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JOSEPH CONTE
"The Virtual Reader:
Cybernetics and Technocracy
in William Gibson and Bruce Sterling's
The Difference Engine"

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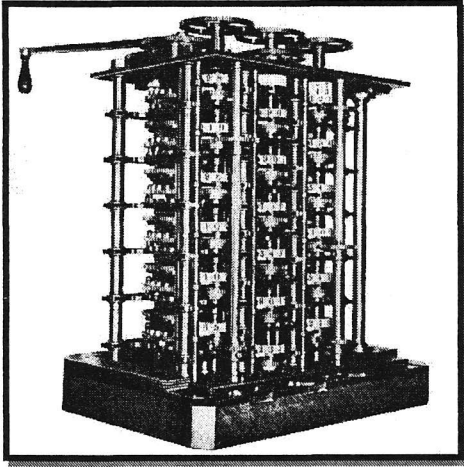
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JOSEPH CONTE

**The Virtual Reader: Cybernetics and Technocracy
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*The Difference Engine***

The promise of a reader actively engaged in the construction of the text has been held out by the practitioners and theoreticians of cybernetic fictions, especially with respect to the development of electronic media. Michael Joyce, author of the original hypertext fiction *afternoon, a story* (1987),¹ posits the interactivity of such work because in “attempting to accommodate our thinking in response to the demands of an application’s control and data structures, true interactivity” exists.² That the reader of



Difference Engine No. 1, Portion, 1832

print fiction has had to learn to negotiate the information delivery platform that is the book can be taken for granted, but the very motility of interactive fictions and the mutability of their data structures presumably requires even greater engagement on the part of the reader. George P. Landow, invoking the poststructuralist theory of Barthes, Derrida, and

Foucault, also proposes that the “multiplicity of hypertext, which appears in multiple links to individual blocks of text, calls

¹ (Watertown, MA: Eastgate Systems, 1987).

² Michael Joyce, *Of Two Minds: Hypertext Pedagogy and Poetics* (Ann Arbor: U of Michigan P, 1995), p. 135.

for an active reader.”³ These representative statements on the reader in cybernetic fictions (and others by Stuart Moulthrop, Espen Aarseth, and Ilana Snyder) all refer to the presence of an Actual Reader.⁴ Such a reader-in-the-world is thought to be empowered by the toggle switching, hyperlink clicking, and page turning that he or she is called upon to perform. But I suspect that this liberatory, millennialist rhetoric of the active reader has been oversold. Cybernetic fictions are not so much concerned with the enabling of an actual reader who thumbs pages or navigates interfaces than with deriving a concept of their most apt reader from the disciplines of cybernetics and communications theory. That reader, always a *lector in fabula*, is a Virtual Reader subject to the determinations and control of the text. The reader as avatar, not so much manipulating the text as manipulated by it, not so much actively engaged in the making of the text as entangled within the feedback loop of its production, represents a darker vision, to be sure, of cybertextuality. But that vision, I would argue, is more in keeping with the technological dystopia that is depicted in my exemplary fiction, William Gibson and Bruce Sterling’s *The Difference Engine* (1991), and in so many other works of the genre.

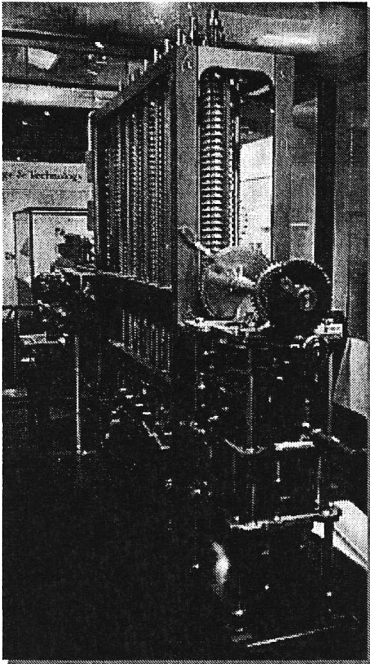
1: Alternate Worlds

William Gibson and Bruce Sterling’s *The Difference Engine* (1991) is a work of alternative history that speculates on how the course of political economy and culture in Victorian England – and indeed the world in 1855 – would have been changed had the English mathematician Charles Babbage (1792-1871) succeeded in demonstrating a calculating machine, the Difference

³ George P. Landow, *Hypertext 2.0: The Convergence of Contemporary Critical Theory and Technology* (Baltimore and London: Johns Hopkins UP, 1997), p. 6.

⁴ See, for example, Ilana Snyder’s “Reconceiving Reading and Writing” in *Hypertext: The Electronic Labyrinth* (Melbourne, Australia: Melbourne UP, 1996), pp. 68-74.

Engine, which he had proposed to the Royal Society in 1822.⁵ Had not the Astronomer Royal, Sir George Airy, convinced the British government to withdraw funding for Babbage's partially



Difference Engine No. 2, 1991,
Science Museum

assembled computing machinery in 1842, it's possible that the mechanical production of the Industrial Revolution powered by James Watt's steam engine (1769) might have been conjoined with the information processing of the Computer Age.⁶ Babbage sought to remedy the introduction of errors that occurred when the tables of trigonometric functions, logarithmic series, and planetary orbits that were needed by mathematicians and navigators were calculated and reproduced manually. The steam power that drove the shafts and gears of locomotives and textile manufacturing, he reasoned, could be employed to crank out sums more accurately.⁷

⁵ William Gibson and Bruce Sterling, *The Difference Engine* (New York: Bantam, 1991).

⁶ For a discussion of whether Babbage's failure to demonstrate the functionality of the Difference Engine No. 1 after nearly twenty years of work was due to the inadequacy of Victorian engineering, or whether the economics of mechanical computing made a nineteenth-century computer revolution impractical, see Tom Standage, "The Little Engine that Couldn't," *Feed Magazine*, 15 January 1999 <http://www.feedmag.com/essay/es160_master.html?alert>.

⁷ In *The Human Use of Human Beings: Cybernetics and Society* (New York: Da Capo Press, 1988), p. 149, Norbert Wiener expresses doubt that Babbage, even properly funded, could have completed his Difference Engine: "Babbage had a surprisingly modern idea for a computing machine, but his mechanical means fell far behind his ambitions. The first difficulty he met, and with which he could not cope, was that a

A second ambitious design for a calculating machine, which Babbage called the Analytical Engine, is more clearly the precursor of the modern computer. It consists of a “store” (memory), the “mill” (central processing unit, or CPU), and a punched card reader (input device). A part of the Analytical Engine, for which Babbage never received funding to build, was successfully built and demonstrated by the Science Museum in London in 1991, one hundred and twenty years after Babbage’s death.

Readers of *The Difference Engine* who are familiar with the “cyberpunk” genre in which Gibson and Sterling have fashioned their separate reputations might feel as if they had been cast into a time warp. Works such as Gibson’s *Neuromancer* (1984) and Sterling’s *Schismatrix* (1986) project the imminent technology of the present into a near future world. The readers of cyberpunk fiction are encouraged to recognize the “insertion curve” of new technology in their present lives as they ponder the dystopia fashioned by the mature form of that technology in the novel. For example, the increasingly familiar use of encrypted bank cards – “plastic money” – to make everyday purchases is extrapolated into an exclusively electronic monetary system in *Neuromancer*, such that paper money can only be exchanged for black market goods while all legitimate purchases are monitored and recorded by the authorities. Gibson remarks in an interview with Larry McCaffery, “When I write about technology, I write about how it has *already* affected our lives.”⁸ The reader of cyberpunk experiences a sort of technological prolepsis in which

long train of gears requires considerable power to run it, so that its output of power and torque very soon becomes too small to actuate the remaining parts of the apparatus.”

⁸ Gibson, “An Interview with William Gibson,” with Larry McCaffery, in Larry McCaffery, ed., *Across the Wounded Galaxies: Interviews with Contemporary American Science Fiction Writers* (Urbana and Chicago: U of Illinois P, 1990), pp. 130-150; here p. 140.

the revolutionary developments of the future are thought to have already occurred. *The Difference Engine* presents the reader with the conceptual reverse of that process, a technological analepsis, in which a development of the future – the introduction of the mainframe computer (ENIAC appeared in 1946) – is thought to have occurred in the past. Cyberpunk fiction asks the proleptic question, What if the privacy concerns for electronic data transfer were not only ignored but unabashedly compromised by multinational corporations and government ministry? The “steampunk” novel asks the analeptic question, What if the calculating power of the computer were introduced to nineteenth-century gunnery; would it have changed the outcome of the American Civil War? In this regard *The Difference Engine* fulfills Jean-François Lyotard’s definition of the postmodern, as the “paradox of the future (*post*) anterior (*modo*).”⁹ We go back to the future, to the nascent state of computing and information technology, to recognize there the full conceptualization, *in utero* as it were, of our present technocracy.

The Difference Engine may also be treated as historiographic metafiction.¹⁰ Prominent historical figures such as Charles Babbage, Augusta Ada Byron Lovelace (1815-1852), the British journalist and diplomat Laurence Oliphant (1829-1888), George Gordon, Lord Byron (1788-1824), John Keats (1795-1821), and biologist Thomas Henry Huxley (1825-1895) intermingle with a host of fictive characters, some of whom are drawn from a novel of the period by one-time Prime Minister Benjamin Disraeli

⁹ Jean-François Lyotard, *The Postmodern Condition: A Report on Knowledge*, transl. by Geoff Bennington and Brian Massumi (Minneapolis: U of Minnesota P, 1984), p. 81.

¹⁰ Linda Hutcheon introduces this genre in *A Poetics of Postmodernism: History, Theory, Fiction* (New York and London: Routledge, 1988), pp. 105-23.

(1804-1881), *Sybil* (1845).¹¹ Linda Hutcheon concisely states the relationship thus: "Historiographic metafiction shows fiction to be historically conditioned and history to be discursively structured."¹² The textuality of history and fiction is a function of bi-directional communication, an open channel in either direction between historical fact and narrative structure. Historical novels conventionally respect the constraints placed upon them by historical facts; these fictions may saturate the historical figures with a sensibility not otherwise recorded for posterity, while heeding the *curriculum vitae* that history has outlined for the characters. Such is not the case in *The Difference Engine* as an alternative history. The introduction of Babbage's computing machinery represents a *clinamen*, or swerve, in the course of history; an alternate world forms that affects the path of every life, however remotely. Keats, though he appears still to suffer from consumption, has survived to the mature age of sixty in the novel. He has abandoned poesy for kinotropy, disdaining print for the programming of moving pictures. He speaks with enthusiasm not of eternal Beauty but, analeptically, of the "screen's resolution" and "refresh-rate," and of the remarkable effects secured "through algorithmic compression."¹³ Lord Byron, who succumbs to fever in 1824 while an expatriate in disgrace in Greece, becomes the oratorical leader – if not the intellectual force – of the Industrial Radical party and has risen to Prime Minister in *The Difference Engine*. Byron leads a revolt against Wellington's Tories and later suppresses the "proletarian Luddites" (309), underwriting the theme of class warfare in the novel. History records that George Gordon, Lord Byron espoused various liberal political causes in the House of Lords,

¹¹ For a variety of historical details I am indebted to Eileen K. Gunn's *The Difference Dictionary*, 1996 <<http://www.sff.net/people/gunn/dd/a.htm>>, a very useful annotation of the novel.

¹² Hutcheon, p. 120.

¹³ Gibson and Sterling, *Difference Engine*, p. 47.

and *contra* his actions in the novel, penned a "Song for the Ludites" in support of the weavers oppressed by the lords of industry. As an alternative history, then, *The Difference Engine* intends a reader who is at least moderately well acquainted with the lives of the Romantic poets and with the history of the Industrial Revolution in England such that an ironical pleasure is derived in the comparison between "what *has* happened" in the Victorian period and "what *might have* happened" had the plug not been pulled on Babbage's government-sponsored research. The authors expect that a bi-directional channel between fiction and history remain operative, and in fact the novel relies on that interrelation for its effective consumption. At the same time, the novel is a metafiction that relies on an awareness of intertextuality, in so doing continually calling attention to its status as writing. If the reader intended by the text is not permitted ignorance of the Victorian period, neither is he or she allowed an absorptive fantasy in otherworldliness. As Herbert Sussman explains, the "narrative and techno-political transformations" of the alternative history of *The Difference Engine* "are achieved through a radical rewriting of [Disraeli's] *Sybil*."¹⁴ The crucial marriage between Sybil and Charles Egremont that represents for Victorians "the dream of mediating the oppositions of industry/culture and industry/pastoral by bringing the factory under the control of a beneficent landed aristocracy"¹⁵ does not take place in Gibson and Sterling's novel. The ideological implications of "refashioning Victorian narratives of technoculture" and class conflict are manifest, in Sussman's thorough analysis.¹⁶ As historiographic metafiction, the novel intends a reader who must also negotiate between the various textual sources alluded to in the novel, including Byron's poetry, Dis-

¹⁴ Herbert Sussman, "Cyberpunk Meets Charles Babbage: *The Difference Engine* as Alternative Victorian History," *Victorian Studies* 38 (1994), 1-23; here p. 7.

¹⁵ Sussman, p. 8.

¹⁶ Sussman, pp. 8-10.

raeli's novel, Babbage's *Passages from the Life of a Philosopher* (1864), and of course, Ada Byron's published Notes on the Difference Engine. Let me state explicitly that I am not referring to an actual reader – would that we could find such equally knowledgeable in Victorian history and literature, cyberpunk fiction, and the history of the computer and computing languages in our classroom – but to an authorial reader, the *lector* intended by and in the text. Such a reader in *The Difference Engine* must negotiate the bi-directional channel between historiography and intertextuality that is constantly at play in this text.

2: Lady Lovelace's Objection

Augusta Ada Lovelace (1815-1852) was the only legitimate daughter of Byron, the product of his short-lived marriage to mathematician Annabella Milbanke. Rumors of an incestuous affair with his half sister, Augusta Leigh, drove Byron into exile in April 1816, and he was never to meet his daughter again, though he would memorialize her in Canto III of *Childe Harold's Pilgrimage* as “The child of Love! though born in bitterness, / And nurtured in Convulsion! Of thy sire / These were the elements, – and thine no less.”¹⁷ Determined not to allow her daughter to fall under the



Ada Byron Lovelace, 1838

captivating sway of Byron's romanticism, Milbanke saw to it that Ada was rigorously tutored in mathematics by Mary Somerville and Augustus De Morgan. That Ada, as a woman and juvenile, would have received such an intensive education

¹⁷ For references to Ada in Byron's poetry, see Appendix 1 in Joan Baum, *The Calculating Passion of Ada Byron* (Hamden, CT: Archon Books, 1986).

in mathematics in early nineteenth-century England was exceptional.¹⁸ At the age of seventeen, Ada Byron would meet Charles Babbage at a party and be introduced by him to the partially completed Difference Engine. Nearly as profligate as her father, Ada would enjoy her first affair of the mind. Following a presentation by Babbage on the Analytical Engine to a group of mathematicians and engineers in Turin, Italy in 1840, Luigi Federico Menabrea endeavored to write an essay, "Sketch of the Analytical Engine," in French, describing the mathematical theses implied by Babbage's calculating machines.¹⁹ It was this essay that Ada took it upon herself to translate into English and append seven Notes, lettered A through G, which combined are more than twice the length of the original essay.

Ada Byron concluded her Notes with a program for computing Bernoulli numbers that are found in the polynomial expansion of some trigonometric functions that were once employed for constructing navigational tables.²⁰ On the basis of this "Diagram for the computation by the Engine of the Numbers of Bernoulli," demonstrating that Babbage's Analytical Engine was capable of conditional branching and multiple loops (or iterations),²¹ Ada has been bestowed with the title of the First Programmer of computers. In fact, Microsoft Corporation embosses its software with a Certificate of Authenticity containing a watermark portrait that identifies Ada Byron as a "Pioneer in Computer Programming," and the Department of Defense named its proprietary programming language Ada in 1980.²² There has

¹⁸ I am indebted for this assessment of Ada's education to Eugene Eric Kim and Betty Alexandra Toole, "Ada and the First Computer," *Scientific American* (May 1999), 76-81.

¹⁹ Kim and Toole, pp. 78-79.

²⁰ Kim and Toole, p. 78.

²¹ Kim and Toole, p. 80.

²² Lev Grossman, "What Ada Knew: Was Lord Byron's Daughter the First Computer Programmer?," *Lingua Franca* (October 1998), 63-69; here p. 63.

been some debate among scholars and biographers of Ada Byron regarding the sophistication of her knowledge of mathematics, but even her detractors concede that, if Babbage's design for the Analytical Engine was a predecessor of the modern computer, Ada's Notes constitute the first program for a computing machine.²³

In Gibson and Sterling's *The Difference Engine*, Ada Byron, now the daughter of the Prime Minister, is indisputably the "Queen of Engines."²⁴ She is the first and most accomplished programmer of the Analytical Engine and the author of a Modus, which is either a program intended to beat the odds of parimutuel wagering at the London racetrack, destroying "the institutions of the Turf"²⁵ (Ada Lovelace did in fact lose spectacular sums gambling late in life; and card-counting programs have long been banned from Las Vegas casinos), or it is a program of such complexity that its "series of nested loops"²⁶ send the most sophisticated computer of the day, the Grand Napoleon Ordinateur, cascading to blue-screen failure. As mechanic and inventor, Charles Babbage is but a minor character in the novel. Mysterious and introspective – and possibly addicted to laudanum – it is Ada who turns at the intellectual center of the world of *The Difference Engine*. In their alternative history, Gibson and Sterling fashion an Ada who is liberated from the Victorian conventions of family and society that, as Ada Lovelace complained in her letters, impeded her intellectual aspirations. Ada Byron is unmarried (her biographical counterpart marries Wil-

²³ In "What Ada Knew," Grossman provides an engaging narrative of the debate over Ada Byron's importance to the history of computing, her facility in mathematics of the time, and her designation as the first programmer. Dorothy Stein's biography, *Ada: A Life and a Legacy* (Cambridge, MA: MIT Press, 1985) precipitated the challenge to Ada's reputation; Baum's *The Calculating Passion of Ada Byron* (Hamden, CT: Archon Books, 1986) represents a rejoinder to that criticism.

²⁴ Gibson and Sterling, *Difference Engine*, p. 95.

²⁵ Gibson and Sterling, *Difference Engine*, p. 189.

²⁶ Gibson and Sterling, *Difference Engine*, p. 421.

liam King, earl of Lovelace, has three children whom she treated with indifference, and dies from cervical cancer at 36, the same age as her father at his death). She is a scientist who gives speeches on her art to the Royal Society (whose premises in Victorian England women were not allowed to enter). Although they otherwise alter the biographies of many of the historical characters in *The Difference Engine*, Gibson and Sterling appear to have optimized Ada Byron's potential as a theorist of computing machinery, making her the catalyst of the second Industrial Revolution. Confirming his enthusiasm for Ada Byron's genius, Bruce Sterling appears "as himself" via a computer up-link in Lynn Hershman Leeson's film, *Conceiving Ada* (1997).

Although the alternative history of *The Difference Engine* has embellished Ada Byron's intellectual achievements, Gibson and Sterling draw directly from Ada's limited scholarly publications, the Notes to Menabrea's essay, in their characterization. When she encounters Edward Mallory, a paleontologist and exponent of the theory of Catastrophism, at the London track (not for horses, but "line-streamed" horseless carriages), she mutters in a narcotized haze portions of her speech to the Royal Society. Her statement is taken nearly verbatim from Note A: "Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent."²⁷ As amusing as this synthesized, "switched-on Bach" might sound, the proposition represents both a theme of the Notes and of the novel. Ada Byron understands the Analytical Engine as far more than a mechanical calculator, capable of symbolic processing powers. Resolving the intractable conflict between her disciplinarian and mathematician mother and her iconoclastic and romantic poet father, Ada

²⁷ Quoted in Kim and Toole, p. 80; cf. *Difference Engine*, p. 93.

speculates that the Analytical Engine could enable the higher functions of consciousness and even offer access to the fundamental music of the spheres. In her letters she was given to further fantasizing on the powers of computation, "I have my hopes, & very distinct ones too, of one day getting *cerebral* phenomena such that I can put them into mathematical equations; in short a *law*, or *laws*, for the mutual actions of the molecules of the brain."²⁸ Of this synthesis of mathematics and cognition, however, note that Ada does not imagine the computing machinery thinking for her, but that the cognitive functions of the brain might be expressed in mathematical terms.

Nor did Ada Lovelace require the assistance of novelists to embellish her intellectual talents. Before Gibson and Sterling, none other than Benjamin Disraeli published the semi-biographical novel *Venetia* (1837), when she was only twenty-one, about a precocious young girl who resides in England with her controlling mother, Lady Annabel, but who has become obsessed with her subversive and impetuous father, the poet Carducis, in Italy. Ada's attraction to and competition with Byron are frankly stated in her letters: "I do *not* believe that my father was (or ever could have been) such a *Poet* as *I shall* be an *Analyt.*"²⁹ Looking beyond the filial rivalry, it's apparent that Ada envisioned a role for the programmer-Analyst that is equally as creative as that of the author-Poet.

Although it's apparent that Gibson and Sterling are familiar with Ada Lovelace's Notes on the Analytical Engine, they do not incorporate into the text of *The Difference Engine* one of the most widely quoted passages, from Note G. As a prelude to demonstrating her work on the Bernoulli numbers, Ada warns the reader "against the possibility of exaggerated ideas that

²⁸ Quoted in Grossman, p. 66.

²⁹ Quoted in Grossman, p. 63.

might arise as to the power of the Analytical engine.”³⁰ She counsels restraint with regard to speculation on the capabilities of the calculating machine. Her analysis, called “Lady Lovelace’s Objection” by Alan Turing in his landmark paper on artificial intelligence in 1950, is as follows:

The Analytical Engine has no pretensions whatever to *originate* anything. It can do whatever we *know how to order it* to perform. It can *follow* analysis; but it has no power of *anticipating* any analytical relations or truths. Its province is to assist us in making *available* what we are already acquainted with. (her italics)³¹

Ada wishes to dispel the notion that the Analytical Engine is “thinking” in ways that the human mind thinks. She reserves to the programmer the capacity to create new operations or truths. The computing machine is only capable of following instructions, and then only when the instructions have been properly programmed. Disorderly input yields disorderly output. There may be syntactic errors in the analysis, or program, that lead to unanticipated – and probably useless – results; but the programmer will never be surprised by operations originated by the computer. She being the first programmer – and as Byron’s daughter somewhat immodest about her creative powers – Ada’s not eager to concede intelligence to the machine from the domain of the programmer. Her objection, however, that computing machinery does not originate but follow analysis, rather presciently sets the standard for whether a computer passes Turing’s Test: it would have to *originate* something. Ada regards computing as a measure of the Analyst’s knowledge and creative ability. The Analytical Engine only processes, or makes available to us in some efficient manner, that which we already know. It is only when the programmer ventures to originate an operation, extending the capability of the Engine, that new ana-

³⁰ Quoted in Baum, p. 81.

³¹ Quoted in Baum, p. 82.

lytical results might arise. The Engine is not an artificial intelligence; it takes measure of the programmer's genius.

The characterization of Ada Byron in *The Difference Engine* is less radically altered than that of other historical figures from nineteenth-century England. Gibson and Sterling mean to examine the premises of Ada's Notes at the analeptic inception of the Computer Age. After all, it is Ada Lovelace who first speculates on the nature of computing, the role of the programmer, and the potential of what she confidently regards as a new realm of intellectual endeavor. In Note A, Ada acknowledges Babbage's adoption of the punched cards that Joseph Marie Jacquard (1752-1834) employed to set the patterns of the weaving loom: "The distinctive characteristic of the Analytical Engine ... is the introduction into it of the principle which Jacquard devised for regulating, by means of punched cards, the most complicated patterns in the fabrication of brocaded stuffs." Such punched cards remained the principal means of input in main-frame computers until the advent of magnetic tape and magnetic disks in the mid twentieth century. Ada's characteristic effusion, however, attends not to how the machine functions but what it might be capable of: "We say most aptly that the Analytical Engine *weaves algebraical patterns* just as the Jacquard-loom weaves flowers and leaves" (her italics).³² Ada evidently regards her Analysis as a mode of artistry; what the programmer weaves in higher mathematics is equivalent to figures created in the other arts. In *The Difference Engine*, Ada Byron is credited with the introduction of a textile pattern, "a dizzy mosaic of tiny blue-and-white squares. Ada Checkers, the tailors called them, the Lady having created the pattern by programming a Jacquard loom to weave pure algebra."³³ In his cameo appearance in Lynn Hershman Leeson's film *Conceiving Ada*, Sterling remarks that

³² Quoted in Kim and Toole, p. 80.

³³ Gibson and Sterling, *Difference Engine*, p. 101.

he and his co-author cast Ada Byron as the “symbolic counterpoint” to the Romantic poet turned Prime Minister, Lord Byron.³⁴ As the visionary theorist of computation, the Mother of all programmers, Ada, and not her father represents the figure of the artist in the novel. In the world of *The Difference Engine*, Analysis, or computation, not poetry, is the highest form of art.

The novel itself is arranged in a series of five Iterations, with the addition of an epilogue entitled “Modus The Images Tabled,” a final compiling of the program.³⁵ Gibson and Sterling establish *The Difference Engine* in an analogical relationship to a calculating machine, weaving its own algebraical patterns. The novel not only imagines a world in which Analysis is artistry, it also performs something like an analytical engine in its iterations. In computing, an iterative process is a means of calculating a result by performing a series of steps repeatedly, often as an embedded loop. Iterations enable a digital computer to obtain an approximate solution that, with the feedback of preliminary results into each successive iteration, eventually leads to a solution of desired accuracy. If *The Difference Engine* is being “run” like an iterative program, as suggested by its section divisions, what is the approximate solution that the novel hopes to resolve? Among the several mysteries presented in the text, one that I have already alluded to seems most germane: the nature and purpose of the stack of “camphorated cellulose” (celluloid was the first synthetic plastic material, first prepared in 1865) cards that is Ada’s Modus. Ordinary “clackers” (computer programmers in “steampunk” argot) suspect that Ada’s stack is a “gambling-system, a secret trick of mathematical Enginery, to defeat the odds-makers.”³⁶ The proletarian revolutionary and murder-

³⁴ *Conceiving Ada*. Dir. Lynn Hershman Leeson. Perf. Tilda Swinton, Timothy Leary, Karen Black, Francesca Faridany, John Perry Barlow. DVD. Fox Lorber, 1997.

³⁵ Gibson and Sterling, *Difference Engine*, p. 397.

³⁶ Gibson and Sterling, *Difference Engine*, p. 189.

ous “vitreuse” Florence Bartlett, however, is willing to kill to possess the Modus for the wealth and power she suspects the program would convey. The Iterations gradually reveal that unfathomable power lies in controlling the Modus, much more so than in governing the analytical engines themselves. Ironically, the paleontologist Edwin Mallory, who is given the stack in safekeeping by Ada Byron, has, according to the kinotrope artist John Keats, “no idea of their astonishing import.”³⁷ The final, yet approximate solution to the Modus is provided in the form of a speech delivered to a Parisian women’s club by Ada Byron herself:

“And yet the execution of the so-called Modus Program demonstrated that any formal system must be both *incomplete* and *unable to establish its own consistency*. There is no finite mathematical way to express the property of ‘truth.’ The *transfinite* nature of the Byron Conjectures were the ruination of the Grand Napoleon [computer]; the Modus Program initiated a series of nested loops, which, though difficult to establish, were yet more difficult to extinguish. The program ran, yet rendered its Engine useless! It was indeed a painful lesson in the halting abilities of even our finest *ordinateurs*.

Yet I do believe, and must assert most strongly, that the Modus technique of *self-referentiality* will someday form the bedrock of a genuinely transcendent meta-system of calculatory mathematics. The Modus has proven my Conjectures, but their practical exfoliation awaits an Engine of vast capacity, one capable of iterations of untold sophistication and complexity.”³⁸

Ada Byron analeptically invokes Kurt Gödel’s Incompleteness theorem (1931) that asserts that no mathematical system is provable, or complete, within itself; every system must be part of a larger structure; and thus, the nature of truth is finally indeterminate – or, in Lady Byron’s terms, “transfinite.” Just as Ada Lovelace’s Notes referred to an Analytical Engine that was never to be built in her or Babbage’s lifetime, so Ada Byron

³⁷ Gibson and Sterling, *Difference Engine*, p. 416.

³⁸ Gibson and Sterling, *Difference Engine*, p. 421.

speculates on the effects that her Modus program would have were it run on a digital supercomputer well beyond “the limits of steam power” in her day.³⁹ Ada’s program has crashed the Grand Napoleon *ordinateur* with its infinitely cycling loops. *The Difference Engine* is itself a work of multiple iterations, compelling the reader simultaneously to regard the text analeptically as an alternative history of Victorian England with steam-driven computing machinery and proleptically as an examination of what effects an information technocracy would have if it were fully instantiated in a society such as our own. As an artist, Ada promotes the “self-referentiality” of her Modus and its access to a transcendent “meta-system” with utopian enthusiasm. The shift from linear to nonlinear analysis in “calculatory mathematics” finds its analogy in the shift from the plot-driven, crankshaft realism of linear narrative to the nonlinear, iterative (high gain) narrative of metafiction. This passage, in which Ada describes her Modus, doubles metafictionally as an endorsement of the reflexive irony in cyberpunk fiction. It’s a little “coming attraction” for the New Age of cybernetic fiction.

The self-referentiality technique of Ada’s Modus will someday spell the death of the Author-programmer. Although Ada Lovelace objected to the premise that a computer performing according to instruction was a “thinking” machine, Ada Byron indulges in speculation on artificial intelligence:

“If we envision the entire System of Mathematics as a great Engine for proving theorems, then we must say, through the agency of the Modus, that such a Engine *lives*, and could indeed *prove* its own life, should it develop the capacity to look upon itself. The Lens for such a self-examination is of a nature not yet known to us; yet we know that it exists, for we ourselves possess it.”⁴⁰

³⁹ Gibson and Sterling, *Difference Engine*, p. 422.

⁴⁰ Gibson and Sterling, *Difference Engine*, pp. 421-22.

No computing machinery has yet passed the test of self-examination. But were such an artificial intelligence to exist, it would have to be able to “originate” thought (the Lovelace Objection) or regard itself reflexively (the Byron Conjecture). Such an Engine that *lives*, freed from the ministrations of programmer and user, would be comparable to the Barthesian *scriptible* text, an “instance writing” freed from the ministrations of the biographical author or actual reader.

3: The Virtual Reader in Cyberfiction

Espen Aarseth’s ergodic reader participates in dynamical computer games and Multi-User Domains by following the “work-path” that the system has established.⁴¹ The ergodic reader is indisputably endowed with election, or the choice of following one or another of the possible work-paths; and some work-paths may be more productive (as judged by the reader, or by the system?) than others. But in his or her election (Aarseth’s “non-trivial effort”⁴²), the ergodic reader is not capable of originating a new passage or solution. Landow’s hypertext reader experiences similar privileges and limitations. One can elect to follow a particular link in hyperfiction or Internet web pages, finding the traversal from one “docuverse” (Ted Nelson’s term) to be either rewarding or, as is so often the case, frustrating or pointless. But again, the reader of hyperlinked texts can neither fashion nor destroy the links that have been encoded there.

As I have already suggested, both the ergodic and hypertext readers are actual readers; they are purveyors of the text, subject to market research; and as such they are, in Barthes’s determination, rather more consumers than producers of the text than their respective theorists would grant. Actual readers-in-the-

⁴¹ Espen J. Aarseth, *Cybertext: Perspectives on Ergodic Literature* (Baltimore and London: Johns Hopkins UP, 1997), p. 1.

⁴² Aarseth, p. 1.

world are likewise subject to Lady Lovelace's Objection with regard to the Analytical Engine. The actual reader can have no pretensions whatever to *originate* anything. He or she can do only what the author-programmer *knows how to order it* to perform. I am arguing that the actual reader, because he or she is embodied, is always limited in the material world in his or her performativity. Keystroke combinations, mouse clicks, shaking the Etch-o-Sketch – whatever servo-mechanical interface is required – must be established in advance of the administration of the text. The actual reader is made active only in his or her bio-mechanical domain, not within textuality itself. Make no mistake, the potential for innovation in the various modes of hypertext, combinatorial-procedural, or cybertext fiction is enormous, and we are merely limning the edge of what digital textuality has in store for us. But so far the power to create the text has not been transferred to the actual reader. Readers of hypertext and other forms of electronic fiction are more acted upon than acting; not so much constructing the text as constructed by it. Insofar as cybertext is a "machine made of words" (William Carlos Williams's definition of a poem), the actual reader performs just as any other human being in a cybernetic system. Norbert Wiener, in *The Human Use of Human Beings* (1954), emphasizes that the performance or nonperformance of the human subject in a feedback loop with a machine may in the parlance of other fields be called "conditioned reflex" or "learning."⁴³ In cybertexts, one must ask, who is the teacher and who the pupil? As in any cybernetic system, where does control reside?

Print-based cyberfiction envisages for itself a Virtual Reader. Not an actual reader with pretensions to originate anything through manipulation of keys or cursors, but an avatar or "stand-in" for the Reader in the text. In *Neuromancer*, Gibson describes a "construct" as "a hardwired ROM cassette replicating a dead

⁴³ Wiener, p. 33.

man's skills, obsessions, knee-jerk responses,"⁴⁴ a personality preserved on a memory chip. Dixie Flatline is presented in the novel not as a "live," embodied character, but as a virtual personality rendered in Silicon Graphics. The Virtual Reader in cyberfiction can be regarded as an extension of this premise: not as a member of an actual, book-buying audience, but as the replication of the Reader in the text. Like a "construct," the Virtual Reader is rendered only within the cybertext and nonexistent when the system powers down. Cyberfictions that are populated with simulated life forms and autotelic information systems are naturally well disposed toward implicating both the authorial and reader functions in the virtual reality of the text. The biographical author and the actual reader are vestiges of nineteenth-century realism, one of whose prominently advertised features is the transparency of the work onto Nature. As the author and reader in realism are themselves regarded as *au naturel*, their embodiment is regarded uncritically; only thus can the book pass between them unimpeded by the medium of transmission. Cyberfictions recognize that author and reader are simulations of the text and that the medium is the message. An avatar is a "temporary manifestation or aspect of a continuing entity." The incarnation of a Hindu deity is a temporary manifestation in human form of divinity; likewise, the avatar of the user in virtual reality. The player of a computer game may identify the avatar as a surrogate self who, controlled by joysticks or other input devices, may be made to do the player's bidding in the virtual world of the game. And yet, the avatar is always already a representation of that virtual reality's programmers, with only those capabilities and pursuits by them so defined. Cyberfiction comfortably adopts as its native milieu the knowing simulation of virtual reality, and thus the avatar serves to define of the surrogate role of the reader.

⁴⁴ Gibson, *Neuromancer* (New York: Ace, 1984), pp. 76-77.

The avatar, or Virtual Reader, is assigned a performing role in the text. In some computer simulations, the anthropoid avatar may assume the role of the protagonist in an adventure, sporting contest, or narrative quest. Just as the performing role of the avatar in computer games will vary with respect to its genre, so the performance of the Virtual Reader will be established by the author to meet the specific needs of cyberfiction. I have already suggested that Gibson and Sterling seek to establish in *The Difference Engine* a bi-directional communication between the alternative history of the Victorian period as presented in the novel and the conventional record of that period. Let's call it postmodern irony when the Virtual Reader recognizes an error in transmission between the world of the Difference Engine and Victorian England, as when the Marquess of Hastings, leading his "swing band" of class revolutionaries, identifies the "still fine poets in England. Did you ever hear of John Wilson Croker? Winthrop Mackworth Praed? Bryan Waller Procter?"⁴⁵ Victorian versifiers, in fact; whereas Shelley has become a Ludite agitator, and Professor Coleridge and Reverend Wordsworth have decamped to the utopian commune of the Susquehanna Phalanstery.⁴⁶ (291). In an interview given shortly after the publication of *The Difference Engine*, Sterling comments on the book's obsession with Victoriana:

It's our disease projected onto a lab animal of the 19th century. Watch what happens to them, watch the course of the symptoms, which will help us to understand what's happening to us. You know, if a Victorian read this book it wouldn't make any sense to him at all Even Charles Babbage wouldn't be able to understand *DE*.⁴⁷

⁴⁵ Gibson and Sterling, *Difference Engine*, p. 300.

⁴⁶ Gibson and Sterling, *Difference Engine*, p. 291.

⁴⁷ Gibson and Sterling, "The Charisma Leak": A Conversation with William Gibson and Bruce Sterling," interview with Daniel Fischlin, Veronica Hollinger, and Andrew Taylor, *Science-Fiction Studies* 19 (1992), 1-16; here p. 6.

Despite the metaphor of clinical pathology, which is a “meat” thing, Sterling makes clear that the Virtual Reader in *The Difference Engine* has been ordered to perform continuously an analeptic and a proleptic analysis of the alternative history: how has the analeptic insertion of the Information Industry into Victorian society altered its course? And what do the symptoms observed there proleptically suggest about our present condition? Any other performance by the Virtual Reader would be outside the rules of the clinical trial. Although virtual reality is beyond the resolution and “refresh rate” of mechanical “clacking” in the novel, the precursor of the avatar in the form of an automaton makes an appearance. Edwin Mallory, Lawrence Oliphant, and visiting Japanese diplomats are served tea by a Japanese doll, or *karakuri*. Mallory exclaims, “I see! Like one of those Jacquot-Droz toys, or Vaucanson’s famous duck, eh?”⁴⁸ The mechanical duck fashioned by Jacques de Vaucanson (1709-1782), which also makes a cameo appearance in Thomas Pynchon’s *Mason & Dixon* (1997), and subsequent automata perform operations without human intervention and employ feedback in self-correcting control systems. Like the *karakuri* among guests, the Virtual Reader in cyberfiction should be the obedient servant to the text.

The Virtual Reader in cyberfiction is, as Barthes would say, the destination of the text. The appeal of virtuality resides in its utterly flexible adaptation to circumstance. Unconstrained by physical limitations, the virtual space can be whatever is required of it. Thus the Virtual Reader as a simulacrum of the reader is “without history, biography, psychology,”⁴⁹ except as those traits would be transiently defined in the text. Italo Calvino, who explored the relationship of cybernetics and literature,

⁴⁸ Gibson and Sterling, *Difference Engine*, p. 168.

⁴⁹ Roland Barthes, “The Death of the Author,” in *Image – Music – Text*, transl. by Stephen Heath (Boston: Hill and Wang, 1977), p. 148.

provides an instance of this simulacral Reader in his fiction, *If on a winter's night a traveler*. The prologue to the novel would appear to address, in the familiar second person singular, a "you" who would be reading Italo Calvino's new novel.⁵⁰ Such a direct address to an assumed actual reader occurs in the prologues of many classic texts, including the "Bill of Fare" in Fielding's *Tom Jones* (1749), the attestations of veracity in Daniel DeFoe's *Robinson Crusoe* (1719), and Miguel de Cervantes's Prologue to the Reader in *Don Quixote* (1605). Yet Calvino's address to the actual reader, suavely seeing to his physical comfort "because once you're absorbed in reading there will be no budging you,"⁵¹ is redolent with postmodern irony. Calvino quickly dispels the illusion that the addressee in the prologue is the actual reader of the book. The recumbent reader, suddenly deprived of the classic, "readerly" text that he desires, is then sent scrambling in pursuit of the unity of the text. "Who you are, Reader, your age, your status, profession, income: that would be indiscreet to ask. It's your business, you're on your own."⁵² Perusing the ten interrupted narratives, Calvino's Reader becomes a figure of the Barthesian *lector*, one for whom a "text is made of multiple writings, drawn from many cultures and entering into mutual relations to dialogue, parody, contestation."⁵³

As in other game worlds, Calvino's Reader pursues the completion of the text that he is reading; he behaves as would any avatar, a subject that is both synthetic and unspecified. The Reader has no personal discretion, but exists to be the destination of the text's unity. In cyberfiction, the narrative's protagonist will often be presented as an avatar. Neal Stephenson's

⁵⁰ Italo Calvino, *If on a winter's night a traveler*, transl. by William Weaver (New York: Harcourt Brace Jovanovich, 1981), p. 3.

⁵¹ Calvino, *If on a winter's night a traveler*, p. 4.

⁵² Calvino, *If on a winter's night a traveler*, p. 32.

⁵³ Barthes, "The Death of the Author," p. 148.

Snow Crash (1992) features a programmer named Hiro Protagonist who has created a virtual reality known as the Metaverse.⁵⁴ The actions of Hiro, who in the flesh is Korean- and African-American, as he pursues his nemesis, Raven, are largely unaffected by the transmission from a Los Angeles wholly governed by corporate franchises and the Metaverse that, “like any other place in Reality,” is similarly subject to commercial development.⁵⁵ The Metaverse is peopled with custom-built avatars for the hackers, and for the neophytes, an assortment of off-the-shelf models. “Hiros’ avatar just looks like Hiro, with the difference that no matter what Hiro is wearing in Reality, his avatar always wears a black leather kimono.” For those who “can’t afford to have custom avatars made and don’t know how to write their own,” they can purchase and assemble generic models from the “Avatar Construction Set™.”⁵⁶ Every avatar is a “construct” that appears only as the programmer-user knows how to order it to appear; and that avatar can only perform – with ritual *kitane* swords or on a Yamaha motorcycle – what the programmer knows how to order it to perform. In the transmission from Reality to the Metaverse, the user would seem to create for himself or herself an identity: “Your avatar can look any way you want it to, up to the limitations of your equipment.”⁵⁷ But in effect it is the virtual reality system that creates the avatar. The Virtual Reader in cyberfiction behaves as such an avatar, always more acted upon than acting, not so much constructing the text as constructed by it.

4: Scriptor and Narratron

The Difference Engine begins with an impersonal surveillance report consisting of a “composite image, optically encoded.”⁵⁸

⁵⁴ Neal Stephenson, *Snow Crash* (New York: Bantam, 1992), p. 22.

⁵⁵ Stephenson, *Snow Crash*, p. 23.

⁵⁶ Stephenson, *Snow Crash*, p. 34-35.

⁵⁷ Stephenson, *Snow Crash*, p. 33.

⁵⁸ Gibson and Sterling, *Difference Engine*, p. 1.

Other such reports, as if they were dispatches from a spy satellite in geosynchronous orbit above London or Cherbourg, France, occasionally punctuate the novel. The reader has no direct evidence as to who or what is gathering this information, or for what purpose; but reasoned speculation might lead to the Central Statistics Bureau whose Engines and clackers maintain the data files on every citizen-number.⁵⁹ And yet the digital technology implied by these surveillance reports would seem to supercede the mechanical gearing, stipple-printing, and kintropy of the Engines. Not until the reader reaches the conclusion of the novel, having parsed the slippages of history, does he or she recognize that something has been “carrying out this vast surveillance of the 19th century from an alternate 1991.”⁶⁰ Not the 1991 of the authors, promoting their newly published novel in a sushi-bar interview in Toronto, nor the 1991 of the avid science-fiction reader who has just devoured the latest cyberpunk novel by Gibson and Sterling, but the 1991 which is the future world of the *Difference Engine*. It is London, and yet a kind of “sim city” of “mirrored plazas of sheerest crystal, the avenues atomic lightning, the sky a super-cooled gas, as the Eye chases its own gaze through the labyrinth, leaping quantum gaps that are causation, contingency, chance”.⁶¹ As Gibson reveals in the Toronto interview, the conclusion of the novel introduces the “narratron,” an automated narrator. “The story purports in the end to tell you that the narrative you have just read is not the narrative in the ordinary sense; rather it’s a long self-iteration as this thing attempts to boot itself up, which it does in the final exclamation point.”⁶² The panoptic machine has not been gathering information on the citizenry in obedient service to an Orwellian regime. We are witness to the advent of an artificial

⁵⁹ Gibson and Sterling, *Difference Engine*, p. 143.

⁶⁰ Gibson and Sterling, “The Charisma Leak,” p. 11.

⁶¹ Gibson and Sterling, *Difference Engine*, p. 428.

⁶² Gibson and Sterling, “The Charisma Leak,” p. 10.

intelligence, capable of self-programming and reflexivity: "In this City's center, a *thing* grows, an auto-catalytic tree, in almost-life, feeding through the roots of thought on the rich decay of its own shed images, and ramifying, through myriad lightning-branches, up, up, toward the hidden light of vision."⁶³ The narratron has apparently benefited from the research of some alternative Ilya Prigogine or Stuart Kauffman on autocatalytic sets as it labors to boot itself up. Its self-awareness – asking the "what am I?" question – signifies intelligence. Sterling states, "Well, it *is* reflexivity; it's a very postmodern move; it's your basic narrative frame-breaking move there. But, yeah, the author of the book is the narratron; it's sitting there telling itself a novel as it studies its own origins."⁶⁴ The narratron's tale – but perhaps it is all a fantastic delusion, in which the authorial function is assigned to a self-reflexive computing machine; that tale, then, is another iteration of the "death of the author," another proposition of a Barthesian *scriptor* engaged in fashioning its own textuality, an automated writing. As an artificial intelligence capable of examining and altering its own programming, the narratron also enunciates the death of the programmer; in cybernetic terms, the control of the narrative resides in the computing machinery. Finally, the narrative frame-breaking (an activity that unites the postmodern with the Luddite) will have an effect on the role of the reader, and here I mean the Barthesian *lector* in the text. The reader, who has previously been concerned to read *The Difference Engine* for its slippages in an alternative history, now must reread the novel entirely as a self-reflexive, metafictional exercise. In a proleptic reading, the reality of the Difference Engine in 1855 leads to a dystopic information society in 1991 that is controlled by an "all-seeing Eye" and which places its human attendants, clackers and navvies, in a

⁶³ Gibson and Sterling, *Difference Engine*, pp. 428-29.

⁶⁴ Gibson and Sterling, "The Charisma Leak," p. 10.

Foucauldian panopticon. More than this, the narratron's "self-iteration" truly creates a Virtual Reader in that such a text, written to account for the computer's own origins, could only have a reader within the virtual architecture of the machine's intelligence.

Enthusiasm for an empowered, actual reader accompanied the millennial optimism for new forms of communications technology. The marketing campaign for personal digital assistants (PDAs) such as the Palm Pilot, cellular telephones and pagers stress the hand-held portability of the devices; each can be personalized with one's own vital data and contact lists; each promises incessant interactivity, linkage to a network, roaming, and total wireless access to the information or persons that matter to you. Yet, as becomes apparent to anyone who has tried to avail themselves of universal connectivity – "Can you hear me now?" – or negotiate the interface between one's satellite devices and the docking platform, or practice safe and seamless data entry and retrieval, the liberation and empowerment of personal communications devices in practice has been oversold. One might as well be carrying a homing device strapped to one's belt that makes targeting the user that much easier for commercial or governmental purposes. Cybernetic fictions have taken a lesson from the developments in communications technology: they regard with skepticism the promised control and organization of information; and they entertain a touch of paranoia that these liberating devices are shackles in another form. The actual reader of Gibson and Sterling's *The Difference Engine* is no more "free" in the text than the rest of the constrained, engine-stippled populace of an information society at large. The virtual reader, however, is that destination of the text that is not personal and in whom the network of communication is realized.