

Prologue

Computing Kin

On the Title

In Neal Stephenson's *Cryptonomicon*, the fictional mathematical genius Lawrence Pritchard Waterhouse is showing off his new mechanical invention to his supervisor, Lieutenant Colonel Earl Comstock. Comstock inquires:

“If you had to give a name to the whole apparatus, what would you call it?”

“Hmmm,” Waterhouse says. “Well, its basic job is to perform mathematical calculations—like a computer.”

Comstock snorts, “A computer is a human being.” (600)

The dialogue reflects the historical fact that in the 1930s and 1940s, people who were employed to do calculations—and it was predominantly women who performed this clerical labor—were called “computers.” Anne Balsamo references this terminology when she begins one of the chapters in her book *Technologies of the Gendered Body* with the line I have appropriated for my title: “My mother was a computer.”¹ Balsamo's mother actually did work as a computer, and she uses this bit of family history to launch a meditation on the gender implications of information technologies. For my purposes, the different interpretations of the sentence from World War II to the end of the twentieth century mark a shift from a society in which the intelligence required for calculations was primarily associated with humans to the increasing delegation of these labors to computational machines. The sentence stands, therefore, as a synecdoche for the panoply of issues raised by the relation of Homo sapiens to Robo sapiens, humans to intelligent machines.²

The semantic shock the sentence is likely to give us today is rooted not only in the shift from human to machine labor, but also in the feeling that a kinship category essential to human society has been violated. In this sense, the sentence alludes to what Hans Moravec, among others, has called our

“postbiological” future: the expectation that the corporeal embodiment that has always functioned to define the limits of the human will in the future become optional, as humans find ways to upload their consciousness into computers and leave their bodies behind.³ In *How We Became Posthuman*, I argued strongly against this vision of the posthuman, ending the book with a call to contest for versions of the posthuman that would acknowledge the importance of embodiment and be conducive to enhancing human and nonhuman life on the planet.

In the half decade since the publication of that book, computational technologies have penetrated even further into the infrastructure of developed countries. Pervasive computing, mobile communication devices, satellite networks, and Internet traffic have spread dramatically; and, correspondingly, economic, manufacturing, transportation, and communication technologies have been tightly integrated into globally mediated networks. As a result, the interplay between the liberal humanist subject and the posthuman that I used to launch my analysis in *How We Became Posthuman* has already begun to fade into the history of the twentieth century. In the twenty-first century, the debates are likely to center not so much on the tension between the liberal humanist tradition and the posthuman but on different versions of the posthuman as they continue to evolve in conjunction with intelligent machines.

In juxtaposing the posthuman with the liberal humanist tradition, I argued that despite many important differences, some versions of the posthuman continued to reinscribe the disembodiment that was a prominent feature of the liberal tradition, insofar as it associated self with mind and saw the body as a mere container for the mind’s operations. As new and more sophisticated versions of the posthuman have evolved, this stark contrast between embodiment and disembodiment has fractured into more complex and varied formations. As a result, a binary view that juxtaposes disembodied information with an embodied human lifeworld is no longer sufficient to account for these complexities. Although I have not abandoned my commitment to the importance of embodiment, it seems to me that contemporary conditions call increasingly for understandings that go beyond a binary view to more nuanced analyses. From my perspective, this development requires repositioning materiality as distinct from physicality and re-envisioning the material basis for hybrid texts and subjectivities. The thinking I did for my book *Writing Machines* has been crucial in allowing me to work out the arguments advanced here. *Writing Machines*, *How We Became Posthuman*, and this book form a trilogy that arcs from the

mid-twentieth century to the present, a trajectory that moves from a binary opposition between embodiment and information through an engagement with the materiality of literary texts to a broadening and deepening of these ideas into computation and textuality.

Materiality, as I defined it in *Writing Machines*, is an emergent property created through dynamic interactions between physical characteristics and signifying strategies. Materiality thus marks a junction between physical reality and human intention. Following Bruno Latour's call for a turn from "matters of fact" to "matters of concern," I like to think of materiality as the constructions of matter that matter for human meaning.⁴ This view of materiality goes hand in hand with what I call the Computational Universe, that is, the claim that the universe is generated through computational processes running on a vast computational mechanism underlying all of physical reality. For scientists making the strong claim for computation as ontology, computation is the means by which reality is continually produced and reproduced on atomic, molecular, and macro levels. In *A New Kind of Science*, Stephen Wolfram extends the claim to include biological systems and, indeed, complex behaviors of every kind, including social and cultural systems.⁵ In this context, "My mother was a computer" can be understood as alluding to the displacement of Mother Nature by the Universal Computer. Just as Mother Nature was seen in past centuries as the source of both human behavior and physical reality, so now the Universal Computer is envisioned as the Motherboard of us all.

The appearance of the Computational Universe at a moment in human history when computers have achieved unparalleled scope and importance is obviously not coincidental. We might draw an analogy with eighteenth-century commentators who, impressed by the reductive power of Newton's laws of motion and the increasing sophistication of time-keeping mechanisms, proclaimed that the universe was a clockwork.⁶ As Marjorie Hope Nicolson pointed out in the 1940s, the clockwork metaphor worked powerfully to express the orderliness and predictability of a universe that moved with beautiful precision.⁷ At the same time, it occluded other aspects of reality that subsequently found expression in such diverse developments as Romantic poetry, quantum mechanics, and complexity theory. Similarly, the Computational Universe enables deeper insight and new intuitions into certain aspects of reality; we may safely assume that it also obscures other aspects of reality, including constructions of subjectivity that have traditionally found expression in the humanities and social sciences. The friction between traditional views of subjectivity and a computational perspective is

one focus of this inquiry, but other foci are new configurations that put traditional and computational perspectives into synergistic cooperation with one another.

In the course of this book, I offer my own commentary on the Computational Universe, including a critical interrogation of current research claims. My primary interest, however, is not in separating the Computational Universe as the means by which reality is generated from its function as a metaphor for understanding natural and cultural processes. Rather, I am interested in the complex dynamics through which the Computational Universe works *simultaneously* as means and metaphor in technical and artistic practices, producing and also produced by recursive loops that entangle with one another and with the diverse meanings of computation as technology, ontology, and cultural icon. This dynamic interplay of recursive, multiple causalities becomes, I argue, the fertile ground for re-envisioning and remaking a wide variety of cultural artifacts, including computer simulations and literary texts.

In addition to its associations with the Computational Universe and Mother Nature, the title also alludes to Friedrich Kittler's influential argument that reading functions as "hallucinating a meaning between letters and lines."⁸ In *Discourse Networks*, Kittler notes that with the introduction of phonics in the nineteenth century, children were taught to read by sounding out words, first articulating them out loud and then subvocalizing them.⁹ These practices gave "voice" to print texts, particularly novels—and the voice most people heard was the same voice that taught them to read, namely, the mother's, which in turn was identified with Mother Nature and a sympathetic resonance between the natural world and human meaning. In the contemporary period, reading as "hallucination" has been displaced in part by the instant messaging, chat rooms, video games, e-mail, and Web surfing that play such a large role in young people's experiences. To an extent, then, the mother's voice that haunted reading has been supplanted by another set of stimuli: the visual, audio, kinesthetic, and haptic cues emanating from the computer. If the mother's voice was the link connecting subjectivity with writing, humans with natural environments, then the computer's beeps, clicks, and tones are the links connecting contemporary subjectivities to electronic environments, humans to the Computational Universe. One strand of my analysis interrogates the effects of these pervasive interactions on the construction of subjectivity and contemporary reading practices, charting the resulting shifts by locating both print and electronic texts in relation to computational practices.

Turning to the title's kinship implications, we can also understand "My mother was a computer" as the answer an artificial-life simulation might give if asked who its parent was. Researchers in the field frequently evoke human kinship terminology to describe computer simulations; it is common, for example, to say that the computer (or more precisely, the program) "gives birth" to evolving artificial biota. Such usage promiscuously mingles anthropomorphic projection with descriptive intent. In this sense "My mother was a computer" articulates a certain kind of anthropomorphic projection that creates (mis)understandings of the computer's functioning. Mystifying the computer's actual operation, anthropomorphic projection creates a cultural Imaginary in which digital subjects are understood as autonomous creatures imbued with human-like motives, goals, and strategies. This projection also has a reverse undertow, for it brings into question the extent to which human beings can be understood as computer programs. The "digital subjects" of the subtitle alludes to this dialectical positioning of humans and artificial creatures in relation to each other. Read as a phrase delineating an area of inquiry, "digital subjects" punningly connects the subject of digitality, especially the Computational Universe, with these hybrid subjectivities.

Why literary texts, the other half of the subtitle? I am indebted to Alan Liu, a reader for the University of Chicago Press, for challenging me on this issue. In the first draft, I took the inclusion of literature to be more or less self-evident. I am, after all, a literary critic (among other things). On further reflection, however, I understand the question both as an indication of literature's increasingly marginal position in mainstream culture, where it competes and cooperates with such cultural phenomena as blockbuster movies and best-selling computer games, and as an invitation to rethink the role of literature in creating the contemporary cultural Imaginary.

To elucidate my decision to include literary texts, I begin from a fundamental question. What resources do we have to understand the world around us? As Nicholas Gessler, among others, has pointed out, these resources can be grouped into three broad categories: mathematical equations, simulation modeling, and discursive explanations.¹⁰ Of mathematical equations, I have little to say, other than to note the point that Harold Morowitz, Stephen Wolfram, and others make about the limited usefulness of mathematics in describing complex behaviors. Because complex systems exhibit nonlinear behaviors that typically cannot be described by equations having explicit solutions, the kind of mathematics that gave us classical mechanics and other triumphs of modern science has little traction in the case

of complex systems, which leaves us with simulations and discursive explanations.

There are, of course, many different forms of discursive explanations, including such preeminent nonliterary forms as history, philosophy, and cultural anthropology. Among these discourses, literature is distinct for creating, as Marie-Laure Ryan puts it, “possible worlds.”¹¹ Kittler’s proposition that reading novels is like a hallucination highlights one of literature’s main fascinations: its ability to create vividly imagined worlds in which readers can “hallucinate” scenes, actions, and characters so fully that they seem to leap off the page and inhabit the same psychic space as the readers themselves. In this respect, literature functions more like simulations than do other discursive forms, because like computer simulations such as Karl Sims’s “Evolved Virtual Creatures” (discussed in chapter 8), literary texts create imaginary worlds populated by creatures that we can (mis)take for beings like ourselves.

There are also important differences between simulations and literary texts. Whereas computation is essential for simulations that model complex phenomena, literature’s stock-in-trade is narrative, especially in the contemporary period when novels have become the preeminent literary form. Narrative is much older than simulation modeling in artificial media—almost as old, many anthropologists believe, as the human species itself. Narrative, with its evocation of the human lifeworld, speaks to subjectivities that remain rooted in human perceptual systems, human languages, and human cultures. Simulations, by contrast, are essentially numerical calculations. Although they can be rendered in visual forms that evoke the perceptible world that humans see (as is the case for Karl Sims’s simulations), these appearances are generated through algorithms that operate first and foremost with numerical quantities. Because computers are much better equipped than human minds to carry out the staggeringly tedious calculations involved in creating simulations, simulations are closely associated with artificial intelligence and with postbiological subjectivities. The dynamic tensions between simulation and narrative thus involve a dialectic between the human lifeworld and the (relatively) inhuman world of massive numerical calculations.

The traffic between language and code that this similarity/opposition sets up is one of the principal ways in which digital subjects and literary texts are interrogated and articulated together in this book. The two other modalities highlighted here are the interpenetration of print and electronic text, and the dialectic between analog and digital representations. Together, these three dynamics can be parsed as making (language and code), storing (print

and electronic text), and transmitting (analog and digital). Making, storing, and transmitting can be thought of as modalities related to information; they also help to constitute the bodies of subjects and texts. Another way in which literary texts and digital subjects are articulated together is by analyzing the effects of these modalities on their bodies. As an embodied art form, literature registers the impact of information in its materiality, in the ways in which its physical characteristics are mobilized as resources to create meaning.

This entanglement of the bodies of texts and digital subjects is one manifestation of what I call “intermediation,” that is, complex transactions between bodies and texts as well as between different forms of media. Because making, storing, and transmitting imply technological functions, this mode of categorization insures that the different versions of the posthuman will be understood, in Kittlerian fashion, as effects of media. At the same time, in my analysis of literary texts and especially in my focus on subjectivity, I also insist that media effects, to have meaning and significance, must be located within an embodied human world. In refusing an either/or choice between media effects and a human lifeworld, I again invoke the necessity, as I did in my repositioning of materiality, to think in terms of multiple causalities, complex dynamics, and emergent possibilities. As both computer simulations and literary texts recognize, autonomous agents interacting recursively with one another and their environments can never be reduced to linear dynamics or simple causalities. The final and most important significance of *My Mother Was a Computer: Digital Subjects and Literary Texts*, as a title and as a book, is to insist on the irreducible complexity of contemporary posthuman configurations as they continue to evolve in digital subjects and literary texts, computer programs and human mindbodies.

Method and Scope

I turn now to the book’s methodology and organization. Three main parts explore the distinct but related processes of making (through language and code), storing (as print and electronic text), and transmitting (through analog and digital encoding). As noted earlier, making, storing, and transmitting imply technological functions that are intimately co-involved. Their division here into separate parts helps to clarify their specific functionalities but should not obscure the fact that they constantly engage one another in dynamic and multiple recursive interactions.

Within each part, different chapters emphasize theory, technology, and thematics. In discussions of electronic literature and computer simulations, the emphasis on technology ensures that the analysis takes place not only

at the level of the screen but also at the level at which screenic effects are achieved. The emphasis on thematics allows me to integrate into the discussion close readings of different kinds of texts, ranging from print novels and electronic literature to computer simulations used in scientific research. Both the technological and thematic analyses have theoretical implications, which the chapters emphasizing theory explore explicitly in ways that the other chapters test, confirm, modify, and extend. Theory, technology, and thematics are, of course, in constant interaction with one another, so all the chapters have some of each, although usually one strand is predominant. The order in which I take up these three strands of inquiry varies from part to part. For example, the chapter devoted predominately to theory comes second in part 1, first in part 2, and last in part 3, whereas the chapter devoted to technology comes first in part 1, last in part 2, and second in part 3. In this regard, the organization of the book is flexible.

Part 1, “Making: Language and Code,” focuses on the signifying processes of language and code. To set the stage, chapter 1 develops the concept of intermediation and relates it to the technologies driving the Regime of Computation. As a result of these developments, code assumes new importance as the lingua franca of nature. This raises the issue of how code can be related to theoretical frameworks for the legacy systems of speech and writing, the topic of chapter 2. From a systematic comparison of Saussure’s semiotics, Derrida’s grammatology, and programming languages, implications emerge that reveal the inadequacy of traditional ideas of signification for understanding the operations of code. In instances where code becomes important—as is the case for virtually all forms of textuality in the digital age—the dynamics at work bring into question such long-held verities as the arbitrariness of the sign, while simultaneously highlighting processes given relatively little attention in Saussurean semiotics and Derridean grammatology, such as the act of “making discrete.” The result is a significant shift in the plate tectonics of signification, with a consequent rethinking of the processes through which texts emerge. The point is not simply to jettison the worldviews of speech and writing—even if by some miraculous fiat this were possible—but rather to understand the processes of intermediation by which they are in active interplay with the worldview of code. This endeavor necessarily assumes an understanding of the differences and similarities between these three worldviews, so in this sense chapter 2 lays the groundwork for the chapters that follow.

Chapter 3 shows how bodies are interpolated differently as the technology transforms from the passive code of the telegraph to the active code of sophisticated cybernetic devices and computer programming, moving

through Henry James's "In the Cage" (1898) to Philip K. Dick's *The Three Stigmata of Palmer Eldritch* (1966) and James J. Tiptree's "The Girl Who Was Plugged In" (1973). The protagonists of these narratives share a common desire to escape from the constraints of life within a capitalistic regime, yearning to partake of an informational realm where goods flow freely and life escapes from being a zero-sum game. As the technology becomes more sophisticated, this dream is not fulfilled; instead, embodied subjects are interpolated ever more tightly into a circuit controlled by capitalistic dynamics. As bodies enter more completely into the circuit, subjects cease to be *circumscribed* by these dynamics and are *constructed* through them, a process enacted in Tiptree's story with disconcerting literalness. The complex dynamic created when language meets code proves to be crucial in all three narratives, highlighting the processes of intermediation that cycle through these fictions.

Part 2, "Storing: Print and Etext," emphasizes the interactions of print and electronic literature as production systems. Chapter 4 is theoretically oriented and argues that received ideas of the foundational concepts of work, text, and document should be reconceptualized to take materiality more fully into account. As I indicated above, materiality on this view cannot simply be collapsed into physicality but is an emergent property generated by interactions between a work's signifying strategies and the physical characteristics it mobilizes as resources for its operations. This chapter argues that taking materiality seriously requires different models of subjectivity than those usually assumed in textual editing, as well as changed concepts of how embodied texts relate to one another. Here the cycles of intermediation are illustrated through the complex dynamics by which novels, films, Web sites, and other media forms interact with one another. Rather than holding up as an ideal a unitary convergent work to which variants can be subordinated (for example, by considering a novel as the "real" work and a film based on the novel as a more or less faithful enactment of the original), this chapter argues that we should conceptualize texts as clustered in assemblages whose dynamics emerge from all the texts participating in the cluster, without privileging one text as more "original" than any other. To articulate this approach further, I compare and analyze the contrasting ideas of Jorge Borges, Warren Weaver, and Walter Benjamin toward linguistic translation.

Chapter 5 asks in what ways a text's existence as an electronic document matters, if its final output form is a print novel. Do the intervening stages, when the document consisted not of durable marks on paper but of flickering voltages in a digital computer, leave their mark on the visible surface of the print book? Although the question might be easily answered in the

affirmative for print books that use computer technology to create innovative typography and other visual effects difficult to achieve without a computer, more challenging are the far more numerous instances of books that are entirely conventional in appearance, such as Neal Stephenson's *Cryptonomicon*. In the admittedly somewhat idiosyncratic case of *Cryptonomicon*, written by a print author who is also a computer programmer, digital processes are deeply implicated in the text's construction and expressed through a subterranean narrative propelled by dialectical interactions between mutating terms. At issue in this subterranean narrative are tensions between figurative language and performative code, between hackers who yearn to make information free and capitalistic moguls who want to convert it into a market commodity. In the convoluted configurations the text assumes, it both mimics and obscures its relation to a digital computer, at once celebrating its form as a print book and suggesting that hidden within it is a powerful command core based on code. Intermediation here is figured as an engine driving narrative reconfigurations, deriving its motive force from complex feedback loops between language and code, print novels and computer programs.

Exploring the relation between fragmented subjects, multiple distributed authorship, and digital textuality, chapter 6 builds on the argument of chapter 2 that code goes farther in the direction of "making discrete" than speech and writing. Locating this electronic work in the context of Mark Rose's analysis of copyright battles in the eighteenth century, this chapter uses his conclusions, specifically the links he establishes between the literary work as intellectual property and the liberal humanist subject, as the backdrop against which Shelley Jackson's *Patchwork Girl* (1995) can be seen as a contestation of the ideology implicit in the print novel as a literary form. Pushing toward new forms of subjectivity even as it enacts different kinds of textual configurations, *Patchwork Girl* both reinscribes the print novel and uses this reinscription to invent a form suitable for digital media. For the principal narrator, subjectivity cannot be separated from the digital technology that produces the work, leading to speculation about what it might mean to be a digital rather than analog subject. Intermediation here manifests itself in a complex entanglement of print and electronic text, continuous and discrete consciousness, language and code.

Part 3, "Transmitting: Analog and Digital," takes up the distinction between the analog and digital, specifically with reference to its implications for subjectivity. Chapter 7 focuses on the intermediation between analog consciousness and digital program within a single creature; chapter 8 explores the dynamics between digital creatures living in computers and hu-

mans interacting with them; and chapter 9 takes up the highly speculative “postbiological” future when humans make digital computerized Copies of themselves that live in computers. As the ramifications broaden, at issue are the feedback loops not only between computation and human consciousness but also between human consciousness and the nature of reality, envisioned as the result of computational processes. In a recursive loop appropriate to intermediation, the epilogue cycles back to reconsider in a new light the issues raised in the first chapter, rethinking computation and embodiment not as opposed visions of a posthuman future but as intermediating modalities, both of which are crucial to the human world in the present.

As all of these chapters illustrate, making, storing, and transmitting are not so much distinct arenas of interaction as they are different analytical slices through the multidimensional dynamics of intermediation. The implications for rethinking digital subjects and literary texts are extensive and include: understanding how the worldview of code is positioned in relation to the worldviews of speech and writing; forging new ways to think about the foundational terms “work,” “text,” and “document”; recognizing the different ways in which print and electronic texts mobilize the processes that produce them; and exploring how computer simulations may be related to human subjectivity and consciousness. The intermediating processes that I partially and incompletely describe are operating in the contemporary moment to challenge received ideas about language, subjectivity, literary objects, and textuality, including both print and electronic forms. If nothing else, I hope this book will convince you that literary and cultural critics steeped in the print tradition cannot simply continue with business as usual. Needed are new theoretical frameworks for understanding the relation of language and code; new strategies for making, reading, and interpreting texts; new modes of thinking about the material instantiation of texts in different media; and new ways to put together scientific research with cultural and literary theory. Rethinking digital subjects and literary texts as intermediation will not be accomplished in a single moment or by any one person. It is necessarily a collective and ongoing enterprise, to which I hope this book contributes.

