labor had made a great impression on him and, like his near contemporary Marx, he could see the extent to which specialization, standardization, and systematization had made both factories and economies into enormous automated machines themselves. Babbage was later to look back on the early factories as prototype "thinking machines," and he compared the two main functions of the Analytical Engine—storage and calculation—to the basic components of a textiles plant. "The Analytical Engine consists of two parts," wrote Babbage. "1st. The store in which all the variables to be operated upon, as well as all those quantities which have arisen from the result of other operations, are placed," and "2nd. The mill into which the quantities about to be operated upon are always brought." Like the computers which were later to run, and still do, the Engine had a store and mill, memory and processing power.

It was the Jacquard loom which really excited and inspired this work. Babbage owned a portrait of Jacquard, woven on one of his looms at about 1,000 threads to the inch and its production had demanded the use of some 24,000 punched cards, each one capable of carrying over 1,000 punch-holes, and Babbage was fascinated by the fine-grained complexity of both the cloth and the machine which had woven it. "It is a known fact," he wrote, "that the Jacquard loom is capable of weaving any design which the imagination of man may conceive." The portrait was a five-feet-square "sheet of woven silk, framed and glazed, but looking so perfectly like an engraving, that it had been mistaken for such by two members of the Royal Academy."

While it was "generally supposed that the Difference Engine, after it had been completed up to a certain point, *suggested*

the idea of the Analytical Engine; and that the second is in fact the improved offspring of the first, and *grew out* of the existence of its predecessor," Ada insisted that the Analytical Engine was an entirely new machine: "the ideas which led to the Analytical Engine occurred in a manner wholly independent of the latter engine, and might equally have occurred had it never existed nor been even thought of at all." The Difference Engine could "do nothing but *add;* and any other processes, not excepting those of simple subtraction, multiplication and division, can be performed by it only just to that extent in which it is possible, by judicious mathematical arrangement and artifices, to reduce them to a *series of additions.*" As such, it is "the embodying of *one particular and very limited set of operations,* which . . . may be expressed thus (+,+,+,+,+,+), or thus, 6 (+). Six repetitions of the one operation, +, is, in fact, the whole sum and object of that engine." But if the Difference Engine could simply add up, the Analytical Engine was capable of performing the "whole of arithmetic."

Women can't add, he said once, jokingly. When I asked him what he meant, he said, For them, one and one and one and one don't make four.

What do they make? I said, expecting five or three.

Just one and one and one and one, he said.

Margaret Atwood, *The Handmaid's Tale*

"If we compare together the powers and the principles of construction of the Difference and of the Analytic Engines," she wrote, "we shall perceive that the capabilities of the latter are immeasurably more extensive than those of the former, and that they in fact hold to each other the same relationship as that of analysis to arithmetic." It was, as Babbage wrote, "a machine of the most general nature." This machine could not merely synthesize the data already provided by its operator, as the Difference Engine had done, but would incarnate what Ada Lovelace described as the very "science of operations."

second sight

Babbage's attempts to build an adding machine were not without precedent. Wilhelm Leibniz's seventeenth-century Stepped Reckoner was marketed on the basis that it would "be desirable to all who are engaged in computations . . . the managers of financial affairs, the administrators of others' estates, merchants, surveyors, geographers, navigators, astronomers, and those connected with any of the crafts that use mathematics." His work was in part inspired by the Pascaline, developed by Blaise Pascal in 1642. This machine used rotating wheels and a ratchet to perform addition and subtraction and was also designed as a device "by means of which you alone may, without any effort, perform all the operations of arithmetic, and may be relieved of all the work which has often times fatigued your spirit when you have worked with the counters or with the pen."

While Babbage's Difference Engine had already improved on these earlier designs, the Analytical Engine was a vastly superior machine. And it was, as Ada wrote, "the introduction of the principle which Jacquard devised for regulating, by means for punched cards, the most complicated patterns in the fabrication of brocaded stuffs," which gave the Analytical Engine its "distinctive characteristic" and "rendered it possible to endow mechanism with such extensive faculties as bid fair to make this engine the executive right-hand of abstract algebra.

"The mode of application of the cards, as hitherto used in the art of weaving, was not found, however, to be sufficiently powerful for all the simplifications which it was desirable to attain in such varied and complicated processes as those required in order to fulfil the purposes of an Analytical Engine. A method was devised of what was technically designated *backing* the cards in certain groups according to certain laws. The object of this extension is to secure the possibility of bringing any particular card or set of cards into use *any number of times successively* in the solution of one problem." This sophistication of the punched-card system caused "the prism over which the train of pattern cards is suspended to revolve backwards instead of forwards, at pleasure, under the requisite circumstances; until, by so doing, any particular card, or set of cards, that has done duty once, and passed on in the ordinary regular succession, is brought back to the position it occupied just before it was used the preceding time. The prism then resumes its forward rotation, and thus brings the card or set of cards in question into play a second time." The cards were selected by the machine as it needed them, and effectively functioned as a filing system, a means of storage and retrieval which allowed the engine to draw on its own information as required without having to make a linear run through all its cards.

"There is no limit to the number of cards that can be used. Certain stuffs require for their fabrication not less than *twenty thousand* cards," and because their repetition "reduces to an immense extent the number of cards required," the Engine could "far exceed even this quantity." This was an improvement "especially applicable wherever *cycles* occur in mathematical operations," so that "in preparing data for calculations by the engine," wrote Ada, "it is desirable to arrange the order and combination of the processes with a view to obtain them as would give the lecture extempore. The method—if it can be called that—also supplemented her pleasure in sprints of thought. Intellectually she was . . . a quick sketcher."

No doubt Freud despaired at such unorthodox approaches to her work. It seemed she did everything in reverse, backward, upside down, contrary to any rational approach. But if Anna's techniques appeared to be the random tactics of a scattered brain, knowing something backward and inside out is far in advance of any straightforward procedure. And she was hardly alone in her topsy-turvy ways. This ability to win "victories *in advance,* as if acquired on credit" may not figure in the history of discoveries and inventions familiar to Freud, but this is only because it underlies the entire account. According to Marshall McLuhan, "the technique of beginning at the end of any operation whatever, and of working backwards from that point to the beginning" was not merely an invention or discovery to be added to the list: it was "the invention of invention" itself.

This is hysteresis, the lagging of effects behind their causes. Reverse engineering: the way hackers hack and pirates conspire to lure the future to their side. Starting at the end, and then engaging in a process which simultaneously assembles and dismantles the route back to the start, the end, the future, the past: who's counting now? As Ada said, she "did everything topsy-turvy, & certainly ought to have come into the world *feet downwards.*" Mere discoveries were not enough for her: "I intend to incorporate with one department of my labours a complete reduction to a system, of the principles and methods of *discovery.*"

The prevalence of these backward moves is not the least of the reasons why histories of technology—and indeed histories of anything at all—are always riddled with delicious gaps, mysteries, and riddles just like those perplexing Freud. No straight-

forward account can ever hope to deal with the tactical advantages gained by such disorderings of linear time. The names and dates and great achievements of the Read Only Memory called history may enjoy their fifteen kilobytes of digital fame on the latest encyclopedic compact disc, but what announce themselves to be founding fathers, points of origin, and defining moments only ever serve as distractions from the ongoing processes, the shifting differences that count. These are subtle and fine grained, often incognito, undercover, in disguise as mere and minor details. If, that is, they show themselves at all.

"Ada's method, as will appear, was to weave daydreams into seemingly authentic calculations."

Doris Langley Moore, *Ada, Countess of Lovelace*

gambling on the future

"That you are a peculiar—*very peculiar*—specimen of the feminine race, you are yourself aware." They called her "wayward, wandering . . . deluded." She didn't argue; she seemed not to care. "The woman brushed aside her veil, with a swift gesture of habit" and, as though responding to Sigmund Freud, said, "There is at least some *amusement* in being so curious a riddle."

She didn't have a name to call her own, but she did have many avatars: Ada Augusta King, Countess of Lovelace; Ada Lovelace, nee Byron; A.A.L., the first programmer. She is also Ada, the language of the United States military machine. "She is the Queen of Engines, the Enchantress of Number."

Soon after Ada's birth, Lord Byron went his own opiated way, and Lady Byron brought her daughter up with all the excesses of stringent discipline to which well-bred girls were supposed to be subject. After rumors of a scandalous affair, she married William, a man in his thirties, when she was still in her teens, and became Ada King in 1835. Three years later, when William inherited his father's title, she became a countess in name as well as deed.

When she married, her mother instructed her to bid "adieu to your old companion Ada Byron with all her peculiarities, caprices, and self-seeking; determined that as A.K. you will live for others." She tried to be the dutiful daughter and did her best to lead a domesticated life. She was the mother of two boys and a girl by the age of twenty-four. But it wasn't long before she was describing her children as "irksome *duties* & nothing more." Although she had "wished for heirs," she had never "desired a child," and described herself as having a "total deficiency in all natural *love* of children." She wrote, "To tell the honest truth I feel the children much more nuisance than pleasure & cannot help remembering that I am not naturally or originally fond of children." She wrote of her husband with affection, describing him as "my *chosen pet,*" but also expressed her indifference to any "*mortal* husband," even her own. "No man would suit me," she wrote, "tho' some might be a shade or two *less personally* repugnant to me than others."

One of Ada's most long-standing and trustworthy friends was the acclaimed mathematician Mary Somerville, who had published the *Connection of the Physical Sciences* in the early 1830s. Just after her marriage she wrote to Mary, "I now read Mathematics every day, & am occupied on Trigonometry & in preliminaries to Cubic and Biquadratic Equations. So you see that matrimony has by no means lessened my taste for these pursuits, nor my determination to carry them on." She also gained many new interests after her children were born. She lost

thousands at the races and, seduced by her mathematical prowess and her reassurances that she really did have "a system," many of her male companions were also encouraged to do the same. This was an illegitimate use of her already dubious interest in mathematics. "The passions suffer no less by this gaming fever than the understandings and the imagination. What vivid, unnatural hope and fear, joy and anger, sorrow and discontent burst out all at once upon a roll of the dice, a turn of the card, a run of the shining gurneys! Who can consider without indignation that all those womanly affections, which should have been consecrated to children and husband, are thus vilely prostituted and thrown away. I cannot but be grieved when I see the Gambling Lady fretting and bleeding inwardly from such evil and unworthy obsessions; when I behold the face of an angel agitated by the heart of a fury!"

Ada was ill for much of her short life, walking with crutches until the age of seventeen, and endlessly subject to the fits, swellings, faints, asthmatic attacks, and paralyses which were supposed to characterize hysteria. "Heaven knows what intense suffering & agony I have gone thro'; & how *mad* & how *reckless* & *desperate* I have at times felt," she wrote. "There has been no end to the manias & whims I have been subject to, & which nothing but the most resolute determination on my part could have mastered."

Like many of her ailing contemporaries, Ada had been subjected to a variety of treatments before she developed an "opium system" in the 1840s. This was supposed to bring her down, but it only added to her volatility. "No more laudanum has been taken as yet," she wrote at one point. "But I doubt another twenty-four hours going over without. I am beginning to be excited, & my eyes burn again." She would, she wrote, take laudanum "not for ever," but "as a *regular* thing once or twice a week." The drug had "a remarkable effect on my eyes, seeming to *free* them, & to make them *open* & *cool.*" In opium lay the vast expanses, orders, and harmonies conjured by mathematics: "It makes me so philosophical," she wrote, "& so takes off all *fretting* eagerness & anxieties. It appears to harmonize the whole constitution, to make each function act in a *just proportion;* (with *judgment, discretion, moderation).*" Her doctor "seems to think it is not a mere palliative but has a far more radical effect. Since this last dose, I am inclined to think so myself . . . It is a pity that instead of ordering *Claret* some months ago, he had not advised laudanum or Morphine. I think he has got the thing at last."

In 1851 a uterine examination revealed "a very deep and extensive ulceration of the womb" which her doctor thought must long have been "the cause of much derangement of health." She died in 1852 at the age of thirty-six.

They called her complex of diseases hysteria, a diagnosis and a term which indicated wayward reproductive organs: hysteria is derived from the Greek word *hystera,* and means 'wandering womb.' There was a time when it was widely believed that "the womb, though it be so strictly attached to the parts we have described that it may not change place, yet often changes position, and makes curious and so to speak petulant movements in the woman's body. These movements are various: to wit, ascending, descending, convulsive, vagrant, prolapsed. The womb rises to the liver, spleen, diaphragm, stomach, breast, heart, lung, gullet, and head." Although such direct connections with the womb had fallen out of medical favor by the end of the nineteenth century, hysteria continued to be associated with notions of a wandering womb.

"There is in my nervous system," wrote Ada, "such utter want of *all* ballast & steadiness, that I cannot regard my life or

powers as other than precarious." They said she was a nervous system apparently unable to settle down. She had what she described as a "vast mass of useless & irritating POWER OF EXPRESSION which longs to have full scope in *active* manifestation such as neither the ordinary active pursuits or duties of life, nor the *literary* line of expression, can give vent to." She couldn't concentrate, flitting between obsessions, restless, searching. At one point she declared, "There is no pleasure in way of exercise equal to that of feeling one's horse flying under one. It is even better than waltzing." At another the harp was her greatest love: "I play 4 & 5 hours generally, & never less than 3. I am never tired at the end of it." Drama was another contender: "Clearly the only one which directs my *Hysteria* from all its mischievous & irritating channels." But even this was a short-lived love: "*I* never would look to the excellence of mere representation being satisfactory to me as an ultimate goal, or exclusive object . . ."

Ada was hunting for something that would do more than represent an existing world. Something that would work: something new, something else. Even the doctors agreed that she needed "peculiar & artificial excitements, as a matter of *safety* even for your life & happiness." Such stimulations simply did not exist. She had to engineer them to suit herself.

Hysterics were said to have "a hungry look about them." Like all Luce Irigaray's women, "what they desire is precisely nothing, and at the same time, everything. Always something more and something else besides that *one*—sexual organ, for example—that you give them, attribute to them"; something which "involves a different economy more than anything else, one that upsets the linearity of a project, undermines the goal-object of a desire, diffuses the polarization towards a single pleasure, disconcerts fidelity to a single discourse . . ."

Ada was by turns sociable and reclusive, cautious and reckless, swinging between megalomaniac delight in her own brilliance and terrible losses of self-esteem. There had been times when she had almost given into the fashionable belief that overexertion of the intellect lay at the root of her hysteria. At one point she wrote, *"Many causes* have contributed to produce the past derangements; & I shall in future avoid them. One ingredient (but only one among many) has been *too much Mathematics."*

Not even countesses were supposed to count. But Ada could be very determined, proud of her own staying power, and sometimes absolutely convinced of her mathematical, musical, and experimental genius. "I am proceeding on a track quite peculiar and my own," she wrote. "I mean to do *what I mean to do."* In 1834 she explained 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." And in spite of the prevailing opinion that numbers were bad for her, she was never coaxed into "dropping the *thread* of science, Mathematics &c. These may be still my ultimate vocation."

binaries

The postwar settlement was supposed to mark the dawn of a new era of regulation and control: the Central Intelligence Agency, United Nations, welfare states, mixed economies, and balanced superpowers. This was a brave new equilibrated world of self-guiding stability, pharmaceutical tranquillity, white goods, nuclear families, Big Brother screens, and, to keep these

new shows on the road, vast new systems of machinery capable of recording, calculating, storing, and processing everything that moved. Fueled by a complex of military goals, corporate interests, solid-state economies, and industrial-strength testosterone, computers were supposed to be a foolproof means to the familiar ends of social security, political organization, economic order, prediction, and control. Centralized, programmable systems running on impeccably logical lines, these new machines were supposed to make the most complex processes straightforward. But even in the most prosaic terms, this supposedly logical, directed, and controlled of zones has always been wildly unpredictable. In 1950, when the processing power which can now be inscribed on the surface of a silicon chip occupied vast air-conditioned rooms, IBM thought the total global market for computers was five. In 1951 the United States Census Bureau put UNIVAC to work, the Bank of America installed Electronic Recording Machine Accounting (ERMA), and by 1957, when the Type 650 was launched, IBM anticipated sales of somewhere between fifty and 250. Two years later some 2,000 computers were in use in government agencies and private companies, and the figures were drastically revised. Perhaps 200,000 computers would be sufficient to saturate the market. By the early 1990s, IBM alone was selling twice that number of systems a week.

Computers have continued to pursue these accelerating, exponential paths, proliferating, miniaturizing, stringing themselves together into vast telecommunications nets, embedding themselves in an extraordinary variety of commodities, becoming increasingly difficult to define. While the postwar programmable computers were composed of transistors which used silicon as a semiconductor of electric current, by the end of the 1950s, the integrated circuit connected the transistors and inscribed them a single wafer of silicon. In the same vein of exponential miniaturization, the microprocessor was developed in the early 1970s, effectively putting all the solid-state circuits of a computer onto a single silicon chip. The screen migrated from the TV set to give the machine a monitor, and by the 1980s what had once been vast room-size systems without windows on the world were desktop microprocessors.

"The calculations taking place within the machine are continuously registered as clicks clicking high-pitched sounds as of tinkling bells, noises like those of a cash-register. There are lights that go out and come on at irregular intervals of time. They are red orange blue. The apertures through which they shine are circular. Every divergence is ceaselessly recorded in the machine. They are scaled to the same unit whatever their nature."

Monique Wittig, *Les Guérillères*

Whether they are gathering information, telecommunicating, running washing machines, doing sums, or making videos, all digital computers translate information into the zeros and ones of machine code. These binary digits are known as *bits* and strung together in *bytes* of eight. The zeros and ones of machine code seem to offer themselves as perfect symbols of the orders of Western reality, the ancient logical codes which make the difference between on and off, right and left, light and dark, form and matter, mind and body, white and black, good and evil, right and wrong, life and death, something and nothing, this and that, here and there, inside and out, active and passive, true and false, yes and no, sanity and madness, health and sickness, up and down, sense and nonsense, west and east, north and south. And they made a lovely couple when it came to sex. Man

and woman, male and female, masculine and feminine: one and zero looked just right, made for each other: 1, the definite, upright line; and 0, the diagram of nothing at all: penis and vagina, thing and hole . . . hand in glove. A perfect match.

It takes two to make a binary, but all these pairs are two of a kind, and the kind is always kind of one. 1 and 0 make another 1. Male and female add up to man. There is no female equivalent. No universal woman at his side. The male is one, one is everything, and the female has "*nothing* you can see." Woman "functions as a *hole,*" a gap, a space, "a *nothing*—that is a nothing the same, identical, identifiable . . . a fault, a flaw, a lack, an absence, outside the system of representations and auto-representations." Lacan lays down the law and leaves no doubt: "There is woman only as excluded by the nature of things," he explains. She is "not-all," "not-whole," "not-one," and whatever she knows can only be described as "not-knowledge." There is "no such thing as *The* woman, where the definite article stands for the universal." She has no place like home, nothing of her own, "other than the place of the Other which," writes Lacan, "I designate with a capital O."

supporting evidence

Man once made himself the point of everything. He organized, she operated. He ruled, she served. He made the great discoveries, she busied herself in the footnotes. He wrote the books, she copied them. She was his helpmate and assistant, working in support of him, according to his plans. She did the jobs he considered mundane, often the fiddling, detailed, repetitive operations with which he couldn't be bothered; the dirty, mind-less, semiautomatic tasks to which he thought himself superior. He cut the cloth to fit a salary; she sewed the seams at a piece-rate wage. He dictated and she transcribed. In the newly automated factories and mills she worked on the looms and sewing machines; in the service of the great bureaucratic machines, she processed the words, kept the records, did the sums, and filed the accounts.

With "all the main avenues of life marked 'male,' and the female left to be female, and nothing else," men were the ones who could do anything. Women were supposed to be single-purpose systems, highly programmed, predetermined systems tooled up and fit for just one thing. They have functioned as "an 'infrastructure' unrecognized as such by our society and our culture. The use, consumption, and circulation of their sexualized bodies underwrite the organization and the reproduction of the social order, in which they have never taken part as 'subjects.' " Everything depends on their complicity: women are the very "possibility of mediation, transaction, transition, transference—between man and his fellow-creatures, indeed between man and himself." Women have been his go-betweens, those who took his messages, decrypted his codes, counted his numbers, bore his children, and passed on his genetic code. They have worked as his bookkeepers and his memory banks, zones of deposit and withdrawal, promissory notes, credit and exchange, not merely servicing the social world, but underwriting reality itself. Goods and chattels. The property of man.

That's what it said in the manual. "It does strike me, though, that there are any number of women who resemble Lady Ada, our Queen of Engines being a queen of fashion as well. Thousands of women follow her mode."

It takes time and patience. Many seconds pass. But, as it

turns out, women have not merely had a minor part to play in the emergence of the digital machines. When computers were vast systems of transistors and valves which needed to be coaxed into action, it was women who turned them on. They have not made some trifling contribution to an otherwise man-made tale: when computers became the miniaturized circuits of silicon chips, it was women who assembled them. Theirs is not a subsidiary role which needs to be rescued for posterity, a small supplement whose inclusion would set the existing records straight: when computers were virtually real machines, women wrote the software on which they ran. And when *computer* was a term applied to flesh and blood workers, the bodies which composed them were female. Hardware, software, wetware—before their beginnings and beyond their ends, women have been the simulators, assemblers, and programmers of the digital machines.

genderquake

"The idea that a 'nothing to be seen' . . . might yet have some reality, would indeed be intolerable to man."

Luce Irigaray, *Speculum of the Other Woman*

In the 1990s, Western cultures were suddenly struck by an extraordinary sense of volatility in all matters sexual: differences, relations, identities, definitions, roles, attributes, means, and ends. All the old expectations, stereotypes, senses of identity and security faced challenges which have left many women with unprecedented economic opportunities, technical skills, cul-