> COMPUTATIONAL POETICS

An Introduction

As I write these introductory remarks, a ceiling-mounted smoke detector in my kitchen emits a loud noise every three minutes or so. A pleasant female voice also announces, "Low battery." This is, I learn, a precaution stipulated by the U.S. National Fire Alarm Code (NFPA 72), §11.6.6 (2013). The clause requiring a "distinctive audible trouble signal before the battery is incapable of operating" is encoded into the device. The smoke detector literally embodies that piece of legislation in its circuitry. We thus obtain a condition where two meanings of code—as governance and as machine instruction—coincide. Code equals code.

I am at home, but I also receive an alarm notification on my mobile phone. Along with monitoring apps that help make my home "smarter," the phone contains most of my library. I often pick it up to read a book. The phrase "reading a book," however, obscures a number of metaphors for a series of odd actions. The "book" is a small, thin black rectangle: three inches wide, five inches tall, and barely a few millimeters thick. A slab of polished glass covers the front of the device, where the tiny eyes of a camera and a light sensor also protrude. On the back, made of smooth soft plastic, we find another, larger camera. At the foot of the device, a grid of small perforations indicates breathing room for a speaker and several microphones. To "open" a book, I touch the glass. The machine recognizes my fingerprint. I then tap and poke at the surface until I find a small image that represents both my library and my bookstore, where I can "buy" and

"borrow" books. However, buying or borrowing books does not involve the possession of physical objects. Rather, I agree to a license that grants limited access to data, which the software then assembles into something resembling a book on-screen. I tap again to begin reading. The screen dims to match room ambiance as it fills up with words. A passage on the first page appears underlined: other readers in my social circle must have found it notable. I swipe across the glass surface to turn a "page." The device emits a muffled rustle to reinforce the pretense of manipulating paper. The image curls ever so slightly as another "page" slides into view. My tiny library metaphor contains hundreds of such page metaphors.

Despite appearances, this electronic metaphor-making device in my hand has more in common with smoke detectors than it does with the several paper volumes scattered on my desk. The electronic book and smoke alarm contain printed circuit boards, capacitors, and resistors. Both draw electric current. Both require firmware updates, and both are governed by codes, political and computational. Smoke alarms and mobile phones connect to the Internet. They communicate with distant data centers and with each other. Yet I continue to "read" these devices as though they are familiar, immutable, and passive objects: just books. I think of them as intimate artifacts, friends even, wholly known to me, comforting, and warm. The electronic book is none of those things. Besides prose, it keeps my memories, pictures, words, sounds, and thoughts. It records my reading, sleeping, and consumption habits. It tries to sell me things, showing me advertisements for cars, jewelry, and pills. It comes with a manual and terms of service. It is my confidant, my dealer, my spy.

Plain Text concerns the nature of digital inscription, the material trace that gives rise to textual phenomena and, more broadly, to all cultural artifacts in which computers mediate. We—readers, writers, interpreters—find ourselves today in an unprecedented, since the Middle Ages, position of selective *asemiosis*: the loss of signification.[1] Many contemporary texts, such as poems inscribed into bacteria and encrypted software, exist simply beyond the reach of human senses.[2] Other forms of writing are illegible by design, in ways that prevent access or comprehension. Increasingly, we write not in the sense of making marks on paper but in simulation. Key presses leave lasting traces in computer memory, which then appear on-screen redoubled and ephemeral. On disk, marks endure in a form legible only to those who possess the specialized tools and training necessary to decipher them.

I appeal to the idea of plain text in the title of this book to signal an affinity with a particular mode of computational meaning making. Plain text identifies a file format and a frame of mind. As a file format, it contains nothing but a "pure sequence of character codes." Plain text stands in opposition to "fancy text," that is, "text representation consisting of plain text plus added information."[3] In the tradition of American textual criticism, plain text alludes to an editorial method of text transcription that is both "faithful to the text of its source" and is "easier to read than the original document."[4] Combining these two traditions, I mean to build a case for a kind of a systematic minimalism when it comes to our use of computers, a minimalism that privileges access to source materials, ensuring legibility and comprehension. I do so in contrast to other available modes of human–computer interaction, which instead maximize system-centric ideals such as efficiency, speed, performance, or security.

The title of this book further identifies an interpretive stance that one can assume in relation to the making and unmaking of literary artifacts. Besides visible content, all contemporary documents carry with them a layer of hidden information. Originally used for typesetting, this layer affects more than innocuous document attributes such as font size or line spacing. Increasingly, devices that mediate literary activity also embody governing structures. For example, the Digital Millennium Copyright Act, passed in the United States in 1996, goes beyond written injunction to require in some cases the management of digital rights at the level of hardware. An electronic book governed by digital rights may subsequently prevent readers from copying or sharing stored content, even for the purposes of academic study.[5] In other contexts a device may monitor and report on reader activity.

Machine instruction thus embodies new forms of technological control. To speak truth to power—to retain a civic potential for critique—we must therefore perceive the mechanisms of its codification. Critical theory cannot otherwise endure apart from material contexts of textual production, which today emanate from the fields of computer science and software engineering. Conversely, a tighter coupling with the critical tradition can reveal technology's often occluded political implications. For example, creating a novel algorithm that predicts crime by analyzing one's reading habits also invites the dystopian possibility of thought policing, unless, that is, such algorithms remain legible, in public view, and under continual counterscrutiny. A vibrant discursive practice of textual exegesis is crucial for the preservation of whatever ideals that demand a literate populace.

THESIS AND ARCHIVE

Plain Text is a response to a particular situation of a literary scholar encountering the field of software engineering. For a long stretch of my professional life, these two areas of activity remained separate. I worked at one and studied the other. At the time, I simply did not think that code had much to do with poetry. Initially, my two selves—the scholar and the engineer—spoke different languages. Reconciling them was and continues to be a disconcerting process by which things dear and familiar to me in both worlds grew strange and unfamiliar, showing themselves to be sometimes less than and sometimes more than I comfortably expected. Nothing could be assumed from the start. Field-specific language, down to its foundations, had to be examined for hidden assumptions that prevented dialogue. With time, I saw that code and poetry have much to do with one another. Writing this book has taught me to embrace the remaining incongruence.

The idea for *Plain Text* came in a moment of realization after I was asked one of those seemingly naïve but fundamental questions that can set research in motion down a long and winding path.

A childhood friend who shares a love for reading asked why he could not lend me a digital copy of the novel that he recently purchased from a major online retailer.[6] In my struggle to answer, I realized that some of my deepest intuitions about literature relied on assumptions firmly attached to print media. Despite my professional experience as a programmer and my academic training in literary studies, I could not readily explain the mechanisms by which electromagnetic charges transformed into pixels and pixels into words. Where to begin? To recount the passage of digital text one has to know something about chip architecture, operating systems, file permissions, networking, and encryption. I could describe parts of that system, but my knowledge was also riddled with unexamined gaps. It did not amount to a coherent story.

Worse yet, it quickly became apparent that these technical details affect all higher-level interpretive activity. To read together—to form a shared understanding of a text—we have to convene on the same page, which was made difficult in my friend's case by imposed geographic restrictions. The text changed as it passed hands. I had to draw on philology and sociology of literature to reflect on textual variants, recensions, and authorship attribution. Digital text is more obviously entwined with its reception history: reader reviews and algorithmic recommendation engines. Despite the new purchase, my

friend's electronic copy of the text was already marked and highlighted. It was synchronized with other media: audiobooks and related television promotions. The work was preprocessed, in both the technical and the social senses of the word, to privilege certain meanings and modes of comprehension.

The task of coming to terms with these emergent contingencies entails an expansive research program, which can be commenced here only in part. The digital literary ecosystem is evolving rapidly. A historical approach to its development extrapolates its trajectory into the future. Crucially, digital knowledge ecologies are only just coming into being; they are still pliable, still in their formative state. Their cultural importance necessitates active commentary and experimentation. Without it, we risk the dominion of what Langdon Winner has called autonomous technology, a condition by which complex systems begin to irrevocably determine our politics. "Modern people have filled the world with the most remarkable array of contrivances," Winner wrote. We are then surprised to find them resistant to change. "The human kind faces a woefully permanent bondage to the power of its own inventions," he concluded. And I hope, along with him, that it is still possible to "reconsider and reconstruct" those outcrops that in retrospect impoverish culture, to "learn and start again," and to retain the "prospect of liberation."[7]

To these ends, *Plain Text* tells a story of a major morphological shift affecting cultural production, particularly as it relates to the mechanics of reading and writing. Were I to interrupt a digital typist to ask, "Where do these words reside?" I would likely receive several conflicting answers in response. In some sense, the words are on-screen, where they can be viewed. In another sense, they are somewhere within the machine, on remote and hermeneutically sealed surfaces: silicon chips, hard drives, flash memory cards. In yet another sense, visible signs are still further removed from the contexts of their production. The word is in the wires. It spreads across servers, routers, and data centers. What was once apparent takes on a more complex structure, stretched across planes and temporalities. The book—this book, any book—gains a new shape. Digital texts form a live lattice, a multidimensional grid, that connects a letter's tactile response at one's fingertips to its optic and electromagnetic traces. In aggregate, these *textual laminates* incorporate the scaffolding of synthetic inscription. I cannot consequently pass a digital note to another person in the same sense that one passes notes in class, on paper. It is impossible to give the entire structure over. Text is irrevocably intertwined with its stratified material contexts. It means—

it becomes—something else when recreated under conditions that are not fully congruent to my own.

Much contemporary anxiety about the intrusion of computational culture into the everyday can be traced to such fundamental reshaping of the sign. Its fracture leads to its multivalence. The lattice expands into spaces between signs, where forces of capital and control intervene to monitor and monetize.[8] Reading and writing are no longer solitary activities. Who shares the page? What entities contest newly found space bearing digital inscription? The answers lie in our ability to perceive latent topographies.

Reflecting on the development of Morse code in 1949 in the *Proceedings of the American Philosophical Society*, Frank Halstead mentioned the difficulty of finding a home in either the arts or sciences for what he called code development: "It is a matter somewhat related to the general art of cryptology, yet it is not wholly divorced from electrical engineering nor from general philology."[9] As Halstead anticipated, research into codification would lead to a rich multidisciplinary archive of materials on the history of literary theory, semiotics, telegraphy, and electrical engineering from the mid-nineteenth century to the end of the twentieth century. That archive includes patents and technical manuals, formalist manifestos, studies of animal communication, human–computer interaction textbooks, and foundational texts in aesthetics and literary theory.

I deploy the archive to argue that extant theories of interpretation evolved under conditions tied to static print media. By contrast, digital texts change dynamically to suit their readers, political contexts, and geographies. Consequently, I advocate for the development of *computational poetics*: a strategy of interpretation capable of reaching past surface content to reveal platforms and infrastructures that stage the construction of meaning. Where "distant reading" and cultural analytics perceive patterns across large-scale corpora, computational poetics breaks textuality down into its minute constituent components. It is a strategy of microanalysis rather than macroanalysis.[10]

In *Plain Text* I also argue that some of the ideological afflictions of the contemporary public sphere (e.g., the acquiescence to routine surveillance and censorship) relate to our failure as readers and writers to come to terms with the changing material conditions of digital text. A society that cares about the long-term preservation of complex discursive formations, such as free speech, privacy, or online deliberation, would do well to heed the textual building blocks at their base. The structure of discursive

formations (documents and narratives) has long been at the center of both computer science and literary theory. By using primary sources from both disciplines, in *Plain Text* I uncover the shared history of literary machines, bringing computation closer to its humanistic roots and the humanities closer to their computational realities.

I make a historical case for the recovery of textual thought that is latent in the machinery of contemporary computing. Just as literary scholarship cannot survive without awareness of its computational present, the design of computational platforms cannot advance without greater awareness of its cultural contexts. The political struggle for meaning making, the very opportunity to engage in the act of interpretation, thus begins and ends with the material affordances of the epistemic artifact.[11]

The future of reading and writing is inexorably intertwined with the development of computer science and software engineering. Even if you are not reading these words on a screen, my message has reached you through a long chain of machine-mediated transformations: from the mechanical action of the keyboard on which I typed my manuscript, to the arrangement of electrons on magnetic storage media, the modulation of fiber-optic signal, the shimmer of the flowing liquid crystal display rendering the text, and on to the typesetter's shop and the printing press. Computation occupies the space between keyboard and screen, which in turn gives rise to higher-order cultural institutions: from social media platforms to massive shared archives. Cultural techniques that guide our use of such technologies are formative of the society as a whole.[12] Daily choices such as choosing a text editor, a filing system, or a social networking platform cannot therefore be addressed in shallow instrumental, system-centric ideals. Complex computational systems do not give rise to ideals any more than financial markets do. From the many available visions of human–computer interaction, I argue for choosing ones that align with a humanist ethos, whatever the reader's politics.

THEORY

Displacement

Plain Text is ultimately an exploration of textual space.[13] I am thus inherently concerned with the dynamics of settlement and displacement, which frame my historical argument and form its theoretical underpinnings.

I mean "settlement" in the way one lives among and within one's own notebooks, bookshelves, and archives. Smart toasters and electronic heart

valves differ from their dumb mechanical counterparts in that they similarly give grounds to inscription. Computers perform reading and writing operations at scale. To support that activity, engineers necessarily create vast, in terms of information capacity, expanses. Commercial, private, and public interests rush in to colonize newly opened territories. Boundaries are drawn. Areas of exclusion are created, even in our most intimate spaces: bedsides, living rooms, kitchens, the body and the mind. A diabetic is not able to modify her insulin pump software; the smart television contains proprietary firmware that is controlled at a distance and without explicit consent. The struggle is not one for virtual but for concrete grounds for inscription.

These intimate territories are remote, however, in that they unfold at quantum scale. Individuals who are not privy to the mechanics of micro-molecular writing are hence in peril of unprecedented dispossession. I am concerned here with our basic ability to shape discourse—to read and write—along surfaces that are not available for immediate scrutiny. Poetics—the affordance of literary space—physically limits the possibility of interpretation. An illegible sign is one that never enters the hermeneutic circuit.

In making the case for a computational poetics, I am helped by recent scholarship in the historically and philosophically inflected studies of media and technology.[14] My notion of poetics also builds on the long history of literary theory, in the genealogy of formalist and structuralist schools. My approach is not limited, however, to the canonical, straight-ahead structuralisms of Roman Jakobson or Jonathan Culler. Rather, I am borrowing from a more peripheral tradition represented best by such third-culture thinkers as Viktor Shklovsky and Vilém Flusser, consummate immigrants both, who extracted a methodology out of the fabric of their displacement.

Flusser in particular considered the condition of unease that comes with migration, both physical and mental, to be a kind of information processing. His thought was influential in making sense of my own displacements, first as a refugee fleeing the dissolution of the former Soviet Union, next as a transplant into Silicon Valley from a strict literary education, and now as a lapsed engineer among humanists. These vantage points offer a singular view onto the material conditions of contemporary intellectual life.

Both Shklovsky and Flusser wrote lucidly about the dynamics of settlement. Their work sheds light on an irresistible compromise at the core of all technology by which we trade critical understanding for comfort. Habit

covers the various homes we make for ourselves in the world "like a fluffy blanket," Flusser wrote. "It smoothes the sharp edges of all phenomena that it covers, so that I no longer bump against them, but I am able to make use of them blindly."[15] When we sit at our desks, for example, we fail to see "papers and books that are lying all about."[16] We are used to them being there as they are. We do not, therefore, parse them as information. Like water that surrounds fish, habituated things pass into the background of experience. Mediums become media. They cease producing meaning, become stages for meaning making, and like a stage disappear from view.

Losing sight of the material contexts of knowledge production is politically perilous, because those who own the contexts set the terms of engagement. Estrangement arrests material concealment. Exile allows the displaced to once again transform habituated media into meaningful information. In exile, "everything is unusual," Flusser wrote.[17] Migrants experience the world as ex-perience (*er-fahrung*, literally "a driving out"). Discovery, Flusser concluded, "begins as soon as the blanket is pulled away," where familiar objects can pass into view again.[18]

To take a simple example, one could write "a field of study" without much thought about figurative space. Shklovsky would have readers pause to consider the implications.[19] In what sense do ideas resemble (or not) a field? A poet could take things further and elaborate: "to scythe a verdant field of literary study." The verb (to scythe) and the adjective (verdant) create an unexpected transference of new qualities not present in the original image (intellectual field). These qualities overdetermine or saturate the metaphor, exposing its conceit. One can do to fields of grass what one cannot to ideas. Subsequently, we realize that the two domains, intellectual and horticultural, do not map onto each other perfectly; they leave a semantic remainder, the chaff. Readers discover intellectual "fields" for what they are: habituated metaphors, neither natural nor self-apparent. Metaphors are made strange again through purposeful defamiliarization. To take the technique to its logical conclusion, a writer could depict several fictional characters in the act of scything a field of grass while discussing the relative merits of structuralism: a discussion about the field on a field. Such literary artifice would make actual the implied connections between fields of grass and ideas. The writer shows what was merely told before. The technique of defamiliarization renews the figure: discarding hardened clichés while suggesting novel linkages between constituent concepts—ideational chaff, leaves of mental grass, combines of thought.

I would like to effect a similar sense of estrangement when it comes to our use of technology. The formalists understood habituated metaphors to lessen the vitality of experience. Shklovsky quotes from the diaries of Lev Tolstoy, who, while dusting his room, could not remember if he had already dusted his sofa. Tolstoy wrote, "Because actions like these are habituated and unconscious, I could not remember . . . whether I dusted and forgot or just did so without thinking—it was as if the action never happened. . . . Thus when life passes without conscious reflection, it passes as if one has not lived at all."[20] Shklovsky added that life so habituated disappears into nothingness when the automatization of experience "consumes things, clothing, furniture, your spouse, and the fear of war."[21]

The formalists rarely quoted Marx directly. Yet Marx resonates throughout. For Marx, dead metaphors marked alienation from humanity.[22] The point at which material artifacts disappear from consciousness is also one where they appear within the social sphere as fetishes.

Shklovsky changed Marx's German *Entfremdung* (alienation), which for Marx always denied life, into the Russian *ostranenie* (estrangement), literally an "othering," of the kind that affirms it. The difference is one of agency. In the first case, subjects are treated like objects by others. In the second, subjects recognize and reject the objectified other within. Formalist estrangement, which is sometimes also translated as defamiliarization, arrests the momentum of tacitly received habit. Once estranged and extracted like a splinter, ossified experience can be revitalized.

Our challenge today is to uproot ourselves from the comforts that rapidly descend on the dwellings of our intellectual life. By dulling the senses, seemingly inconspicuous conduits of agency—electronic books and smart desks—acquire a sense of intelligence of their own. Devices that "watch," "hear," "see," and "think" give rise to object-oriented ontology and the Internet of Things. A new generation of objects clamors for participatory intelligence. They claim space in the home, near heart and hearth. Smart phones, smart lightbulbs, smart thermostats, smart homes, and smart watches enter the networked public sphere in the role of independent agents.[23] A conversation begins about their personhood: their levels of trust, friendships, rights, and accountability.[24] Marx's table that "evolves out of its wooden brain grotesque ideas" becomes Microsoft Surface and PixelSense, that is, actual smart tables, intellect itself, commodified.[25]

If we hope to understand digital culture and especially literature "under

conditions of high technology," as Friedrich Kittler would write, we can do so only from the position of humanism. One cannot otherwise lament the systematic erasure of the human from the literary process and, at the same time, advocate for a post- or antihumanism. Unlike Kittler, who wrote that under conditions of high technology "literature has nothing more to say," I believe that literature and literary analysis continue to have a voice in contemporary life.[26] Technology does not—cannot be allowed to—determine literary silence. Rather, as the material grounds for all reflective textual activity recede from view, readers face the prospect of selective illiteracy.[27] The command of technologies such as networking and encryption separates those able to read and write under conditions of high technology from those who no longer are, which is another dispossession.

When we mistake things for animate actors, we further diminish our capacity for critical analysis or collective action. Objects that surround us log our reading habits, social interactions, and intimate conversations. Agents that benefit from trade in such personal data are neither cyborgs nor posthuman assemblages. The bargain that trades critical understanding for comfort benefits specific individual interests. To address objects as though they could respond in kind shifts our attention from seats of power to things powerless, inarticulate, and indifferent to our protestations. One can no more extract justice from a smart desk than hold a bureaucracy accountable. Notions of justice and accountability presuppose a robust model of agency, which is absent in the assemblage.

The internal exile that we must undergo for smart books and smart desks to come into view cannot compare in difficulty to the experience of physical displacement that follows natural disaster, war, poverty, or political instability. Yet our systematic reluctance to take on even those small intellectual discomforts that could lead to acts of localized dissent and disobedience—to write using free software, build open archives, or share memories in private—cannot be said to exist outside complex systems that perpetuate inequity and violence globally. The emotional affirmation that accompanies exuberant technesis (e.g., the ecstasy of constant communication) brings with it governing structures invoked in the name of law enforcement and national security. Comfort and security constitute the same ill-conceived bargain that leads to critical disempowerment. But where it is difficult to imagine or to enact strategies of digital disobedience on a universal scale, we can begin to address them through numerous minute local transactions

that in aggregate brace everyday literary exchange. This we can do here and now. Computational poetics begins with machines in our immediate proximity, closest to thought and touch.

Picking up an electronic book and taking it apart may be against the law in some jurisdictions.[28] Given the extent to which emergent thought things—epistemic artifacts such as electronic books and smart phones—participate actively in the production of meaning, we can no longer use strategies of interpretation at the level of ideology or representation alone.[29] The praxis of close reading must reach down to the silicon bedrock: material entities and physical structures that bear the weight of interpretation. Literary theory, a discipline fundamentally engaged in the exegesis of figurative trope, is therefore crucial to the understanding of new computational environments, which have enveloped intellectual life through metaphoric substitution. To read the machine is to learn how it is made, but it is also to unpack the rich metaphors that guide our tactical engagement with the word: the boot in rebooting, the wares in software, the bug and the joystick, the interpreter and the shell.

Settlement

Estrangement cannot be practiced effectively in monologue. To produce meaning, Flusser reminds us, it needs to become a dialogical, dialectical practice. Perpetual exile is otherwise uninhabitable.[30] Without the shelter of one's home, everything turns to noise. Information cannot exist without dwelling, "and without information, in a chaotic world, one can neither feel nor think nor act," Flusser wrote.[31] Estrangement thrusts the displaced into the chaos of unsettled existence. With time, they make a new home, from which they can once again "receive noise as information" and produce meaning: "I am embedded in the familiar so that I can reach out toward the unfamiliar and create things yet unknown."[32] A dialectics of exile leads to "informed renewal" of shared space, through what Flusser called a creative dialogue between the settled and the displaced.[33]

In *Plain Text* I thus model the reciprocal movement to "making strange" on the diverse practices of reverse engineering. Similar in method to what Matthew Kirschenbaum called forensic argumentation, reverse engineering recalls the formalist strategy of structural decomposition.[34] The function of case studies in an engineer's education, as Henry Petroski explained in his *Invention by Design*, is to understand the ways by which one gets "from thought to thing."[35] From thought to thing would be an apt definition of

poetics and an alternative subtitle to this book. Along with literary and historical exposition, each of my chapters contains at least one literary thought thing. Each enacts a deconstruction—a literal taking apart—of that device. A reification of the ideal, the epistemic object is meant to augment and refine theory.

The reverse engineering of literary devices reveals that not all texts are created equal. In print, traditional distinctions between form and content lie flat. A printing press embeds ink into paper, leaving no space between type and page. Materially minded critics such as Johanna Drucker, Katherine Hayles, and Jerome McGann have urged literary scholars to reevaluate textuality in its media-specific contexts.[36] Their work reminds us that the flatness of digital text is an illusion. Low-level operational intuitions that govern textuality—ideas about form, content, style, letter, and word—change profoundly as texts shift their confines from paper to pixel.

A substantial gap separates visible text from its storage medium. The two sites of inscription, screen and electromagnetic storage, are physically incongruent. One must be translated, transformed into the other. Control codes govern the process of transfiguration, which brings with it physical control at the level of platform and architecture. This is a layer where, for example, we can find spyware and censorship filters, digital rights management, and advertisement delivery.

I propose to begin, then, with this obvious sense of difference between paper and pixel: Where print is governed by law from without (think, for example, of England's Obscene Publication Acts), digital text is governed by code from within.[37] I go further than others to maintain that digital text *is* code, in the sense that it is always parsed and potentially executable.[38] Control binds to content inextricably to become an organ in the same unified corpus.

Changing material conditions of textual transmission alter the theoretical vocabulary of literary criticism. The ease with which some digital texts can be reproduced, for example, has the unexpected effect of destabilizing the material bases for authorship attribution. Text that is easy to copy is easy to cite or plagiarize. The physically diminished notion of authorship makes certain ways of talking about such constructs as authorial intent and fidelity to the original difficult to sustain. Practices of collaborative and machine-assisted writing (e.g., Wikipedia, automatic news summarization) further erode notions of authorship based on individual genius.

The author is not dead, however; authors continue to live and collect royalties.[39] Autopoiesis (literature writing or discourse speaking itself) does not displace the social institution of authorship.[40] Codification merely makes the flows of poiesis less apparent. Although it is difficult to find specific parties responsible for massive spam campaigns or to credit individual Wikipedia writers, spammers do routinely find themselves in court just as notable Wikipedia contributors receive "barn stars" in recognition of their efforts.

Extant models of literary transmission assume movement through passive and immutable media. Paper constitutes the document of record, which, once archived, does not change its contents. Philological techniques like genetic criticism and forensic reading make it possible to reconstruct if not authorial intent, then at least a trace of an author's hand. In some cases—think manuscripts and folios—we may even ascribe properties such as fidelity to original works of art. When media are immutable, one imagines a causal chain of custody between works and their creators, who at some point must have occupied the same contiguous time and space: The closer a parchment to Shakespeare, the higher its evidentiary (and market) value.

The transition between the Gutenberg press and Project Gutenberg, an online library containing thousands of texts, complicates the linkage. Unlike pen and paper, which come in direct contact with each other during writing, the bridge between keyboard and screen passes through multiple mediating filters. Writing itself becomes a programmed experience. We do not write on-screen in the conventional sense of etching marks into a static host. The act is a simulation displaced in time and space. We neither immediately touch nor see the textual conduit. The visible does not correspond to the actual. An erased word on paper, for example, implies the physical destruction of ink. By contrast, a simulated digital erasure, of the kind that happens when a writer presses the backspace key, does not necessarily correspond to the erasure of content on disk. The "erased" word could persist and even multiply across other storage drives and devices. Erasure in that sense no longer nullifies; it bears witness. It can be used to train algorithms or indicate the intent to conceal. The changing materialities of digital inscription thus ultimately entail wide-ranging political consequences.

The illusory affordances of the fractured sign, as described, require a poetics capable of reconstructing a sequence of willful delegation: from thought—someone's thought—to thing. A discipline of close attention to the minute particulars of encoding, transmission, storage, and the decoding of

texts reclaims a measure of intent and thereby authorial responsibility. In many cases we may not care to speak of it. One would hardly find Tolstoy at fault for his *War and Peace*. In other contexts, as when unsolicited advertisements clutter bandwidth to the exclusion of other forms of speech, we must.

This may seem strange at first: to recover the subject in the physical minutiae of the encounter between text and machine. The point of contact between human, text, and device is significant because it is in the liminal zone of semiotic exchange where subjects disappear into machines and where machines step forth as animated and seemingly intelligent actors. Our ability to apprehend the politics of smart objects depends on the formulation of their poetics: how they are made.

METHOD

> We cannot separate the two things: head and hand. . . . The science of life . . . is a superb and dazzlingly lighted hall which may be reached only by passing through a long and ghastly kitchen. . . . We shall reach really fruitful and luminous generalizations about vital phenomena only in so far as we ourselves experiment and, in hospitals, amphitheaters, or laboratories, stir the fetid or throbbing ground of life.[41]

My approach to writing *Plain Text* stems from the desire to enact theory capable of addressing the grim picture Friedrich Kittler painted at the end of his influential monograph *Gramophone, Film, Typewriter*.[42] By all accounts, Kittler was neither a technological romantic nor a Luddite. I hence understand his *Gramophone, Film, Typewriter* as a call to action. When Kittler wrote that "media determine our situation," he challenged his readers to choose between complicity and defiance.[43] It was not a statement of fact but the articulation of a question: What can one do to counteract technological determinism? In what follows, I outline several intellectual lineages—materialist, pragmatist, and experimental—that frame my answer.

Critical theory at its best aims to see "the human bottom of nonhuman things."[44] As such, it is one of our most powerful tools for analysis and resistance against technological determinism. Max Horkheimer wrote that the issue "is not simply the theory of emancipation; it is the practice of it as well."[45] My thought and practice is inspired by scholars of media and technology (Bernard Stiegler, Christina Dunbar-Hester, Tiziana Terranova, and Lilly Irani among others) who have turned the tools of critical theory toward the instrumental contexts of knowledge production.[46] I join them to argue that in

treating the instruments of intellectual production uncritically, all of us, readers and writers, accumulate a debt that accrues both technical and ethical interest. It is one thing, for instance, to theorize about the free movement of literary tropes across cultures and continents and quite another to have that theory appear in print behind paywalls inaccessible to most global reading publics.[47] Similarly, a theoretical distinction between form and content, when instantiated in specific file formats such as Microsoft Word (docx) or Adobe Reader (pdf), establishes divisions of labor between editors, booksellers, and offshore typesetting firms.[48] One group trades content in an economy of prestige, another controls distribution for corporate profit in a market economy, and yet another labors invisibly on formatting in an economy of survival. Distinctions of labor persevere so long as theory persists in the abstract. A materialist critique cannot achieve its stated aims without purchase on the material world. Contemporary knowledge workers stare into rectangular black boxes for a considerable part of their days, suspecting, in the absence of other feedback, that their gaze is met in bad faith. Bad faith points to a misalignment between thought and action.[49]

Connecting theories of meaning making to their practice offers a way out of the conundrum. The solution to connect meaning with operational meaning thus belongs equally to a species of pragmatism, as it does to critical theory. William James articulated the approach concisely when he wrote that "reality is seen to be grounded in a perfect jungle of concrete expediencies."[50] For James and other pragmatists, truth could not be found outside that jungle, in the abstract. It always entailed real consequences, causes, and effects.[51] In his essay "Pragmatism's Conception of Truth," James asked, "How will the truth be realized? . . . What concrete difference will its being true make in anyone's actual life? . . . What experiences will be different from those which would obtain if the belief were false?"[52] Frank Ramsey, the young British philosopher close to Ludwig Wittgenstein, would later write in a similar vein about meaning "defined by reference to the actions."[53]

For a pragmatist, truth-carrying propositions of the shape "*X* is *Y*" (as in "the author is dead" or "art is transcendent") raise the questions of where, when, for whom, and what is at stake in maintaining that? Following the pragmatic insight of James and Ramsey, I proceed with the conviction that abstract categories such as literature, computation, and text cannot possibly be reduced to a number of essential structural features. Rather, to borrow from Wittgenstein's *Philosophic Investigations*, categories denote a set

of related practices that share some familial characteristics.[54] In our case, imagine a tree diagram in which the branches of computation and textuality intersect and diverge in ways that we have yet to untangle.

In an approach to *doing* theory, *Plain Text* joins the experimental turn steering the academy toward critical practice, especially in fields long dominated by purely speculative thought. The experimental turn represents a generation's dissatisfaction with armchair philosophizing. Recall the burning armchair, the symbol of the experimental philosophy movement. Joshua Knobe and Shaun Nichols, some of the early proponents of the movement, explain that "many of the deepest questions of philosophy can only be properly addressed by immersing oneself in the messy, contingent, highly variable truths about how human beings really are."[55] The emergence of spaces where research in the humanities is done exemplifies the same trend. In naming the locations of their practice "laboratories," "studios," and "workshops," humanists reach for new metaphors of labor. These metaphors aim to reorganize the relationship between body, space, artifact, knowledge, and inscription. In my lab and elsewhere, researchers have taken to calling this approach the experimental humanities.

As an example of what I have been calling here the experimental turn in the field of early modern history, consider the preface to the recent volume *Ways of Making and Knowing*, edited by Pamela Smith, Amy Meyers, and Harold Cook. They write that the "history of science is not a history of concepts, or at least not that alone, but a history of the making and using of objects to understand the world."[56] Smith translates that insight in her laboratory, where, together with students, she bakes bread and smelts iron to recreate long-lost artisanal techniques. For those who experiment, book knowledge and artifactual knowledge connect in practice.

Artifactual knowledge—from typesetting software to e-book readers and word processors—shapes our everyday encounter with literature. Such technologies should not be understood as value-neutral conduits of information. I follow Lewis Mumford and Langdon Winner to argue that technology affects the exercise of textual politics in subtle and profound ways.[57] Artifacts cannot hold beliefs about politics. Rather, political power is exercised through them. For example, stairs do not discriminate against the mobility impaired; the human failure to enforce accessibility through specific legal and architectural choices does. Typesetting software, e-book readers, and word processors similarly embody implicit communication models: ideas about deliberation,

ethics of labor, discursive values, and views about "natural" human aptitude for interpretation. The maker of the electronic book encodes how the book is sold and where, minimum and maximum font size, the visibility of marginal notation, the possibility of sharing, the availability of critical apparatus. Content in that sense is meant for further processing, in a way that maximizes its extracted value. Contemporary documents are capable of structuring the literary encounter to these ends according to a reader's economic status, gender, race, age, location, or physical ability.

To what extent does the book in front of you sanction access? Whatever the answer, a function of understanding the text includes an explication of its physical affordances. The experimental approach to reading enables critics to lay bare the device. A literary scholar's version of baking bread and smelting iron is to make literal the archaeology of media at the level of the mechanism. In *Plain Text* we will unearth and excavate textual machines. In practicing archaeology, I contend that cardinal literary-theoretical concepts, such as word, text, narrative, discourse, author, story, book, and archive, are thoroughly enmeshed in the underlying physical substratum of paper and pixel. It follows that any attempt to articulate the idea cannot attain its full expressive potential without a thick description of its base particulates.

Luckily for us, reading and writing are not esoteric activities. They are readily available for introspection. I therefore occasionally encourage readers to encounter the immediate contexts of their reading anew: to put down the book or to lean away from a screen and to look at these textual artifacts with strange eyes. In this movement of the body, I want to disrupt the mind's habituated intuitions, pitting them against knowledge at hand and fingertip knowledge, as when ruffling through the pages or typing at a keyboard. How ephemeral is an electronic text, for example? The pragmatic answer lies not in reductive universal propositions—very or not at all—but in contingent technological affordances attached to specific reading devices. What can a reader do with this text, here and now? Where is it stored? Are readers given dispensation to copy and paste? Do they have legal permission to quote at length, to perform publicly, or to otherwise transmediate? Will this text disappear when its reader closes the book's cover?

PLAN OF THE PRESENT WORK

The pathways of inscription winding their way through the device exist in relation to distinct communities of computational practice. A researcher cannot

for this reason expect to discover a single theoretical framework that captures the complexity of digital text in motion. An engineer's use of the words *code* and *poetry* differs from that of a poet's. The changing contexts evoke a corresponding shift in operational definitions. This book is thus neither a total history of modern computing nor a survey of literary theory. Rather, the argument herein progresses from the action of the alphanumerical keyboard switch, through copper and silicon, to liquid crystal and the floating gate, and on toward the reader and the community. It is but one of many possible passes through a cavernous black box.

The first chapter begins with a question: What does it mean to turn a page when neither pages nor the action of turning them corresponds to the implied analogy? A close reading of the metaphor leads to an intellectual history of human–computer interaction. It progresses from the conversational programming school of design to the direct manipulation school, the latter shaped by theories from cognitive linguistics and immersive theater. The logic of directness culminates in the rapidly developing field of brain–computer interfaces. The chapter concludes with a moment of speculative formalism, in which I consider the possibility of affective literature that eschews language and representation.

At the core of the book's second chapter lies the notion of a modernist literary device, understood both as literary technique and thought experiment about intelligent machines, directly connected to the birth of modern computing. A section on literary technique in the work of Percy Lubbock, Walter Benjamin, and Mikhail Bakhtin opens the discussion. Materialist poetics rise concomitantly alongside a mechanistic, rule-based view of language. In this chapter I reconstruct a series of thought experiments first in the writing of Ludwig Wittgenstein and then in Alan Turing's seminal paper on an imaginary computer capable of reading and writing. The verbs *to read* and *to write* imply a type of cognitive processing. What does it mean to read and to write for a machine? What about broken mechanisms of comprehension? At once device and algorithm, the Turing machine blurs the boundaries between software and hardware, code and content, intelligence and its imitation.

In the third chapter the intellectual history of literary formalism collides with format theory found in both textual criticism and computer science. The concept of format, as I describe it, mediates between a text's intrinsic rules for construction and its extrinsic shape, transforming one type of structure (a series of bits arranged into tracks and sectors) into another (letters arranged

into sentences and paragraphs). A history of document formats illustrates the theoretical discussion. Formatting comes into being with several control characters, which are limited in function to actions such as carriage return and stop transmission. With time, formats encompass all manner of machine instruction, including technical means of enforcing digital rights management, copy protection, and other legal instruments. A manufacturer's ability to censor or to surveil digital text is thereby contained in the formatting layer: from electronic books that modify themselves to suit the reader's geographic location to smart contracts that contain the rules of their own execution.

The fourth chapter begins with an apparent paradox. A camp of media theorists and textual scholars in the 1990s conceived of electronic texts as a near immaterial phenomenon. Text shimmered and glared; it was discussed in terms of ephemera, hypertext, light writing, and electricity. A generation of theorists that came after insisted on the weighty materiality of electronic media. Reading began to engage the morphology of rare metals, media archaeology, hard-drive forensics. Both accounts, I argue, capture an aspect of the same underlying condition. The perceived image of an archived inscription splits from its source. The sign plausibly resides both on the screen and on the hard drive. It fractures in some real sense, diverging at the site of its projection from the site of the archive. Using materials from the history of telegraphy in the late nineteenth and early twentieth centuries, I chart the gradual fissure and ultimate illegibility of the newly composite sign. Marks made on punch cards and ticker tape protruded through the medium. Although difficult to read, these forms of machine writing were readily visible and therefore amenable to analysis. The advent of magnetic storage forced the composite inscription into an opaque conduit. Unable to perceive magnetic polarities without the aid of a machine, readers often manipulated text blindly. In this way a typist would type several sentences without seeing the printed output. The chapter identifies a milestone in the history of human textuality: the moment at which the inscription passed from view, giving rise to the sometimes conflicting but nevertheless consistent accounts of digital textuality.

The fifth and final chapter charts the emergence of screen reading. Screens restore a measure of visibility lost to electromagnetic inscription, with one major side effect: Fidelity between visible and archived inscription cannot be guaranteed. Screen reading further happens on screens that refresh themselves at a rate of about 60 cycles per second (Hertz). The digital word is technically an animation; it moves even as it appears

to stand still. This property attunes the reader to a particular mode of apprehension, affecting not just the physics but also the aesthetics of digital media. Works by philosophers Henri Bergson, John Haugeland, and Nelson Goodman construe a phenomenology of screen-based digital perception. The digital emerges not as a medium's intrinsic property but as a structure imposed from without. In the extreme, that means that a censored *electronic* text can appear in practice as a perfectly *analog* artifact, despite being digital in all other senses of the word. Conversely, texts in print are already born digital, in the sense that all literary works are already to some extent amenable to "reliable processes of copying and preservation."[58] Properties that make media digital or analog reveal themselves to be neither universal nor essential to the medium. The medium is not the message. As I argue in the conclusion of the chapter, reliability and preservation of textual copies may mean one thing to a literary scholar, another to a software engineer or a legal professional, and something entirely different to a librarian. It matters not what the text is but what we can do with it.

In a short conclusion I gesture toward the contemporary political consequences of the material covered, discussing also the possibility of machine phenomenology in relationship to humanism. Computational poetics, I maintain, encourages users to become active thinkers, tinkerers, and makers of technology. I further encourage those who may have considered themselves mere users of computation to apply the same critical acuity they employ in the close reading of prose and poetry to the understanding of code and machine. For text to render on-screen properly, it must be encoded or translated from machine-transmittable code into human-readable shape. Encoding constitutes a primitive field of textual activity—a system of semiotic exchange—visible at the crossroads of computer science and literary theory. Encoding finally matters because how texts are encoded, transmitted, and stored decides who gets to decode, receive, and revise.