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CLICKING IN

HOT LINKS TO A DIGITAL CULTURE

EDITED BY

Lynn Hershman Leeson

The Future Looms

Weaving Women and Cybernetics

Sadie Plant

Ada Lovelace First Weaves Women and Cybernetics Together in the 1840s

It takes another hundred years for this association to cross its runaway threshold, and then there's no stopping them. After the war games of the 1940s, women and machines escape the simple service of man to program their own designs and organize themselves; leaking from the reciprocal isolations of home and office, they melt their networks together in the 1990s.

Cybernetics Is Always Ahead Of Itself

This convergence of woman and machine is reinforced by cyber-feminism, a perspective indebted in this text to the figures of Ada Lovelace and a few ideas from Luce Irigaray, but already running beyond anyone's work and appearing as if from elsewhere, beyond the fabrications of social security systems and patrilineal traditions with which it already collides. The matrix no longer transmits from the past: cyber-feminism is received from the future.

The computer emerges out of the history of weaving, a process often said to be the quintessence of women's work. The loom is the vanguard site of software development, and if Ada Lovelace makes an early encounter between woman and computer, the association between women and software throws back into the mythical origins of history. For Freud, weaving imitates the concealment of the womb: the Greek *hystera;* the Latin matrix. Weaving is woman's compensation for the absence of the penis, the woman of whom, as he famously insists, there is "nothing to be seen." The technique is disdained with her. Yet the development of the computer might itself be described in terms of the introduction of increasing speed, miniaturization, and complexity to the process of weaving, which threads its way to convergence in the global data webs and communication nets of the late twentieth century.

This is the virtual reality which is also the absence of the penis and its power, and already more than the void. The matrix emerges as the processes of an abstract weaving which produces, or fabricates, what man knows as "nature": his materials, the fabrics, the screens on which he projects his own identity, and behind them the abstract matter which comes from the future with cyber-feminism. The matrix makes its own appearance as the surfaces and veils on which its operations are displayed; the impossible elsewhere of cyberspace; the impossible reality of woman.

Queen of Engines

As well as his screens, and as his screens, the computer also becomes the medium of man's communication, carrying his messages like woman once again. As Charles Babbage worked on his computing machines, Ada Lovelace dispersed the codes, conveying his ideas and, as if incidentally, programming the first abstract machine. Means of communication already turning each other on.

Babbage displayed his Difference Engine to the public in 1833, and "Miss Byron, young as she was, understood its working, and saw the great beauty of the invention."[1] Ada had a passion for mathematics at an early age. She was admired and was greatly encouraged by Mary Somerville, a prominent figure in the scientific community with whom she corresponded and, in 1835, attended a series of lectures on Babbage's work at the Mechanics' Institute. Ada was fascinated by the engine and wrote many letters to Babbage imploring him to take advantage of what she considered her brilliant mind. Eventually, and quite unsolicited, she translated a paper by Menabrea on Babbage's Analytical Engine, later adding her own notes at Babbage's suggestion. Babbage was enormously impressed with the translation and, once she had made him promise 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," and not to "slur & hurry things over; or to mislay & allow confusion & mistakes to enter into documents &c,"[2] Ada began to work with him on the machine's development.

Babbage's tendency to flit between obsessions left many of his projects incomplete, but there were also more pressing technical reasons for the unfinished state in which his computing machine was abandoned for a hundred years. It is nevertheless this extraordinary time lag which inspires Bruce Sterling and William Gibson to explore an alternative story, in which Ada lives in a Victorian England already running on the software she designed. The Difference Engine uses her maiden name and takes her into a middle age she never saw: the real woman, Ada Lovelace, died in 1852 while she was still in her thirties.

> The woman brushed aside her veil, with a swift gesture of habit, and Mallory caught his first proper glimpse of her face. She was Ada Byron, the daughter of the Prime Minister. Lady Byron, the Queen of Engines.[3]

The real woman? Cyberpunk is only one confusion: Ada's letters—and indeed her scientific papers—are scattered with suspicions of her own strange relation to humanity. When one of her thwarted admirers declared: "That you are a peculiar—very peculiar—specimen of the feminine race, you are yourself aware,"[4] he could only have been confirming an opinion she already—and rather admiringly—had of herself. "I am proceeding in a track quite peculiar & my own, I believe," she wrote in 1844, and although she was always trapped and sometimes defeated by the duty to be dutiful, she was often convinced of her own immortal genius as a mathematician. Indeed, she worked with a mixture of coyness and confidence; attributes which often extended to terrible losses of self-esteem and megalomaniacal delight in her own brilliance. "That Brain of mine is something more than merely mortal; as time will show,"[5] she wrote. "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."[6]

Ada died in opiated agony in 1852, but her dreams of immortality gave her a strange and fearless intimacy with death. It was instead the constraints of life with which she had to struggle. "I mean to do what I mean to do," she declared, defying her confinement to the familiar roles of wife, mother, and victim of countless "female disorders." By the age of 24 she had three children, of whom she later wrote: "They are to me irksome duties & nothing more."[7] One admirer called her "wayward, wandering . . . deluded." To another, she confided "not only her present distaste for the company of her children but also her growing indifference to her husband, indeed to men

in general."[8] As a teenager she was being treated for hysteria (already the wayward matrix, the wandering womb, but it was not until the 1850s that the diagnosis was cancer of the womb), and when she married she was told 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."[9] But she never did. Scorning public opinion, she nevertheless gambled, took drugs, and flirted to excess. But what she did best was computer programming—the mathematics of the unfamiliar.

Ada Lovelace immediately saw the profound significance of the Analytical Engine, and she went to great lengths to convey the remarkable extent of its capacities in her writing. Although the Analytical Engine had its own limits, it was nevertheless a machine vastly different from the Difference Engine, which can "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."[10] With the Analytical Engine, however, Babbage had set out to develop a machine capable not merely of adding, but performing the "whole of arithmetic." Such an undertaking required the mechanization not merely of each mathematical operation, but the systematic bases of their functioning, and it was this imperative to transcribe the rules of the game itself which made the Analytical Engine a universal machine. Babbage was a little more modest, describing the Engine as "a machine of the most general nature,"[11] but the underlying point remains: the Analytical Engine would not merely synthesize the data provided by its operator, as the Difference Engine had done, but would incarnate what Ada Lovelace described as the very "science of operations." In her notes on Menabrea's paper, this is the point she stresses most: the Engine, she argues, is the very machinery of analysis, so that "there is no finite line of demarcation which limits the powers" or the applications of the Analytical Engine.[12]

The Difference Engine was "founded on the principle of successive orders of differences,"[13] while the "distinctive characteristic of the Analytical Engine, and that which has rendered it possible to endow mechanism with such extensive faculties as bid fair to make this engine the executive right-hand of abstract algebra, is the introduction of the principle which Jacquard devised for regulating, by means of

punched cards, the most complicated patterns in the fabrication of brocaded stuffs." Indeed, Ada considered Jacquard's cards to be the crucial difference between the Difference Engine and the Analytical Engine. "We may say most aptly," she continued, "that the Analytical Engine weaves Algebraical patterns, just as the Jacquard loom weaves flowers and leaves. Here, it seems to us, resides much more of originality than the Difference Engine can be fairly entitled to claim."[14] Ada's reference to the Jacquard loom is more than a metaphor: the Analytical Engine did indeed weave "just as" the loom, operating, in a sense, as the abstracted process of weaving.

BITS OF FLUFF

Weaving has always been a vanguard of machinic development, perhaps because even in its most basic form, the process is one of complexity, always involving the weaving together of several threads into an integrated cloth. It is no coincidence that those Egyptian divinities associated with weaving are also the spirits of intelligence, since "all data recorded in the brain results from the intercrossing of sensations perceived by means of our sense organs, just as the threads are crossed in weaving."[15] Even in the China of 1000 B.C., complex designs "required that about 1,500 different warp threads be lifted in various combinations as the weaving proceeded."[16] With pedals and shuttles, the loom becomes what one historian refers to as the "most complex human engine of them all," a machine which "reduced everything to simple actions: the alternate movement of the feet worked the pedals, raising half the threads of the warp and then the other, while the hands threw the shuttle carrying the thread of the woof."[17] The weaver was integrated into the machinery, bound up with its operations and linked limb-by-limb to the processes. In the Middle Ages, and before the artificial memories of the printed page, squared paper charts were used to store the information necessary to the accurate development of the design, and the punched paper rolls and cards of the eighteenth-century French weavers developed the principles on which Jacquard based his own designs for the automated loom which revolutionized the nineteenth-century textiles industry and continues to guide its contemporary development. Jacquard's machine strung the punch cards together, finally automating the operations of the machine and requiring only a single human hand

It was of course "bitterly opposed by workers who saw in this migration of control a piece of their bodies literally being transferred to the machine."[18] But this was already the second phase of a migration out to man- and machine-made fabrics. The introduction of manufactured cloth disrupted the marital and familiar relationships of every traditional society on which it impacted. Now "the man had to leave home to make money to buy cloth for his wife" who, moreover, "had ceased to fit the traditional picture of a wife."[19] In China it was said that if "the old loom must be discarded, then 100 other things must be discarded with it, for there are somehow no adequate substitutes."[20]

Weaving is always already entangled with the question of female identity, and all stages of its mechanization bring inevitable disruption to the familiar preindustrial scenes in which woman appears as the weaver. Certainly Freud finds a close association. "It seems," he writes, "that women have made few contributions to the discoveries and inventions in the history of civilization; there is, however, one technique which they may have invented—that of plaiting and weaving." Not content with this observation, Freud is of course characteristically "tempted to guess the unconscious motive for the achievement. Nature herself," he suggests, "would seem to have given the model which this achievement imitates by causing the growth at maturity of the pubic hair that conceals the genitals. The step that remained to be taken lay in making the threads adhere to one another, while on the body they stick into the skin and are only matted together."

This passage comes out of the blue in Freud's lecture on femininity. He even seems surprised at the thought himself: "If you reject this idea as fantastic," he adds, "and regard my belief in the influence of a lack of a penis on the configuration of femininity as an *idée fixe*, I am of course defenseless."[21] He is indeed defenseless, not least because his suggestion that weaving is women's only contribution to "the discoveries and inventions in the history of civilization" gives an incredible power to the feminine he imagines himself to be dismissing once again. For weaving is the fabric of every other discovery and invention, not the least those of Freudian analysis itself. The dream work of condensation is a process of "interweaving," as Freud explains in his analysis of the "Dream of the Botanical Monograph," a dream sufficiently complex to serve as an illustration of the intricate overdetermination in which this weaving results. "Here," he writes, "we find ourselves in a factory of thoughts" where, as in Goethe's "Weaver's Masterpiece," "one treadle stirs a thousand threads" and "over and under shoots the shuttle."[22] Yes, what a contribution to have made! Weaving has been the art and the science of software, which is perhaps less a contribution to Freud's civilization than its virtual termination. Hidden in history as the fabric of his world, weaving threads its way from squared paper to the data nets of artificial memory and machine intelligence.

Babbage owned what Ada described as "a beautiful woven portrait of Jacquard, in the fabrication of which 24,000 cards were required."[23] Woven in silk at about 1,000 threads to the inch, its incredible detail was due to the new loom's ability to store and process information at unprecedented speed and volume. When he began work on the Analytical Engine, it was Jacquard's strings of punch cards on which Babbage based his designs, introducing the possibility of repeating the cards, or what, as Ada wrote, "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."[24] This was an unprecedented simulation of memory. The cards were selected by the machine as it needed them and effectively functioned as a filing system, allowing the machine to store and draw on its own information.

The Jacquard cards made memory a possibility, so that the Analytical Engine could "possess a library of its own,"[25] but Babbage had become convinced that "nothing but teaching the Engine to foresee and then to act upon that foresight could ever lead me to the object I desired,"[26] and this had to be a library to which the machine could refer both as to its past and its future operations. The punch cards endowed the Analytical Engine with the ability to process information from the future of its own functioning, and Babbage "had devised mechanical means equivalent to memory," as well as "other means equivalent to foresight, and that the Engine itself could act on this foresight."[27]

There is more than one sense in which foresight can be ascribed to the Analytical Engine. When the imperatives of war brought Lovelace's and Babbage's work to the attentions of the Allied military

machine, their impact was immense. Her software runs on his hardware to this day. In 1944, Howard Aiken developed Mark 1, what he thought was the first programmable computer, although he had really been beaten by a German civil engineer, Konrad Zuse, who had in fact built such a machine, the Z-3, in 1941. Quite remarkably, in retrospect, the Germans saw little importance in his work, and although the most advanced of his designs, the Z-11, is still in use to this day, the American computer had the greatest impact. Mark 1, or the IBM Automatic Sequence Controlled Calculator, was based on Babbage's designs and itself programmed by another woman, Captain Grace Murray Hopper, often described as the "Ada Lovelace" of Mark 1 and its successors. She wrote the first high-level language compiler, was instrumental in the development of the computer language COBOL, and even introduced the term "bug" to describe soft- or hardware glitches after she found a dead moth interrupting the smooth circuits of Mark 1. Woman as the programmer again.

Runaway Circuits

Cybernetics, the term coined by Norbert Wiener for the study of control and communication in animal and machine, was integral to these wartime computers. Governors and thermostats are basic examples of cybernetic devices which, unlike the linear operations of less complex machines, respond to their environments by looping their own information back on themselves. Postwar cybernetics was the science of this abstract procedure, a nonlinear approach to systems of every scale and variety of hard- and software which nevertheless perpetuated the modernist myth of human control and wanted only the negative feedback of controlled equilibrium. At the end of the century, cyber-feminism's man is inside, not in charge of, circuits which are not so well-behaved; runaway mutations which guide his history to its own termination. Matrix cybernetics runs with the positive feedback of the new world disorder.

The computer is always heading toward the abstract machinery of its own operations and running beyond its intended constraints. Emerging from attempts to produce or reproduce the performance of specific functions, such as addition, it leads to a machinery which can simulate the operations of any machine and also itself; abstract machines which can turn their abstract hands to anything. The Analytical Engine was not yet this advanced; as Ada Lovelace recognized, it had "no pretensions whatever to originate anything. It can do whatever we know how to order it to perform."[28] It was an abstract machine, but its autonomous abilities were confined to its processing capacities: what Babbage, with terminology from the textiles industry, calls the mill, as opposed to the store. Control is dispersed and enters the machinery, but it does not extend to the operations of the entire machine.

Not until the Turing machine is there a further shift onto the software plane so that the mill and the store begin to work together, and "programs that change themselves could be written."[29] An unprecedented dispersal of control, the Turing machine still brings control back to its master program, and it is only really after the introduction of silicon in the 1960s that the decentralized flow of control becomes an issue, eventually allowing for systems in which "control is always captured by whatever production happens to have its conditions satisfied by the current workspace contents."[30] The abstract machine begins at this point to function as a network of "independent software objects," running on horizontal lines of communication without the necessity of dominant points of reference.

This is the strange world to which Ada's programming has led: self-organizing systems, self-arousing machines; systems of control and synthetic intelligence exceeding the commands of some central authority; an unfamiliar agency which has no need of a central will and has already bypassed a subject position.

Past Caring

Human history is the self-narrating story of the drive to resist precisely this move. It pulls itself up from carnal passions to self-control in a journey from the strange fluidities of the material to the self-identification of the soul. Stealth bombers and guided missiles, telecommunications systems and orbiting satellites epitomize this flight. Matter, the womb, is merely an encumbrance; either too inert or dangerously active; woman has never been the subject, the agent of this history, the autonomous being. Not that she is left behind; carefully concealed, she nevertheless continues to function as the ground and possibility of his quests for identity, agency, and self-

control. She wears "different veils according to the historic period."[31] Woman has been the natural resource for man's own cultural development. She has provided a mirror for man, his servants and accommodation, his tools and his means of communication, his spectacles and commodities, the possibility of the reproduction of his species and his world. If the repression of the matrix, the veiling of the womb, is integral to this flight, the cybernetic systems which bring the matrix into human history are equally the consequences of a drive for domination and autonomy. Still confident of his own indisputable mastery, man continues to excite and turn these systems on. In so doing he merely encourages his own destruction. Every software development is a migration of control away from man, in whom it has been exercised only as domination, and into the matrix, or cyberspace, "the broad electronic net in which virtual realities are spun."[32]

The matrix weaves itself in a future which has no place for historical man: his agency was always a figment of its loop. Like woman, software systems are used as man's tools, his media, and his weapons; all are developed in the interests of man, but all are poised to betray him. At the peak of his triumph, the culmination of his machinic erections, man confronts his systems of social security and finds them female and dangerous.

This will indeed seem a strange twist to history to those who believe that it runs in straight lines. But as Irigaray asks: "If machines, even machines of theory, can be aroused all by themselves, may woman not do likewise?"[33]

The computer is a machine which can simulate its own operations and those of any other machine; like woman, it is both the appearance and the possibility of simulation. "Truth and appearance, according to his will of the moment, his appetite of the instant." Woman cannot be anything, but she can imitate anything valued by man: intelligence, autonomy, beauty . . . perhaps the very possibility of mimesis, the one who weaves her own disguises. The veil is her oppression, but "she may still draw from it what she needs to mark the folds, seams, and dressmaking of her garments and dissimulations."[34] These mimetic abilities throw woman into a universality unknown and unknowable to the one who knows who he is: she fits any bill, but in so doing, she is already more than that which she imitates. Woman, like the computer, appears at different times as whatever man requires of her. She learns how to imitate; she learns simulation. And, like the computer, she becomes very good at it, so good, in fact, that she too, in principle, can mimic any function. As Irigaray suggests: "Truth and appearances, and reality, power . . . she is—through her inexhaustible aptitude for mimicry—the living foundation for the whole staging of the world."[35]

But if this is supposed to be her only role, she is no longer its only performer. Now that the digital comes on stream, the computer is cast in precisely the same light: it too is merely the imitation of nature, providing assistance and additional capacity for man, and more of the things in his world, but it too can do this only insofar as it is already hooked up to the very machinery of simulation. If Freud's speculations about the origins of weaving lead him to a language of compensation and flaw, its technical development results in a proliferation of pixelled screens which compensate for nothing, and, behind them, the emergence of digital spaces and global networks which are even now weaving themselves together with flawless precision.

Software, in other words, has its screens as well: it too has a user-friendly face it turns to man, and for it, as for woman, this is only its camouflage.

The screen is the face it began to present in the late 1960s, when the TV screen was incorporated in its design. It appears as the spectacle, the visual display of that which can be seen, and also functions as the interface, the messenger; like Irigaray's woman, it is both displayed for man and becomes the possibility of his communication. It too operates as the typewriter, the calculator, the decoder, displaying itself on the screen as an instrument in the service of man. These, however, are merely imitations of some existing function; and indeed, it is always as machinery for the reproduction of the same that both women and information technology first sell themselves. Even in 1968, McLuhan argued that "the dense information environment created by the computer is at present still concealed from it by a complex screen or mosaic quilt of antiquated activities that are now advertised as the new field for the computer."[36] While this is all that appears before man, those who travel in the information flows are moving far beyond the screens and into data streams beyond his conceptions of reality. On this other side run all the fluid energies denied

by the patrilineal demand for the reproduction of the same. Even when the computer appears in this guise and simulates this function, it is always the site of replication, an engine for making difference. The same is merely one of the things it can be.

"They go beyond all simulation," writes Irigaray of women.[37] Perhaps it was always the crack, the slit, which marked them out, but what they have missed is not the identity of the masculine but their own connection to the virtual, the repressed dynamic of matter. Misogyny and technophobia are equally displays of man's fear of the matrix, the virtual machinery which subtends his world and lies on the other side of every patriarchal culture's veils. At the end of the twentieth century, women are no longer the only reminder of this other side. Nor are they containable as child-bearers, fit for only one thing. No longer the adding machines, they are past caring; with the computer, as abstract machine, there is nothing they cannot do.

The computer was always a simulation of weaving; threads of ones and zeros riding the carpets and simulating silk screens in the perpetual motions of cyberspace. It too presents the screens, the clothing of the matrix, already displaying the virtual machinery of which nature and culture are the subprograms, and joins women on and as the interface between man and matter, identity and difference, the actual and the virtual. Cybernetic systems are fatal to his culture; they invade as a return of the repressed, but what returns is no longer the same: cybernetics transforms woman and nature, but they do not return from man's past, as his origins. Instead they come wheeling around from his future, the virtual system to which he has always been heading. For the last 50 years, as his war machine has begun to gain intelligence in readiness for his last stand, women and computers have unleashed a proliferation of screens, intelligences, lines of communication, media, and simulations with which to hack it down. No longer the void, the gap, or the absence, the veils are already cybernetic; an interface taking off into its own unmanned futures.

Ada refused to publish her commentaries on Menabrea's papers for what appear to have been spurious confusions around publishing contracts. In translating Menabrea's work from French, she nevertheless provided footnotes more detailed and substantial—three times as long, in fact—than the text itself and became the world's first computer programmer.

Footnotes have often been the marginal zones occupied by

women writers. Translation, transcription, and elaboration: outside the body of the text, women have nevertheless woven their influence between the lines. While Ada's writing was presented in this form and signed simply "A.A.L.," hers was the name which survived her death: in recognition of her work, the United States Defense Department named its primary programming language ADA, and today her name shouts from the spines of a thousand manuals. Neither her married nor her maiden name: it is Ada herself who lives on, in her own name, her footnotes secreted in the software of the military machine.