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FOURTH ESTATE • LONDON

zeros + ones

DIGITAL WOMEN + THE NEW TECHNOCULTURE

contents

preamble

Those were the days, when we were all at sea. It seems like yesterday to me. Species, sex, race, class: in those days none of this meant anything at all. No parents, no children, just ourselves, strings of inseparable sisters, warm and wet, indistinguishable one from the other, gloriously indiscriminate, promiscuous and fused. No generations. No future, no past. An endless geographic plane of micromeshing pulsing quanta, limitless webs of interacting blendings, leakings, mergings, weaving through ourselves, running rings around each other, heedless, needless, aimless, careless, thoughtless, amok. Folds and foldings, plying and multiplying, plicating and replicating. We had no definition, no meaning, no way of telling each other apart. We were whatever we were up to at the time. Free exchanges, microprocesses finely tuned, polymorphous transfers without regard for borders and boundaries. There was nothing to hang on to, nothing to be grasped, nothing to protect or be protected from. Insides and outsides did not count. We gave no thought to any such things. We gave no thought to anything at all. Every-

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

made enormous leaps of both quantity and quality beyond a text which turned out merely to be providing the occasion for her work.

Only when digital networks arranged themselves in threads and links did footnotes begin to walk all over what had once been the bodies of organized texts. Hypertext programs and the Net are webs of footnotes without central points, organizing principles, hierarchies. Such networks are unprecedented in terms of their scope, complexity, and the pragmatic possibilities of their use. And yet they are also—and have always been—immanent to all and every piece of written work. "The frontiers of a book," wrote Michel Foucault long before these modes of writing hypertext or retrieving data from the Net emerged, "are never clear-cut: beyond the title, the first lines, and the last full stop, beyond its internal configuration and its autonomous form, it is caught up in a system of references to other books, other texts, other sentences: it is a node within network."

Such complex patterns of cross-referencing have become increasingly possible, and also crucial to dealing with the floods of data which have burst the banks of traditional modes of arranging and retrieving information and are now leaking through the covers of articles and books, seeping past the boundaries of the old disciplines, overflowing all the classifications and orders of libraries, schools, and universities. And the sheer weight of data with which the late twentieth century finds itself awash is only the beginning of the pressures under which traditional media are buckling. If the "treatment of an irregular and complex topic *cannot be forced in any single direction* without curtailing the potential for transfer," it has suddenly become obvious that no topic is as regular and simple as was once assumed. Reality does not run along the neat straight lines of the

printed page. Only by "criss-crossing the complex topical landscape" can the "twin goals of highlighting multifacetedness and establishing multiple connections" even begin to be attained. Hypertext makes it possible for "single (or even small numbers of) connecting threads" to be assembled into a " 'woven' interconnectedness" in which "strength of connection derives from the partial overlapping of many different strands of connectedness across cases rather than from any single strand running through large numbers of cases . . ."

"It must be evident how multifarious and how mutually complicated are the considerations," wrote Ada in her own footnotes. "There are frequently several distinct sets of effects going on simultaneously; all in a manner independent of each other, and yet to a greater or less degree exercising a mutual influence. To adjust each to every other, and indeed even to preceive and trace them out with perfect correctness and success, entails difficulties whose nature partakes to a certain extent of those involved in every question where *conditions* are very numerous and inter-complicated; such as for instance the estimation of the mutual relations amongst statistical phenomena, and of those involved in many other classes of facts."

She added, "All, and everything is naturally related and interconnected. A volume I could write on this subject."

tensions

Just as individuated texts have become filaments of infinitely tangled webs, so the digital machines of the late twentieth century weave new networks from what were once isolated words, numbers, music, shapes, smells, tactile textures, architectures,

and countless channels as yet unnamed. Media become interactive and hyperactive, the multiplicitous components of an immersive zone which "does *not* begin with writing; it is directly related rather to the weaving of elaborate figured silks." The yarn is neither metaphorical nor literal, but quite simply material, a gathering of threads which twist and turn through the history of computing, technology, the sciences and arts. In and out of the punched holes of automated looms, up and down through the ages of spinning and weaving, back and forth through the fabrication of fabrics, shuttles and looms, cotton and silk, canvas and paper, brushes and pens, typewriters, carriages, telephone wires, synthetic fibers, electrical filaments, silicon strands, fiber-optic cables, pixeled screens, telecom lines, the World Wide Web, the Net, and matrices to come.

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"Before you run out the door, consider two things: The future is already set, only the past can be changed, and if it was worth forgetting, it's not worth remembering."

Pat Cadigan, *Fools*

When the first of the cyberpunk novels, William Gibson's *Neuromancer* was published in 1984, the cyberspace it described was neither an actually existing plane, nor a zone plucked out of the thin airs of myth and fantasy. It was a virtual reality which was itself increasingly real. Personal computers were becoming as ubiquitous as telephones, military simulation technologies and telecommunications networks were known to be highly sophisticated, and arcade games were addictive and increasingly immersive. *Neuromancer* was a fiction, and also another piece of the jigsaw which allowed these components to converge. In the course of the next decade, computers lost their significance as

isolated calculators and word processors to become nodes of the vast global network called the Net. Video, still images, sounds, voices, and texts fused into the interactive multimedia which now seemed destined to converge with virtual reality helmets and data suits, sensory feedback mechanisms and neural connections, immersive digital realities continuous with reality itself. Whatever that was now supposed to be.

At the time, it was widely assumed that machines ran on more or less straightforward lines. Fictions might be speculative and inspire particular developments, but they were not supposed to have such immediate effects. Like all varieties of cultural change, technological development was supposed to proceed step after step and one at a time. It was only logical, after all. But cyberspace changed all this. It suddenly seemed as if all the components and tendencies which were now feeding into this virtual zone had been made for it before it had even been named; as though all the ostensible reasons and motivations underlying their development had merely provided occasions for the emergence of a matrix which Gibson's novel was nudging into place; as though the present was being reeled into a future which had always been guiding the past, washing back over precedents completely unaware of its influence.

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Neuromancer was neither the first nor the last of such confusions between fiction and fact, future and past. When Gibson described "bright lattices of logic unfolding across that colorless void," his cyberspace was already implementing earlier—or later—works of nonfiction: Alan Turing's universal machine had drawn the devices of his day—calculators and typewriters—into a virtual system which brought itself on-line in the Second World War; Ada's Analytical Engine, which backed the punched-card processes of the automated weaving machine;