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Heuristic Futures:

Reading the Digital Humanities through Science Fiction

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Abstract

This dissertation attempts to highlight the cultural relationship between the digital humanities and science fiction as fields of inquiry both engaged in the development of humanistic perspectives in increasingly global digital contexts. Through analysis of four American science fiction novels, the work is concerned with locating the genre's pedagogical value as a media form that helps us adapt to the digital present and orient us toward a digital future. Each novel presents a different facet of digital humanities practices and/or discourses that, I argue, effectively re-evaluate the humanities (particularly traditional literary studies and pedagogy) as a set of hybrid disciplines that leverage digital technologies and the sciences. In Pat Cadigan's *Synners* (1993), I explore issues of production, consumption, and collaboration, as well as the nature of embodied subjectivity, in a reality codified by the virtual. The chapters on Richard Powers' *Galatea 2.2* (1995) and Vernor Vinge's *Rainbows End* (2006) are concerned with the passing of traditional humanities practices and the evolution of the institutions they are predicated on (such as the library and the composition classroom) in the wake of the digital turn. In the final chapter, I consider Cory Doctorow's *Little Brother* (2008) as a digital call to arms that, through an impassioned portrayal of hacktivism and the struggle for digital privacy rights, rejects the invasive political laws established in the U.S. since 9/11 and enabled by digital technologies.

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Contents

"The future cannot be predicted, but futures can be invented."

— Dennis Gabor, *Inventing the Future*

Introduction

In the summer of 1984, William Gibson published his debut novel *Neuromancer* to widespread acclaim. Through its "synthesis of poetics, pop culture, and technology" (McCaffery, "Interview" 264), the work galvanized the cyberpunk aesthetic and tapped into a cultural zeitgeist on the verge of being transformed by human-computer interfaces. Its pervasive virtual reality network, the cyberspace of the matrix, provided a metaphor for emerging digital technologies that, according to Sadie Plant, positioned it as both "a fiction" and "another piece of the jigsaw that allowed these [technological] components to converge" (12). In this sense, the novel stands both as a time-specific commentary upon the evolving information age in which "immersive digital realities" were becoming "continuous with reality itself" (13), and as a navigational cultural artifact in the ongoing global transition from analogue to digital modes of thinking and being. According to Carlen Lavigne, cyberpunk's thematic unity resides in "noir-style narratives, techno-dystopian futures, and the sleek computerized aesthetics of the digital age." The first wave (of which Gibson's novel is a part) is "credited with revolutionizing science fiction and having a real impact on the development of the 'real world' technologies and software programs that were subsequently created by its tech-savvy fans" (1). As the genre's *de facto* representative, then, *Neuromancer* served as an important literary touchstone and cultural guide for a world lurching toward and increasingly defined by the digital.

But while the work is in many ways a self-fulfilling prophecy for the pervasive uptake of digital technologies, we might also see it as a kind of metanarrative for the birth and ancestry of the digital age itself. Gibson produced the manuscript for *Neuromancer* on a 1933 Hermes 2000 portable typewriter. If this fact seems surprising, it is surely because the narrative is so saturated with computer hackers, cyber-realities, posthuman biomechanical implants, artificial intelligences, and bleeding-edge computer jargon. After all, as Gibson has himself pointed out, though the typewriter is "often presented as evidence of [his] weird lotek [*sic*] eccentricity," few writers in the early eighties were using computers or "new-fangled 'word processer[s]'" ("Neurotyper").[1] The peculiar contrast between analogue writing tool and written content makes for an interesting historical and sociocultural analysis. In his *Matters of Gravity: Special Effects and Supermen in the 20th Century* (2003), Scott Bukatman spends an entire chapter on this very subject. "What emerges from a consideration of Gibson's typewriter," he suggests,

> are several overlapping tropes that tie cyberculture to its historical forbears. Reinstating the history of the typewriter indicates that *Neuromancer*'s disembodied informational cyberspaces are anticipated by the 'obsolescent' rhetorics and technologies of what Mark Twain, author of the first typewritten manuscript, once called 'machine culture' (34).

Gibson's typewriter, like all information technologies before and after, sits on this continuum of machine culture. That the artistic notion of cyberspace was created by an analogue technology draws attention to the function of back-reference (to borrow a phase

[1] One famous exception, as Gibson notes, is Stephen King.

from computer science) in evolving systems of knowledge production and consumption, information exchange, and communication.

For the purposes of this project, the paradox at the heart of the typewriter anecdote serves as a figurative illustration of the digital humanities as a collective whole. The fields of digital humanities, like science fiction, rely upon a central dialectic of qualitative and quantitative ideas, finding expression in the odd, interesting and hybrid manifestations produced between the two. In formal terms, the digital humanities shares with science fiction Darko Suvin's concept of "cognitive estrangement"—a "constant intermingling of imaginary and empirical possibilities" that brings together diverse concepts, discourses and disciplines (6). Indeed, as Carl Freedman argues of science fiction, it is precisely within "the *dialectic* between estrangement and cognition" that these fields are fully engendered (16). Digital humanities' interpretive practices and discourses are built around similar strategies employed by science fiction writing, in the quantitative examination and exposition—using digital technologies and frameworks—of qualitative, humanities-based materials. Since at least the early 2000s, digital humanities work has tended to embrace these competing epistemologies in an effort to recalibrate the dominant ideologies of white, male hegemonic power structures. The emphasis of digital humanities 2.0 is not on the technology itself, but rather on how the technology might be harnessed in service of humanistic learning, research, and creativity. As digital networks continue to play a decisive role in discourses of globalization, it is becoming increasingly necessary for (digital and traditional) humanists to pay at least some attention to digital technologies and their impact upon culture as transformative and/or confrontational media. Johanna Drucker shares this perspective, arguing that if the humanities are to "assert… cultural

authority in a world whose fundamental medium is digital," they must demonstrate they have a critical stake in the development of digital technologies that "embody humanistic values" (86). In so doing, she suggests, they must retain humanistic strategies of inquiry starting with the principle that "interpretation is performative, not mechanistic" (88). Contemporary digital humanities work operates within this paradigm by leveraging the heuristic and semantic processing power of digital tools to conduct quantitative interpretation of human values and ideas.

Its literary counterpart—science fiction inherently informed by and emerging from digital contexts—follows a similar pattern. In a 2007 interview, the author of *Neuromancer* stated, "I've never really been very interested in computers themselves. I don't watch them; I watch how people behave around them" (quoted in Chang). The four science fiction novels I have chosen to analyze for this project—Pat Cadigan's *Synners*; Richard Powers' *Galatea 2.2*; Vernor Vinge's *Rainbows End*; and Cory Doctorow's *Little Brother*—are all deeply rooted in this sentiment. Like *Neuromancer*, each text explores the ramifications of digital technologies in and upon human cultures through speculative frameworks, foregrounding and extending many of the issues central to digital humanities work and criticism. A sociological (rather than a techno-fetishist or essentialist) approach to the study of the digital is key to positioning these novels as both products and producers of digital humanities in popular culture. As I will argue, through various portrayals of digital technologies and their impact upon the humanities and human culture, these texts help culturally situate us in our digital moment. In thematic and stylistic terms, they function as digital humanities texts by engaging "the totality of the social sciences and humanities" to harness, as Marin Dacos writes in his "Manifesto for the Digital Humanities," "all the

paradigms, *savoir-faire* and knowledge specific to these disciplines, while mobilizing the tools and unique perspectives enabled by digital technology." Moreover, they have each developed out of the same critical and sociocultural impulses that drive digital humanities. Writing into and about what Bernhard Rieder and Theo Röhle perceive as the "continuously expanding space of cultural production and social interaction riddled by machine mediation," they each offer intimate treatments of "[digital] artifacts… and the human realities they are entwined with" (67).

One of the chief aims of this project is to demonstrate some of the important intersections between science fiction and the digital humanities as epistemological fields that both combine, and thus unite, the sciences and the humanities. As I point out in my discussion of *Galatea 2.2* in the second chapter, the popular and critical growth of these hybrid spheres opposes C.P. Snow's infamous 1959 claim that the sciences and humanities exist as two cultures, mutually exclusive of one another in art and scholarship. Due to the "gulf of mutual incomprehension" he felt separated the two (4), Snow could not foresee the extent to which information sciences and the humanities would come to permeate one another. Lisa Yaszek supports this argument, suggesting that these "relatively new fields of inquiry both work to bridge" Snow's dialectic (6). One story she relates, which took place during a National Science Foundation initiative to map "the circulation of technoscientific ideas throughout culture," revises the long-held narrative that the sciences influence art, but not vice-versa:

> While the scientists came onto the project assuming that our understandings and representations of new sciences and technologies flow from the realm of science to the realm of public policy and then to the realm of science fiction, after studying the

> database they realized what many of us SF scholars already know: that in many cases, SF writers are the first to come up with compelling representations of new sciences and technologies, and that scientists and public policy makers rely on those representations both explicitly and implicitly when generating their own discussions of these topics. (7)

In fact, boundaries between the sciences and humanities have been eroding for some time. With the postmodern "incredulity toward metanarratives" (Lyotard xxiv) that emerged in the wake of the fractured and accelerated epistemologies of the modernist period and during the ascendance of digital technologies, the fields began to overlap, either cannibalizing one another or finding common interests that effectively freed them from the constraints of their individual academic silos. Before this "radical break," the so-called "dominant culture and aesthetic" of Enlightenment-era liberal humanism, as Fredric Jameson puts it (Foreword vii), had by the mid-twentieth century helped fashion the research university into an institutional model of "segmented humanities departments separated from the natural and social sciences" (Burdick, et al. 7). Although this organizing principle remains more or less in place, the recent proliferation of digital scholarly and pedagogical modalities and literacies have encouraged disciplinary cross-pollination and the development of new critical and collaborative practices and discussions.

As an elastic array of specialties and specialist knowledges, the digital humanities cuts across many disciplines and often demands interdisciplinary collaboration, creation and knowledge sharing. Kathleen Fitzpatrick outlines the field as a collection of "changes that digital technologies are producing across the many fields of humanist inquiry" ("Humanities" 13). Its schematic and theoretical concerns counteract the traditional image

of solitary researcher through "integration and generative practices" and "the building of bigger pictures out of the *tesserae* of expert knowledge" (emphasis removed) (Schnapp and Presner 4). The digital technologies it utilizes, argues David M. Berry, "problematize where disciplinary boundaries have been drawn in the past, especially considering the tendency of the digital to dissolve traditional institutional structures" (Introduction 4). The same impulses are at work in posthumanist discourses, which have grown out of the postmodern maelstrom of globalization, gender and identity play, the production of non-linear digital tools, and the ontological displacement of the traditional humanist subject. Ihab Hassan reads the concept of posthuman as a diverse yet convergent range of open-ended and overlapping sociocultural ideas. As early as 1977, he suggested that "'[a]rt, technology, and even science seem to me three veils for the same face, three metaphors that cover, then dissolve, into a single reality'" (210). Much like the characters in the novels chosen for this project, digital humanists are posthumanists, yoked to and cyborged between the humanities, sciences and information technologies. The posthuman discourses that have emerged over the last fifty years continue to frustrate Snow's contention in his *Two Cultures* that, while "the scientists [had] the future in their bones" (12), the humanist intellectuals were "natural Luddites" (23).

The production of posthumanist phenomena and critical work in the late twentieth and early twenty-first centuries has, in fact, proven impactful enough to be considered one of four "'ego-smashing' historical moments for humanity" in which "the discontinuity between human and nature" is thwarted (Bukatman, *Terminal Identity* 8). Following Bruce Mazlish's recapitulation of an assertion made by Sigmund Freud, Bukatman reports that the first three of these were

> the Copernican revolution, which displaced the earth from its central position in the universe; Darwin's theories, which "robbed man of his peculiar privilege of having been specially created, and relegated him to a descent from the animal world"; and Freud's own contribution, which demonstrated that the subject "is not even master in his own house," but is the subject to the unknowable operations of the unconscious. (8)

To this list, Bukatman notes, Mazlish offers "a *fourth* discontinuity… 'between man and machine… [that] must now be eliminated—indeed, we have started on the task—and that in the process man's ego will have to undergo another rude shock'" (8). As the humanities and the sciences continue to collapse into one another under the aegis of this fourth ego-smashing revolution, their parallel inclination for generating quantitative *and* qualitative contexts/environments is becoming clearer. Both have matured as interrogative and investigative sites of the technical and the abstract—as culminations of "rationality and non-rational processes, recklessness and constraint, and imagination reigned in—but not too tightly" (Friedman). Or, as Donna Haraway observes, "there was always the spectre of the ghost in the machine" (152).

*

The inclusive mixtures that make up the digital humanities—mixtures that the science fiction of posthumans, digital technologies, and other techno-inspired contexts explore—work as heuristic narratives. I have chosen the word *heuristic* to represent this project as a whole, and I use it in two different but closely related senses. The Merriam-

Webster Dictionary lists the adjective form of "heuristic" as, on the one hand, "involving or serving as an aid to learning, discovery, or problem-solving by experimental and especially trial-and-error methods"; and on the other, "of or relating to exploratory problem-solving techniques that utilize self-educating techniques (as the evaluation of feedback) to improve performance." In the first sense, the dictionary expands its definition to include "*heuristic* techniques" and "*heuristic* assumption" in human learning methodologies. The second is expanded to address the exploratory and self-educating algorithms of "a *heuristic* computer program." Given the close association of these descriptions in the processing of qualitative data, it seems appropriate to understand the term as a bridge between human and machine learning practices, modes of inquiry, and interpretive strategies.

Beginning with the pioneering work of Alan Turing, John von Neumann and others during and after the Second World War, machine learning in cybernetics research has been "[m]odeled on outward expressions of human cognitive skills" (Plant 89). Despite the fact that, as Plant argues, this research has been limited by an "overriding conviction" that artificial intelligence "'is to be regarded as nothing but a reflection of the intelligence of its creator'" (89), advances in the sheer power of interpretative and heuristic processing in the last thirty or so years indicate a potential for expansion beyond rote and serialized machine processes. Rieder and Röhle discuss the central importance of heuristic procedure to research methods and tools in digital humanities. Heuristic digital tools, they suggest, are "constitutive for the discovery and production of new knowledge" in and across these fields (69). At they same time, they help establish new and augment existing humanities research methods and epistemologies that allow scholars to "share experience and establish

reference points that provide orientation—even when there is little agreement on utility or validity" (68).

If heuristic method can be understood as an element central to humanities scholarship/pedagogy, science fiction about the digital, and real-world digital processes, a whole register of connections begins to emerge between the humanities and the sciences. Of course, a great deal of critical work already exists on many aspects of these connections. As Matthew Kirschenbaum points out in his essay "What Is Digital Humanities and What's It Doing in English Departments?," there has been a "long association between computers and composition" in the humanities (9), culminating in an abundance of digital scholarship and pedagogies in and across "the historically hospitable settings" of English departments and similar fields (8). Moreover, as early as the mid-1960s, writes Meredith Hindley, the National Endowment for the Humanities commenced its first project-based "grants for development of humanistically oriented computer research." Nevertheless, there do not seem to be many comprehensive analyses of science fiction's generative influence upon the digital humanities; or, for that matter, many critical explorations of portrayals of digital humanities practices in science fiction.[2] Why is there a need for such a study in humanities scholarship? While Tom Shippey has described "science fiction [as] the literature of change" (Pohl 11), Frederik Pohl argues that the genre's critical power resides in its ability to effect change through "actual developments in the real world" (15). This, as I will argue,

[2] By this I mean book-length analyses. Many humanities scholars have devoted much critical space to the relationship between digital humanities and science or speculative fiction as part of larger projects. See, for example, N. Katherine Hayles' chapter ("The Semiotics of Virtuality") on speculative fiction and how it can be used to "map the posthuman as a literary phenomenon" in her book *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999) (247).

is a crucial factor in determining science fiction and the digital humanities as intersecting and mutually engaged fields of inquiry.

In the chapters that follow, this project will examine four science fiction novels, each of which depicts and expands certain aspects of the digital humanities and digital humanity. In doing so, I will attempt to position the genre as vital to any contemporary understanding of the sociocultural, political and economic paradigms that are increasingly influenced by and produced through digital contexts and digital media. By framing science fiction as a generative, timely, and urgent literature of the digital age, I am arguing a case for its pedagogical value. As a literature, science fiction strives for epistemological effect through an ontological aesthetics, and as Samuel R. Delany asserts, can be utilized as "a tool to help you think… [that] doesn't do the thinking for you" (35). It therefore stands to reason that such a body of writing may help acculturate us to contemporary digital environments and orient us toward the digital future.

Chapter 1, on Cadigan's *Synners*, establishes the foundations of this contention by mapping Cadigan's text—and the cyberpunk movement more generally—as a literary precursor to real-world digital production, consumption, remediation, and collaboration, particularly as they apply to commercial art and popular media systems. Its synners (short for synthesizers), I argue, are forerunners of today's generation of digital natives, operating through a multiplicity of perspectives and material forms to create, remediate and extend their environments, whether virtual or real. The novel is rooted in feminist discourses of the posthuman, and I consider the various ways in which its female characters reinstate N. Katherine Hayles' idea of lived "embodiment" as a restorative to the disembodied consciousness of liberal humanism that threatens to erase or deconstruct the female body

(*How We Became Posthuman* 5). In this way, I show how the novel is allied with the digital humanities agenda in advocating for "new ways of being a subject in the world" through digital tools and mediums (Toffoletti 10). Through "bodily transformations," "augmentations," and digital interaction, argues Kim Tofoletti, "'human essence'" is complicated rather than transcended. *Synners* operates as its own index of posthuman figurations by "interrogating what it means to be human in a digital age" and rescuing subjective bodily experience from the virtual ether (13).

Following this discussion of posthumanism and its role in digital humanities debates, chapter 2 explores Powers' 1995 novel *Galatea 2.2* as a hybrid narrative that, Janus-like, weaves past and future in a posthuman agglomeration of human memory, storytelling, literary and linguistic revelation, informatics, and artificial intelligence. Powers' text is an important part of this project because it is a transitional narrative shaped by tradition in the humanities, the fledgling global network of the World Wide Web, and an emerging humanities supplemented or entirely informed by digital technologies and scientific discourses. This is reflected in the portrayal of the linguistic and literary education of an artificial intelligence named Helen—a speculative descendant of George Bernard Shaw's Eliza. Focusing on the relationship that develops between Rick (the novel's human protagonist) and the A.I., I will examine how the text uses posthuman and collaborative forms of learning and pedagogy to explore the emotional, rhetorical and philosophical topographies of the English literary canon and the ironies and irrationalities of the English language. Moreover, I will argue that development of the A.I. and its subsequent humanities education stands as a comprehensive fictional illustration of project-based digital humanities work.

In chapter 3 I move onto a consideration of the future of humanities education and institutions in digital environments in Vinge's *Rainbows End*. The digital age has ushered in a generation of people who, as John Palfrey and Urs Gasser note, are born digital, "connected to one another by a common culture" of digital networks (1). As "Digital Natives" (1), they have grown up in a world in which digital forms of learning, creating, knowledge sharing and communicating have always been in place—and they will be the first generation to live "from cradle to grave in the digital era" (2). Vinge, one of the first to write critically on the concept of the Technological Singularity (the point at which artificial intelligence surpasses humanity), is deeply engaged in the idea that we are on the cusp of a digital posthumanities—one that threatens to fundamentally reshape or perhaps even obliterate traditional humanities models. Like *Galatea 2.2*, *Rainbows End* is caught up in this academic transition, organizing its depiction of pedagogy, scholarly projects, and humanities environments around developing digital rhetorics. My study reflects upon these narrative aspects from two perspectives: as critical to an exploration of the future of education, research and teaching, particularly as they shift toward multimodal, collaborative, and decentralized frameworks; and as an ideological struggle between the techno-literate younger generation and the bitter "Digital Immigrants" like the former poet Robert Gu (Palfrey and Gasser 4), whose traditions they perceive are being outmoded by the continuing saturation of digital technologies.

Finally, in chapter 4, I extend my analysis of digital natives and their active engagement with/production of new humanities practices to Doctorow's *Little Brother*, which appeared only two years after *Rainbows End*. As the title implies, Doctorow's book reworks Orwell's vision in *Nineteen-Eighty Four* of the abuses of technology by those in

power to show how digital technologies can also be harnessed by, and provide a voice for, ordinary citizens. This, I argue, is especially important in the aftermath of the September 11, 2001, terrorist attacks on the United States, a time in which American and global freedoms were being curtailed by stringent governmental policies established under the guise of national security. Throughout the chapter, I examine the role of hacktivism, a form of digital activism that opposes the systemic abuse of power and violation of (digital) civil liberties that accompany legalized information hacking and seizure, widespread surveillance, biometric data collection, and many other invasive activities. I also discuss open-access, online publishing, copyright, and digital rights management, and what they mean for the future of digital rights in the United States. Doctorow is passionate about freeing digital data from the control of government and corporations and returning a sense of democracy and openness to digital platforms.

By drawing together and identifying practices or issues inherent in the digital humanities throughout these four texts, I hope to demonstrate the importance of science and speculative fiction to digital humanities discourses. Through their sociological engagement with the digital, the fields share a similar preoccupation for charting the effects of digital technologies in different sociocultural contexts and in the creation of a 'posthumanities' that absorbs the digital. Science fiction about the digital is useful for making sense of a world culture increasingly informed by digital media and digital paradigms. The present study argues for the genre's pedagogical value in this regard: as a literature of transition and reflexivity, situated between the humanities and sciences, that helps us adapt to the wild digital transformations happening around us.

1

Mindscapes

Artistic Production, Collaboration, and Consumption in Pat Cadigan's *Synners*

The title of Pat Cadigan's 1991 cyberpunk novel *Synners* is curious. It refers to a group of commercial artists whose work involves the creation, manipulation, and synthesis of sounds and images into machine-readable data. These abstract concepts—the humanistic ephemera of fantasies, dreams, memories, and experiences—are synthesized into rock music videos, television ads, and numerous other media for the financial gain of the companies they are produced for. In this line of work, characters like Gina Aiesi, Visual Mark, and Gabe Ludovic are known as synthesizers, or synners. Gina's old boss, an old-school music video producer called the Beater, thinks up the name: "*You and Gina and the rest of them, you synthesize the sound and the pictures into what* [the consumers] *want to see and hear. You're the real synthesizers… I may be a* sinner*, but I ain't no synthesizer… Synner, then. With a y*" (Cadigan 91). Cadigan's term deconstructs the notion of original sin. As the synners continue to transform their subjectivity through virtual reality and machines, "the practices of the new synthesizing technology," Laura Chernaik points out, come to "displace the religious meaning of 'sin'" (82). This reinterpretation of the subject, in which technological interaction replaces the metaphysical in the formation of a new ethics (Chernaik 82), causes them to become, in Gina's view, "'original synners'" (Cadigan 475).

Later in the novel, Los Angeles-based Diversifications, Inc. (the novel's *de facto* multinational corporation[3] run by CEO Manny Rivera) combines brain socket technology, which allows for direct human-computer interfaces, with traditional techniques of artistic, multimodal synthesis. As employees of Diversifications, Visual Mark, Gina, and Gabe are obliged to undergo surgery for socket implants—a process that allows them to transfer their own thoughts or dreams directly into a computer console. In the "capitalist information economy" that Cadigan shows us, to use Anne Balsamo's phrase (*Technologies* 140), the synners' production of commercial data through brain/machine interfaces renders them "postmodern subjects, cyborged synthesizers of a near-future Los Angeles" (Chernaik 70). They are posthuman digital humanists—forerunners of what Palfrey and Gasser identify as today's born digital generation who "live lives of digital immersion" and "only know a world that is digital" (4). These digital citizens are constantly connected on a global scale to information and social networks, and feel comfortable using digital tools, platforms, and the native literacies and hypertexts of the World Wide Web.

Cadigan is centrally concerned with the idea of the posthuman in *Synners*, using her narrative to explore discontinuities between technology and the body, identity and the self in a fragmented and digitally saturated urban space. The novel's cast of posthumans goes some way to validating Hassan's claim that "the human form—including human desire and all its external representations—may be changing radically, and thus must be re-visioned" (212). Toffoletti suggests that it is the "tension between the human and technological [that] is indicative of the posthuman," a tension that "disrupts traditional understandings of selfhood, identity, the body and reality." For Toffoletti (and, as I will argue, in Cadigan's

[3] Corrupt multinational corporations are a staple of cyberpunk.

text), "posthuman images can be appealing" precisely because "they are contradictory and unstable," not because they "[offer] a better version of human existence" (4). Indeed, this is a novel that celebrates embodied, gendered posthuman subjectivities, not the disembodied consciousness of liberal humanism.

But of course, posthuman syntheses of human and machine are far from unprecedented. According to Scott Dexter, from at least 1765 to a little after World War II, computers were people hired to perform mathematical computations long before the machines that would later supplant them (130). Plant makes a similar observation, also restoring the gender-specific aspect of this history: "[W]hen *computer* was a term applied to flesh and blood workers, the bodies which composed them were female. Hardware, software, wetware—before their beginnings and beyond their ends, women have been the simulators, assemblers, and programmers of the digital machines" (37). The contemporary and widespread use of digital tools (in ways psychological, emotional, social, and physical) is slowly bringing us back to the status of computers—heuristic human synthesizers.

As a work of science fiction, *Synners* is well positioned to respond to these transformative discourses and contexts as they have developed over the last fifty or so years. In his 2002 introduction to the tenth anniversary Gollancz edition of Cadigan's book, Neil Gaiman writes that the work "attempts, and in the main succeeds, in fusing a dozen different things into a portrait of a now" in which its frenetic cultural artifacts and phenomena "are all beginning to interface into something liminal and numinous and street" in the post-industrial West (xi-xii). *Synners* is more than prediction, though. It spoke to a moment in the early 1990s in which a nascent cyberculture was forming. Through a combination of perceptive observation of her cultural moment and the extrapolative

function of science fiction, Cadigan is able to achieve a vision of what John Clute sums up as "the burning presence of the future" (184). Ursula K. Le Guin argues that science fiction should be created as "a thought-experiment… not to predict the future… but to describe reality, the present world" (xii). More than mere "reportage (that is, a description of actual events)" that have not yet occurred in reality (Le Guin 17), *Synners* has a critical stake in the cultural moment in which it is written. "The digital age was only just taking off when Cadigan was writing about it," observes Lisa Tuttle in her own 2012 introduction to the novel. "[T]wo decades on… we are still only beginning to grapple with the problems she had guessed at" (viii-ix). On one hand, *Synners* casts its speculative line through "the contemporary hopes and fears of its author" (Tuttle viii) and its wider digital contexts on the one hand; and on the other, its acute prescience helps a contemporary readership to alter its awareness of current technological issues, trends, and ramifications. Emerging from the "crisis of narratives" caused by postmodernism (which, as Jean-François Lyotard argues, have "altered the game rules for science, literature, and the arts" [xxiii]), the novel tries to anticipate the fragmented epistemologies of global digital networks that continue to accrete in ever-more complex layers and points of connection.

In this chapter I position *Synners* as a both a contributor to and constituent part of the early development of digital culture during the early 1990s. More specifically, I link its thematic exploration of body/mind relationships, posthumanism, and digital artistic production, synthesis, collaboration and consumption to concerns in nascent and contemporary digital humanities discourses and practices. Central to this discussion is an examination of Cadigan's novel as a key text of the cyberpunk fiction that, Lawrence Person observes, "carried technological extrapolation into the fabric of everyday life" where

"everyday lives are… impacted by rapid technological change and an omnipresent computerized infrastructure." Like much artistic work of the time,[4] *Synners* grew out of and helped generate the commentaries and discourses that began to coalesce around the proliferation of digital technologies in mainstream American society.

I will begin by examining the efficacy of Cadigan's text as a cultural artifact in the context of the cyberpunk movement, as it grew out of and contributed to a formative cultural understanding of the digital age. I will then move into a discussion of the evolution in knowledge production/consumption from traditional analogue modes of analysis to emergent digital modes of synthesis—particularly as it relates to collaborative frameworks found in abundance in digital humanities practices. Finally, I will attempt to show how the novel's engagement with posthumanism and the figure of the cyborg (both as a metaphor and literal presence), as well as the debates surrounding embodied and cognitive digital realities, provide a useful record of/direction for early digital discourses and transformations in humanities methodologies.

Cyberpunk

As the only prominent female author of first-wave cyberpunk[5] in the 1980s and early nineties, Cadigan was known as the "Queen of Cyberpunk" (Lavigne 30). Larry

[4] The most obvious example is William Gibson's *Neuromancer*. Other works include Bruce Sterling's influential *Mirrorshades* anthology (1986), Gibson's *Burning Chrome* (1986), and Rudy Rucker's *Ware* tetralogy (1982-2000). The U.S. magazine *Mondo 2000* had a brief but important run throughout the 1980s and nineties. And films like *Blade Runner* (1982), *Videodrome* (1983), *Tron* (1985), *Hackers* (1995), and *The Matrix* (1999) continue to receive critical and popular acclaim.

[5] The first-wave cyberpunk authors are usually understood to be William Gibson, Pat Cadigan, Rudy Rucker, Lewis Shiner, and John Shirley. However, their work was heavily influenced by what has come to be known as proto-cyberpunk fiction, including Alfred Bester's *The Demolished Man* (1953) and *The Stars My Destination*

McCaffery traces the beginnings of the cyberpunk aesthetic to a catalytic combination of technological leaps, the changing faces of popular culture, and the lasting influence of postmodern writers whose suspicion of grand narratives typified an era of intense epistemological anxiety. McCaffery describes the cyberpunk writers as "the first generation of artists for whom… technologies… were not exoticisms, but part of a daily 'reality matrix.'" They were also "the first generation… who had grown up immersed in technology but also in pop culture, in the values and aesthetics of the counterculture associated with drug culture, punk rock, video games," and stylized violence ("Introduction" 12). The characters in their fictions, often reflecting their own existential disaffection, are "marginalized, alienated loners who [live] on the edge of society… where daily life [is] impacted by rapid technological change, an ubiquitous datasphere of computerized information, and invasive modification of the human body" (Person).

It was from this context of fluctuations—the changing social structures of family home and workplace, innovations in analogue and digital media technologies (the VCR and CD player, for example), and increasing on-demand access to an abundance of knowledge—that these writers "presented themselves as 'techno-urban-guerilla' artists announcing that both the technological dreams and nightmares envisioned by previous generations of SF writers were already in place" (McCaffery, "Introduction" 12). Indeed, as Bruce Sterling reports in his preface to the *Mirrorshades* anthology, these writers developed their style "not only within literary tradition of science fiction but in a truly science-fictional world" in which "extrapolation [and] technological literacy... are not just literary tools but an aid to

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(1956); James Tiptree, Jr.'s "The Girl Who Was Plugged In" (1973); John Brunner's *The Shockwave Rider* (1975); Vernor Vinge's *True Names* (1981), which included the first extensive rendering of what Gibson would eventually call cyberspace; and others. The term cyberpunk originates from a 1983 short story by Bruce Bethke called "Cyberpunk."

daily life" (344). In their literary engagement with the ongoing upheavals of postmodernism, the growth of international capitalism, and a sense of the self as a mutable series of ones and zeroes, then,

> Cyberpunk… became a significant movement within postmodernism because of its ability to present an intense, vital, and often darkly humorous vision of the world space of multinational capitalism—and to render this vision both formally (through a style appropriate to its age) and concretely (through the dominant cultural imagery). (McCaffery, "Introduction" 12)

In *Neuromancer*, Gibson introduced us to the immersive "consensual hallucination" of "cyberspace" (51), a virtual reality that captured the spirit of 1980s American hacker culture. In a 1991 interview with Gibson, McCaffery describes the cyberspace of the author's work as a conceptual space in which "data dance with human consciousness… human memory is literalized and mechanized… multi-national information systems mutate and breed into startling new structures whose beauty and complexity are unimaginable, mystical, and above all nonhuman" ("Interview" 264). Similarly, according to Gaiman, the novel was "the first frugal strain of romance with the artificial, creating an imaginary space for the real world to move into and inhabit" (xi). Like *Neuromancer*, *Synners* describes a burned out and frenetic urban landscape of "high tech and low life" (Ketterer 141) in which the interface between human and digital has become, much as our own, a widespread reality. Just as we are constantly connected through wifi and the cloud to our external brains—through smartphones, tablets, Wikipedia, and Google—the people of Cadigan's text are plugged in.

Synthesis and the New Knowledge Economy

One of the most sociologically significant effects of the digital in recent times has been the shift to a new kind of learning, creating, and experiencing in the humanities that favors breadth (synthesis) over depth (analysis). In the digital age, overwhelmed by information overload, Nicholas Carr argues that technologies have rewired our brains, "remapping the neural circuitry, reprogramming the memory," to help us cope with a multiplicity of vastly disparate incoming and outgoing data (*Shallows* 5). This claim is certainly debatable, though others—including, for example, UCLA neuroscientist Gary Small in his *iBrain: Surviving the Technological Alteration of the Modern Mind* (2009)—are tentatively gravitating towards similar arguments. For Jeffrey Rydberg-Cox,

> technologies such as ubiquitous wireless networks and inexpensive portable computing devices, along with contemporary science fiction… and the work of researchers, such as Steven Mann in "computer mediated reality" suggest that the Internet is already serving in some ways as an "enlarged intimate supplement to memory." (13-14)

Synners character Fez gets to the heart of these assertions when he announces to a room full of synthesizers and hackers, "'[w]e've become denizens of the net. Homo datum'" (Cadigan 421). In the digital twenty-first century, we are Homo Datum, the next step in human evolution. "Wherever our real bodies may be," Douglas Rushkoff points out, "our virtual personae are being bombarded with information and missives" (72). The discourses of "digitally mediated reality" are rooted in our collective sociocultural and temporal experience, and it is difficult to return to a pre-technological state. Rushkoff identifies this phenomenon (a process in which we sacrifice "the true now of a coherently living human"

for "digital bombardment") as "*digiphrenia—digi* for 'digital,' and *phrenia* for 'disordered condition of mental activity'" (75).

The permeation of digital technologies into the cultural consciousness has given rise to a generation of "'Digital Natives'" (Palfrey and Gasser ii), nurtured on social and critical concepts of synthesis (social networking, multimodal work, collaborative digital projects, real-time information streams) as well as more traditional modes of learning such as deep reading and analytical investigation. Synthesis—a methodological approach to the formulation and production of knowledge that works through breadth of experience and understanding by combining and/or remediating various different cultural phenomena—is the central basis of Cadigan's novel. In digital contexts, synthesis is made possible by the remediative and multimodal qualities of new media. In their work on the concept of remediation, Jay David Bolter and Richard Grusin argue that "remediation is a defining characteristic of the new digital media" because "digital media [continually] remediate their predecessors" (45). The act of synthesis is implicit in digital mediums that remediate older mediums and, thus, is both engendered by and imitates remediation. As Leah A. Lievrouw points out, "[c]ontent remediation," which has a "continuous, mutually constitutive interrelationship" with reconfiguration, operates as an umbrella term for "synthesis, repackaging, augmentation, refashioning, and absorption" (231-32). Likewise, the nature of the synthesizer's work relies on multiple channels of attention; the ability to juggle and direct different media all at once; multimodal approaches to content creation; the repurposing and remixing of traditional media forms through interactivity and *bricolage*; and collaborative effort. "The work," in this sense, "becomes a mosaic" of various experiences and artifacts (Bolter and Grusin 47). We might think of Hayles' work on hyper

and deep attention here, where, rather than working in the "[d]eep… cognitive style traditionally associated with the humanities," synners are hyper-attentive, "switching focus rapidly between different tasks, preferring multiple information streams, seeking a high level of stimulation, and having a low tolerance for boredom" (187).

Steve Anderson and Anne Balsamo co-opt the term synner for their 2011 article "A Pedagogy for Original Synners" to highlight the current trend toward synthetic and rhizomatic learning and making in U.S. education and elsewhere. In an effort to re-evaluate new modes of learning and creating, they write, we must "refine our understanding of 'critical thinking' to focus more specifically on the skills of creative and critical *synthesis*." Like the video artists of Cadigan's work, the students of this generation are "'original synthesizers' whose most important literacy will be the ability to create knowledge by harvesting information from diverse sources" (245). Such a skill is indispensible in the new knowledge economy, under whose digital aegis educational development and creative literacy become a matter of participation, decision-making, and the selective, delicate and high-speed processing of vast quantities of information.

Despite the educational and creative benefits that come with this new kind of literacy, however, the novel investigates how the skills of synthesis can be exploited for commercial profit. During a Diversifications shareholders meeting, Manny Rivera discusses Visual Mark in cold, detached terms: "'the visualizing center of his brain is hypertrophied—overdeveloped, that is, so overdeveloped that he should have no trouble at all sending out anything he visualizes'" (Cadigan 141). To Rivera, he is little more than a biological machine whose subjectivity is incidental to the company's projected profit margin. And ironically, given the nature of what he produces, he will always be (in this capacity, at least)

Visual Mark—a concept, a floating signifier in the free market. However, Visual Mark seems to have no trouble embracing his role—or at least thinking of his flesh—as a medium. Since he is nearing fifty and mentally burned out, digital tools like the brain socket technology offer him the opportunity to transcend a decaying body he despises. Shortly after Gina's surgery, he tells her with a great deal of jubilation, "'We're *real* synthesizers now. Real synners'" (Cadigan 236). The technology allows him to passively channel "[t]he video show that ran endlessly in his head" (94)—a sound and image collage of memories, feelings and desires not unlike an abstract painting or film:

> he was standing on the lake with the stony shore, a million-million stones worn smooth as eggs by the lapping of the water, and every stone a secret world to blossom at his touch…
>
> He could feel the stones hard against his bare feet as he made his way unsteadily along the arc of the shore. The sun was high overhead, falling hard on the water like a demand. (95)

Synthesizers, whose literacies have moved beyond the traditional humanistic methodologies, not only interface with their technologies to produce art; they are changed physically and cognitively by those technologies.

Through the production of art (that is, the images and sounds of dreams and fantasies) for commercial consumption, synning can be understood in Marxist terms. "In the late capitalist circuit of production," argues Debra Benita Shaw, Gabe and Mark

> are hot property, their value determined by their ability to manipulate, synthesize and produce information. In this context, their retreat from the flesh marks the dissolution of the body in an incurably informed world in which the 'meat' is

constantly manipulated and thoroughly mediated. (86)

During one of Gina's synthesizing sessions, the mental images that occur to her seem to support this theory: "He could just stick a socket in his head and out it would come, essence de V. Mark. Video on tap" (Cadigan 231). Clearly, as part of what Jameson calls "a first crude inventory of the new world order" (*Archaeologies* 385)—and, indeed, as much cyberpunk tends to reveal—Mark's entire conscious being is mediated, codified and commoditized for consumption in the free market. Cyberpunk, Jameson suggests, expresses this core "truth of emergent globalization" through the 1980s and early nineties (*Archaeologies* 384), spurred by global and transnational flows, development of new communications technologies, and the international expansion of financial and corporate markets. The commercial digital reproduction of art (simulacra) in *Synners* contributes to what Walter Benjamin once called a withering of "the aura of the work of art" through its loss of authenticity (221). In the "postmodern culture," in which "'culture' has become a product in its own right," Visual Mark's visions, bottled up like some designer perfume or cask ale, are reproduced *ad nauseum* at the behest of "consumption of sheer commodification as a process" (Jameson, *Postmodernism* x). Mark is the signifier of this culture, divorced from its signified referent.

But while this closed mode of free market exploitation contravenes what Jeffrey Schnapp and Todd Presner see as the digital humanities' utopian spirit of "open source, open resources" (emphasis removed) (3) and process over product (5), Mark's willingness to offer the synthesized substance of his self—"I was born to do it," he tells Gina (Cadigan 232)—does not. On one hand, this model of synthesis reproduces and perpetuates the post-industrial capitalist framework of postmodern knowledge and information exchange. Cadigan is keenly aware that postmodern incursions into unified epistemologies, especially

during the proliferation of digital data transfer, assign market value to and recycle information. “Knowledge,” writes Lyotard, “is and will be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange” (4).

On the other hand, the medium (that is, the synner) carries with it—and delivers, at the moment of the reception of its product—an undeniable dimension of lived human experiences and desires. Thus, while the message may be designed to line the pockets of capitalists and ruling classes across the postmodern cybercultural wasteland, it nonetheless relies on a level of human connection that re-humanizes the process of knowledge production and consumption. In this way, synthesis becomes more than the cyclical production and provision of commercial services, which, in this case, is rock videos: audiences can “finally *be* the music” (Cadigan 90). The synner provides stylized visions directly from her/his brain that the consumer can experience vicariously as a fantasy/wish fulfillment. The intimate connection between dreamer (producer) and audience (consumer) through dream (product), “*to give them what they want to see and hear*,” suggests a kind of carnal cerebral exchange, or sin, reinforced by the pun of the neologism synner.

In reference to Visual Mark’s talents, Gina’s definition further underscores the process of synthesis. It is as though, she muses, “he had a pipeline to some primal dream spot, where music and image created each other, the pictures suggesting the music, the music generating the pictures, in a synesthetic frenzy” (Cadigan 118). There is very much an emphasis on the cerebral ecstasy derived from the paradigms of consumerism—“a pipeline”—for producer and consumer. The various layers of media being synthesized

build into a multimodal climax of sensations that flood the brain's conscious and subconscious areas at the same time. And since the artist cannot decide upon but only manipulate the images as they occur (they are created at the subconscious level), the experience is rendered more visceral, primal and organic for both parties. We see this in Gina's own synning sessions—experiences that are often intricately embedded in the nature and sensuality of the body, intimate and collaborative. One such moment comes during an informal session with music producer Valjean and his rock band:

> "We're going to play some music now, Gina. We'd like you to just let your mind go with it the same way you would if you were creating a video for it. All right?"
>
> *Video?*
>
> First you see video… "All right?"
>
> *Video—*
>
> Then you wear video… "All right?"
>
> *Video…*
>
> Then you eat video…
>
> "Just run with it. Let the pictures come. All right?"
>
> *Video.*
>
> *Then you… be…* (226-27)

Again, one can eat, wear, and *be* the music, the video—or any number of cultural artifacts that threaten to eclipse nature in the simulated postmodern reproduction of signs. Jameson has suggested that postmodernism arrives "when the modernization process is complete and nature is gone for good. It is a more fully human world than the older [modern] one, but one in which 'culture' has become a veritable 'second nature'" (*Postmodernism* ix) and

"the waning of affect" has been instigated (17). However, as I will argue, though characters like Visual Mark (in his desire for the "second nature" of culture and a release from the flesh) would lend credence to this argument, Gina (and Sam Ludovic, Gabe's daughter) manages to retain the connection to her gendered, embodied nature in the post-industrial now.

Indeed, Gina's sessions always feature some physical aspect. For example, synning is a sensory and generative experience for her, a kind of childbirth: "It wasn't just hearing the music, it was being in the music, and the images coming up on the screen of her mind, forming as she looked at them. As soon as she thought it, there it was, and if she thought to change it, it changed, growing from her like a live thing" (Cadigan 245). Later, Valjean requests a video that depicts her (as she has both imagined and physically experienced it) falling from a tall building: "Her inner ear went crazy, the wind rushed into her, choking off her breathing, guided express missile, toes pointed at the sidewalk and the world blurring, smearing upward—" (262). Specific and embodied, Gina's experience is one of affect, of bodily sensations and experiences—and the very real damage the street below is capable of inflicting. More generally, the experiential aspect of creation, combined with the abstract dimensions of synthesis and mediation, echoes the sentiments that course through contemporary work in the digital humanities: the images the synners produce are rendered by embodied instinct (excepting Visual Mark, who ultimately rejects his body) and the power of emotional states. For this reason, they also tend to be highly malleable and suggestive during their genesis. The transfer of this imagery to digital media allows the synner to actively manipulate and synthesize the end result into each project's wider whole. Likewise, "[t]he digital humanities try to take account of the plasticity of digital

forms and the way in which they point toward a new way of working with representation and mediation, what might be called the digital 'folding' of reality, whereby one is able to approach culture in a radically new way" (Berry, "Computational Turn" 1). In Cadigan's text, the possibilities of the digital have expanded to dreams, giving its practitioners a level of control over artistic representation that is unprecedented in human history. This "digital 'folding' of reality"—which might be read as the ability to bend reality to one's own creative will through digital technologies—is what makes writing like Cadigan's so culturally urgent and significant. It is, in effect, a pure synthesis of internal humanistic abstracts and external quantitative tools—a consequence that both anticipates and echoes the idea that the "[d]igital humanities is born of the encounter between traditional humanities and computational methods" (Burdick et al. 3).

Becoming Cyborg

As we follow this encounter in the novel along its natural trajectory, it becomes more difficult to distinguish humans from digital technologies, in physical as well as figurative terms. Cyberpunk fiction is typified by its interest in posthuman hybrids, liminal identities and the playful multiple possibilities of the figure of the cyborg. As Sterling argues, cyberpunk writers "are fascinated by interzones." Responding to the instability of subjectivity in a world that is constantly shifting and being renegotiated, cyberpunk employs "a wide-ranging, global point of view" (347). It is almost certainly no coincidence that the popularity of cyberpunk paralleled popular and commercial interest in the funding/advancement of digital technologies research. The timely appearance of Haraway's

seminal essay "A Cyborg Manifesto" (1991) also cannot be a coincidence, acting, it seems now, as a virtual bridge between the two. Like Haraway's cyborg, "[c]yberpunk comes from the realm where the computer hacker and the rocker overlap, a cultural Petri dish where writhing gene lines splice" (Sterling 346). Both are cultural enigmas, interchangeable; the products of myriad identities all gleefully frustrated and indefinable. The cyborg in Haraway's essay is a symbolic amalgamation of "transgressed boundaries, potent fusions, and dangerous possibilities" that delights in eluding the fixity of Dualist subject positioning that regulates definitions of gender and the delimitations of embodiment (154). Its sociocultural mission is rooted in the same posthuman sentiment as the cyberpunk ethos: "Some find the results bizarre, even monstrous; for others this integration is a powerful source of hope" (Sterling 346).

In defiance of socially and culturally constructed categories that seek to lock identities firmly into place, the cyborg is a deconstructing and reconstructed torch amidst the darkness of what Haraway calls an "informatics of domination" (163). This positivist, patriarchal construction (a world system that *a priori* codes identity through the patriarchal conceptions of work, reproduction, and communication), she argues, operates in antithesis to feminist and socialist ideals that value polymorphous interchange, multiple perspectives, bodily possibility, and reassembly of socially constructed institutions/roles in both the public and private spheres in new and surprising configurations. The cyborg stands as a signification of these values, representing "a disassembled and reassembled, postmodern collective and a personal self" that bucks superficial dualisms in favor of deeper, multiple and more complex connections (163). The emergence of such a porous, shifting creation—a rallying figure for characters like Cadigan's Gina and Gibson's Molly

Millions of *Neuromancer*—reinforces Hayles' point that "the boundaries of the human subject are constructed rather than given." Once again, following the advancement of cybernetic research throughout the decade, Hayles suggests, epistemological and ontological conceptions of humanity were being and had to be rewritten (*How We Became Posthuman* 84).

Haraway's essay was published the same year as *Synners*, in 1991, and though their styles are very different, the authors share many of the same sociocultural convictions. Both were writing at a time of radical political, social, and technological change in America: more women than ever before were taking jobs and making personal choices previously denied to them; the country was recovering from the Cold War and steeped in postmodern declarations about crises and apocalyptic "senses of the end of this or that" (Jameson, *Postmodernism* 1); evolutions in informatics and digital technologies simultaneously eroded and forced the reinvention of the ways many institutions operated; and social structures, particularly traditional white, heteronormative notions of home and work place, were irreversibly shaken up. These kinds of seismic shifts in the fabric of an already delicately bound society are reflected in Haraway's cyborg—a mixture of "partiality, irony, intimacy, and perversity" (151) that represents "our ontology" and "gives us our politics" (150).

We can trace the same sentiments in Cadigan's work—a text equally concerned with the potent and potential (re)combinations of self, body, machine. In various important ways, digital humanists (and, indeed, many others) can be considered cyborgs, since their work relies upon a deeply integrated and cyclically escalating relationship with technology. Like Haraway's cyborg, Cadigan's synners are composite postmodern entities, born out of

human social and historical conditions rather than the humanist conception of nature. Citing Haraway, Laura Chernaik suggests "they are cyborgs, not goddesses; changed by technology, not in tune, cyclically, with nature" (70). Hayles alludes to this emerging social dynamic in her essay "How We Think: Transforming Power and Digital Technologies," suggesting that "[t]he more we use computers, the more we need the large-scale analyses they enable to cope with enormous data sets" (48). If our increasing utility of digital technologies is proportionally related to our increasing dependence upon their computational power, it is clear that in our cyborg relationships with our devices, they/we are deployed as reflexively constituent of us/them. In other words, as we use computers to accomplish tasks, communicate, or create, our reliance upon them to generate more output in shorter amounts of time grows exponentially.

Thus, interaction with machines must lead to a fundamental revision of the human in humanist terms. This is reflected in Nicholas Carr's assertion that entanglements of body and machine, in the brain's cognitive encounter with (digital) information, lead to "the pathways in our brains… once again being rerouted" (*Shallows* 77).[6] Leighton Evans and Sian Rees follow this line of thinking, arguing that

> the nature of digital technology is such that we are becoming integrated with the text itself; our brain is not simply picturing a new world, it is instead developing a new world, opening up new neural pathways in reaction to the speed and expanse of interaction with digital data. (21)

Though they are speaking of the text in the narrow sense of the humanities, we might understand it in this process as a representation of the point of contact and departure—an

[6] For more on the subject of the effects of digital media on the brain, see Carr's *The Big Switch: Rewiring the World, from Edison to Google* (2013) and his essay "Is Google Making Us Stupid?" (2008).

interface—between user and machine that intrinsically refashions both in an epistemic fusion. Or, as Visual Mark's vending machine epiphany goes, one must "change for the machines" if one expects to survive in a world constructed with and sustained by the cultural artifacts and ephemera of the digital (Cadigan 105).

Through the synners of Cadigan's text, taken to its literal but perhaps logical end-point, we can see the relationships digital humanists form with digital technologies, tools, and literacies. The elaborate and demanding nature of their work means that synners like Gina and Visual Mark must physically interface with machines that record their visions through wires connected to sockets built into their brains. Again, they must "change for the machines." Working from a similar idea in an earlier novel, *Mindplayers* (1987),[7] and "Rock On" (1984), the short story upon which *Synners* is based, Cadigan's depiction of the integration of flesh and machine is as gruesome and dangerous as it is multiplicitous and destabilizing. This is perhaps best portrayed by Gabe's transformation, from producing simulations via an external hotsuit to producing them via a cerebral/digital interface made possible by the infamous brain sockets. Shortly after the surgery, Gabe confronts his newly altered self for the first time:

> He was looking at himself in the mirror in Medical's bathroom, turning his head from side to side. Just as they'd said, he didn't look any different. Same old head, only now it had eight holes in it, eight holes to be filled with eight plugs and a small menu of commands he could use to manipulate the images in his head. *Top. Forward. Reverse. Freeze. Resume. End. Save. Quit.* (Cadigan 269)

[7] Cadigan's *Mindplayers* also deals with brain interfaces through advances in digital technologies. Mindplayers are a lot like psychoanalysts, and, like synners, they play in the folds of human consciousness. In this case, however, the mindplayer's optic nerve is connected directly to the patient's brain, rather than to a machine, allowing them to explore the mind of that person as a conceptual landscape.

In her introduction to the book, Tuttle calls these neurological connectors "snaky wires" (vii), suggesting that a kind of anthropomorphizing is taking place; or, perhaps, a Kafka-inspired metamorphosis that conjures the gorgon Medusa as much as a moment of radical cyber-enhancement. But these wires are something more. Tuttle suggests the physical connections between synner and machine are representative of neural pathways with the potential to be remodeled and remade by input from external agents and/or collaborators (vii). And indeed, the work of synning depends on the synner's willingness to open up her/his body and mind to manipulation, alteration, voyeurism, and exposure—all for the sake of the production of art. Throughout the novel, the external forces intimated by Tuttle (some malignant, some benign—collaborators, musicians, company executives, and not to mention the machines themselves) act upon the synners' bodies and minds in various ways, forever changing and marking them. The fact that Visual Mark refers to himself as "Markt" later in the novel is telling (Cadigan 425).

Before this transformation, though, Gabe is addicted to a virtual reality simulation that he designed. As a "simulation producer" (Cadigan 473), he is, like rock video synner-god Visual Mark, a hot commodity in the orgiastic age of digital information and simulation. In a vain effort to suppress the demands of his work for Diversifications, his failing marriage, and his distant relationship with his daughter, Sam, Gabe spends his time playing a game called *Headhunters* with avatars Marly and Caritha. In this simulated fantasy, Gabe's "cultural perception" is engendered by the "feedback loops that run between technologies and perceptions" (Hayles, *How We Became Posthuman* 14), providing him the opportunity to reinvent himself in and merge with the computer generated landscape. He can even program the game (in a vain attempt to feel something, even though it is just simulated) to

let the player "die at the end if you wanted to, or even blind-select so you wouldn't know whether you would survive or not" (Cadigan 47). The exhilaration this provides, leaving him "feeling alternately energized and drained" (101), is indicative of his emotional and physical sublimation into technology. Moreover, his professional work on a simulated ad for Gilding BodyShields—a product typical of a society in the throes of the death of affect—perhaps shows us why.

Gabe's perception, at least until he meets Gina, follows "the view that parses virtuality as a division between an inert body that is left behind and a disembodied subjectivity that inhabits a virtual realm"—a view not unlike *Neuromancer* protagonist Case's "bodiless exultation of cyberspace" (Hayles, *How We Became Posthuman* 290). As with Visual Mark, it is the technology that leaves its indelible mark on Gabe's body, not human contact. We see this in his near-fetishistic, post-simulation undressing: "He unzipped the hotsuit, peeling it away from himself. Underneath, his skin bore the impression of a baroque pattern of snaky lines punctuated by the sharp geometric variations of the numerous sensors" (Cadigan 46). While, the ritual suggests a primal connection to an embodied sense of self—a *marked* body—it is in fact the concretized, erogenous yet seriated effects of technology and simulation-as-experience that take precedence. Hayles writes of "the duality at the heart of the condition of virtuality—materiality on the one hand, and information on the other" (*How We Became Posthuman* 14); but in Gabe's case, digital information and technologies have overwhelmed his body to such an extent that we can literally see the pattern of his hotsuit pressed into it.

The blurring of humans and machines in figurative and literal ways is not a new idea in critical work or the cultural imagination, however (Evans and Rees 22). Though the

widespread pairing of artificial and biological elements might have seemed (at least a little) radical to readers of cyberpunk and viewers of *The Six Million Dollar Man* in the 1980s, advances in biology, cybernetics and informatics have brought the essence of the cyborg into commonplace reality today. While the label cyborg (understood in the popular cultural sense) may still sound overly science fictional, real-life examples abound. Depending on the expanse of our definition, for instance, a cyborg might be a person outfitted with an artificial body part, or simply someone using a smartphone as an extension of themselves, their memory, and/or their communicative faculties. As Veronica Hollinger notes, discussing Mark Dery's critical collection of essays on cyberculture,[8] a vast majority of humans are now part of "the middle-ground, the interface between the body and the machine inhabited by so many of us now living in the post-industrial west" (125).

Indeed, our continuing association with infinitely complex and capable digital technologies has reshaped the way we think about and interact with each other and the world. Sherry Turkle argues that our digital tools "provide space for the emergence of a new state of the self, itself, split between the screen and the physical real, wired into existence through technology" (16). It is within this postmodern, posthuman sensibility of being constantly connected that we become "newly free in some ways, newly yoked in others" (152). In effect, then, by continuously using the technologies that are in response fundamentally altering it, humanity is being rewritten in the image of Cadigan's synner. In a world in which "[w]e make our technologies, and they, in turn, make and shape us" (263), we are already participants in some form of the cyborg future laid out in the cyberpunk visions of Cadigan, Gibson and others. Following McLuhan and Fiore's claim that, as an

[8] Dery, Mark, ed. *Escape Velocity: Cyberculture at the End of the Century*. New York: Grove, 1996.

"extension of the central nervous system" (40), "media work us over completely" (26), Nicholas Carr makes a similar claim. Media, he suggests, "supply the stuff of thought, but they also shape the process of thought" (*Shallows* 6). In fact, as active rather than passive conduits for the delivery of information, such (digital) media actively participate in the permanent transformation of our cognitive behavioral functions.

Many of the characters of *Synners* are integrated with technologies designed specifically to create or change humanistic ideas or dreams into information—a transmutation that might be considered a kind of digital alchemy. These human/machine relationships are inflected in the same way as the real-life movement of concept to code: "To mediate a cultural object," writes Berry, "a computer requires that everything is transformed from the continuous flow of everyday life into a grid of numbers that can be stored as a representation which can then be manipulated using algorithms" (Introduction 2). The process of making art through computation begins by taking a cultural object—a dream or hallucination, for example—and subjecting it to a series of subconscious editing tools (as demonstrated by Gabe with his internal graphical menu of commands). In so doing, the synner, as an active participant in the neuro-digital conversion of abstract idea into quantitative data and its subsequent manipulation, approximates the status of computer (or perhaps a biological Photoshop, with its dizzying array of digital editing capabilities).

Synners can thus be understood as cyborgs—simultaneously computers in the machine sense, and computers in the biological, human sense. And like these synners, digital humanists stand at the nexus of humanistic ideas and encoded digital data. They are also concerned with the synthesis and mediation of fuzzy data and abstract concepts using

generative models made possible by critical digital toolsets. In these machine-enhanced approaches to new modes of criticism in the humanities, practitioners thus become synthesizers, or synners, in their own right.

Cognitive and Embodied Realities

For some characters like Visual Mark, engagement with the digital means a sacrifice of real-world situatedness, physicality, and individual identity. Since "[t]he pictures [always] ran the way they would," Mark thinks of his brain (the physical bundle of neurons and electrical signals as opposed to the mind) as "just the medium" (Cadigan 95)—a vessel whose produce is to be consumed by an insatiable society as he slowly burns out (though he may not realize he is doing so). In fact, he wants to outstrip his weary body for digital immortality. In a conversation with Gina, sick of the finite and damaged flesh that holds him back from his true potential, he tells her

> "Someday you're gonna come into a room, and you're gonna see this funny-looking thing, a piece of flesh clutching into naked console, and you're gonna stop and stare, because you won't be sure where the flesh stops and the chips and the circuits begin. They'll be, like, melted into each other, and some of the console'll be as alive as flesh and some of the flesh'll be dead as console, and that'll be me. All of that'll be me." (232-33)

The conflation of console and flesh here, combined with the implicit Dualist rhetoric of the fundamental split between body and mind, is literalized by the full transition of Mark's consciousness into virtual space, transcending the fallibility of his body. "The prospect of

returning to the meat, of being weighted down," he contemplates, "was less appealing all the time" (325). Such a sentiment has long been popular with techno-fetishists and futurists for a number of years now.

Cybernetics engineers such as Norbert Weiner and Hans Moravec have written extensively on notions of disembodied consciousness and the desire for "writing the body into computers" (Hayles, *How We Became Posthuman* 193). Constance Penley and Andrew Ross refer to this ideological line of thinking as the "postmodern celebration of the technological sublime" (xii). Hayles, among others, has criticized this impulse, however, arguing that disembodied consciousness—although a strand of deconstructing postmodern schemata—threatens to permanently erase the female body, suppressing it once and for all under the dominant locus of a liberal humanism that values cognition over embodiment (*How We Became Posthuman* 5). In Toffoletti's view, "Hayles' response to the posthuman is very much directed toward interrogating the associations between posthumanism and disembodied forms of existence. She aims to re-embody the virtual spaces and digital technologies that have often ignored or denied women's bodies and their lived experiences of the world" (15). In literary terms, Lavigne echoes this view, pointing out that first-wave cyberpunk has been "criticized for being misogynist and classist… [because] its virtual realities and digital escapism represented a white, middle-class, heterosexual and very male perspective" (1). Cadigan's novel, especially with regard to characters Visual Mark and Gabe, should also be read as a criticism of this perspective.

Like Hayles and Haraway, Cadigan is concerned with the epistemological importance of embodiment in technological forms of human liberation from systems of control; or, in Haraway's words, from patriarchal "world historical systems of domination"

that fuel both liberal humanist and techno-fetishist discourses and modes of social organization and governance (161). Thus, as Balsamo notes, the men (Visual Mark and Gabe) are obsessed with virtual disembodied consciousness—the technological sublime—while the women (Gina and Sam) actively retain and celebrate their embodiment and physical inter-connectedness (137). While Mark is reconstituted as omnipotent consciousness in digital space, and Gabe (whose marriage and job are both a cause of great stress) turns for emotional support to his immersive virtual reality simulations, Sam and Gina are rooted firmly in the physical world. Their bodies are in conversation with—not an inextricable part of—the spheres of the digital.

Sam, a born-digital seventeen year old, is augmented with a makeshift insulin pump/sunglasses combination that she has converted to get onto the dataline (online). Working on some ripped-off encrypted data, she shows Fez and Rosa "where the two needles went into the fleshiest part of her abdomen," making her in her own words "'a potato clock.'" She explains that the pump uses her body as "'an alternative power source. You can use batteries, or house current with an adapter, but if the power fails from one or the other, it's crash time. This never crashes'" (Cadigan 59). The intimate and generative overtones of using her body's energy reinforce the emphasis in cyborg discourses on gender, reproduction and embodiment. They also lend support to the argument that "all material objects are interpenetrated by flows of information, from DNA code to the global reach of the World Wide Web" (Hayles, *How We Became Posthuman* 14). Through the enfleshed connection to technology that keeps her biologically connected to the digital, Sam defies Visual Mark's wholesale rejection of physicality. She identifies with her embodied self through the technology that has cyborged her into real life. This is clear

when Fez asks her why she does not use batteries instead. "'Not personal enough,'" she replies (Cadigan 59). Visual Mark, on the other hand, looks back without regret at "the idle meat, still in the pit" (324), disdainfully conjuring the image of an animal carcass abandoned and rotting.

In her review of Balsamo's *Technologies of the Gendered Body*, Hollinger traces this concern in Cadigan's novel: that "[a]lthough technology promises the 'effacement' of the body, in fact the discourses of cyberculture… as often as not work to enforce exactly the kinds of boundaries which it promises to erase forever"—especially, she suggests, the boundaries of gender. Moreover, Tuttle argues, the novel is something more than "plugging into a machine… just to leave 'the meat' behind while indulging escapist fantasies." It is about "connection with other minds… to share your deepest self" (vii). Nonetheless, Visual Mark is swept up into the comfort of eternal digital abstraction, finding connection not with other enfleshed human beings, but a massive artificial intelligence known as Dr. Art Fish. In the virtual spaces of the dataline, Art Fish shows him that "[i]*nformation can neither be created nor destroyed—it's accessible or it's inaccessible, but it* is" (Cadigan 416); that he is, for all intents and purposes, a digitized version of pure energy. This thermodynamic law of information is later reinforced, in their joint effort to fight a particularly vicious virus in the network, when their programs are combined to form the super-AI Markt.[9]

Visual Mark's evolution to digital information—and his subsequent merging with the Art Fish AI—engenders two opposing facts: 1) it is the apex and actualization of the techno-optimist's dream—a totalizing representation of "data made flesh" (Gibson,

[9] Mark + Art = Markt. This neologism, a clever piece of word play on Cadigan's part, acts as a proxy for Visual Mark's discarded body: it is the digital space that is now marked by his sublimated consciousness; not his flesh.

Neuromancer 17); and 2) it is a failure in contrast to the digital humanities' resistance against the notion that any work contingent upon the human condition "speaks outside of time, space, and the physicality of the human body" (Schnapp and Presner 5). But perhaps this kind of escapist, self-effacing, bodiless cognitive state is to be expected from a man whose foremost purpose for the last twenty years of his life has been to serve up the imagery running through his mind for commercial distribution.

By contrast, the characters that frequent the Mimosa strip—a gritty part of this alt-Los Angeles that epitomizes the high tech/low life binary of cyberpunk—are an "incurably informed" part of the physical world (Cadigan 4). At one point, Visual Mark describes the strip as a hotbed for "the hackers and the bangers, the laces and the cases roiling around on the sand and the walkways, squatting in vacant buildings, flimsy lean-tos, under piers" where the hackers "could tap a little power with their piggybacks and fooler loops and whatever else they had" (88). The strip acts as a central open-source hub and DIY techno-utopia—a safe-haven from the authorities and the commercial conglomerates that seek to shut down their activities through copyright infringement laws. It is a literal expression of what Anne Burdick and others identify as the transition in contemporary culture from closed to open modes of production and information distribution. Moreover, they suggest (following Richard Stallman), the proliferation of open-source contexts that offer a "'technical means to a social end'" is key to ongoing social, cultural, political and economic transformations of the twenty-first century (77).

The most visible members of the Mimosa strip—Sam, Fez, Rosa, Gator, Keely, Jones, and others—are hackers permanently tethered to real life through wiry gadgets that give them access to their virtual playground, the dataline. Unlike Visual Mark, their experience

of cyberspace is far more conventional and much closer to our own. Sam, like many of the younger characters, is brilliant in all things digital and adept in the navigation and manipulation of the dataline. Along with her hacker friends, she is the prototypical digital native, born and raised on culturejamming, hacked-together hardware and software, and fluent in the languages of the datasphere and the streets. Her relative position in both the physical world and to the romantic, ideological notion of disembodiment popular in cyberpunk (as with Gina) underscores "an often repressed dimension of the information age: the constitution of the informed body" (Balsamo, *Technologies* 140). This dimension—the humanistic, experiential, and physically present aspect of the digital age—is vital for building a digital humanities that "engages a world of linked and lived experiences" and, I would add, embodied awarenesses (Burdick, et al. 75).

In their own way, Sam and her friends are synthesizers like the commercial synners at Diversifications. But then again, all the novel's characters should be read as synners; the digital and multivalent reshaping of modes of cultural production and consumption along the lines of authorship, collaboration, experience and action necessitates it. Their down and dirty interaction with new media in the novel often approaches, if not spills over into, a kind of skilled, co-operative handicraft exclusive to the digital age. As such, they are representative of the current "generation now cursed with the label 'digital natives'" whose cognitive training is regulated by the digital demands for synthesis and rhizomatic understanding (Burdick, et al. 15). In emergent digital environments, much like Cadigan's hackers, the members of this new generation "will surely develop the capacity to become comprehensive digital humanists" that thrive "in a fluid environment in which remixing and culture jamming are the common currency" (15).

One of the most effective moments of digital collaboration—though Gina reacts to it at first as a "retrograde experiment in techno-Walden-Pondism on the communal level" (Cadigan 424)—comes during the final battle with a viral AI that has infected the dataline. Visual Mark and Art Fish (as Markt) as well as Sam and the Mimosa strip crew, and Gina and Gabe, must work together to collectively outwit the virus by combining their respective hacking and simulating abilities and technological know-how. The battle takes place in the virtual spaces of the dataline where Gina and Gabe—plugged in via connections to their brain sockets—fight the subconscious memories/desires of their own minds thrown at them by the virus. But in the larger context of the novel, we can read their experience inside the dataline as an ontological and epistemological struggle for supremacy between disembodied consciousness and sensory/emotional affect.

The conceptual space of virtuality thus becomes an arena or "'tool for examining our very sense of reality'" and investigating the discursive possibilities and pitfalls of erasure (Heim, quoted in Bukatman, *Terminal Identity* 188). Within the virtual paradigm, according to Bukatman, "epistemological and ontological issues… are all placed… in question around the discursive object of virtual reality and the postulated existence of perfect, simulated environments" (*Terminal Identity* 188). Gina and Gabe are ensnared in the web of this uncertainty, watching their memories and desires being played out; twisted; deconstructed. While Gabe is dealing with the spliced-in, transmogrified abstractions of *Headhunters* and fragments of Visual Mark's stony beach video hallucinations, Gina is fighting the confusion of the last remnants of her love for Visual Mark and her growing affection for Gabe. In both cases, the question of embodiment is at stake. Their sublimation (also echoed in the narrative's formal dissolution into an abstract and fragmented prose

style) into a "perfect, simulated [environment]" threatens to efface the characters' remaining connection to a sense of embodiment—as Gabe's *Headhunters* simulation once tempted him. In other words, for the two, the virtual reality of the dataline almost makes good on the promise of virtuality as "the very embodiment of postmodern *disembodiment*" (Bukatman, *Terminal Identity* 188).

Meanwhile, back in real life, Fez, Sam and the others monitor the data outputs for Gina and Gabe's physical states and the havoc the virus is reaping across the interconnected world. Once again, Sam provides support with the insulin pump using her body as its power source—in this case for Gina and Gabe's trip through virtual space. When Gabe shows signs of injury brought on by the illusion of virtual cognition, her emotional discomfort is telling:

> Sam clutched the unit on her thigh, her other hand resting on the wire leading to the needles in her stomach… One little yank; if that was what it would take to save her father's life, she would do it and hope it wasn't already too late, if that weird swelling in his face didn't mean he'd stroked out— (Cadigan 443-44)

There is an even greater sense here of experiential embodiment and the intimate connection (through wire connectors as well as in the figurative sense) she is at last sharing with her formerly estranged father. We might see this connection—in addition to his body's outward markers of pain and the "stigmata" of impressions caused by the hotsuit (Cadigan 444)—as his tether to material reality.

But perhaps the most potent reaffirmation of embodiment occurs when Gabe asks Gina, caressing and kissing her before they enter the dataline, "'[y]ou think we can synthesize something together?'" Gina's responds immediately: "'I'll pop your chocks again

if we don't; I'll take your whole fucking head off'" (Cadigan 424). The raw and visceral sexuality of this scene is steeped in the erotic, sensory and generative terms of enfleshed creation—to "synthesize something"—that acts as a counterweight to the techno-optimism of disembodied digital consciousness and the need to "change for the machines." It also anticipates the generative and synthetic methodologies that course through digital humanities work in general. Later, in the dataline, the proposition is returned. Gina suggests they attack the viral AI by merging consciousnesses—"Part my brain and part yours… Doesn't get much more fucking intimate than that" (Cadigan 432). Gina and Gabe's union is, then, in real life and on the dataline, an expression and ultimately a celebration of experiential, embodied connection. It is the kind of concretized intimacy the narrative yearns toward, climaxing in the erotically charged realization of the pair's literal and figurative "fucking intimate" merging together.

Conclusion

Taken together, the various portrayals of digital heuristic collaboration, production, and synthesis in *Synners* stand as an invocation of the "array of convergent practices" that would come to define digital humanities practices and discourses (emphasis removed) (Schnapp and Presner 2). These moments culminate in the final collaboration between many of the novel's primary characters, unifying its many disparate strands. Fez captures the essence and interconnectedness of this collaborative work when he muses, "We might actually have two species of humans now, synthesizing human and synthesized human, all of us being the former, and Art Fish being the latter." "And Mark being the bastard offspring

of both," adds Gina (Cadigan 421). Their point is that in their creative interdependence upon one another, they represent a new version of humanity complicit in its collective synthesis and representative of what it synthesizes—not in exclusively biological terms, at least. None of them could have beaten the viral AI alone; not even the AI super-combination of Visual Mark and Art Fish. "Cyberpunk has little patience with borders" (Sterling 347), and the boundaries of flesh, metal, digital information, sexuality, gender and more are blurred everywhere here.

Unlike *Neuromancer*, the novel resists prevalent essentialist and metaphysical discourses of the era that heralded the sublimation of the body into disembodied digital code. At the same time, the work should be understood as a product of the period that grew out of conflicts between selfhood and the proliferation of digital and virtual environments, shifting social and cultural norms (both local and global), and an upsurge in critical discourses that attended to issues of materiality and embodiment. From this perspective, it is possible to read cyberpunk as a catalytic and diverse outcome of a highly unique set of cultural phenomena: the residual effect of decades of postmodernism; countercultural, social and economic upheaval; and the proliferation of digital technologies that raised the possibility of effacement of bodily imperfection and finitude.

This perhaps explains why the original cyberpunk style was simultaneously so influential and so ephemeral. It exists now as an immutable facet of American cultural history—a legacy that provides insight into a moment of intense humanistic and technological transition. Its lasting influence can be seen in wry post-cyberpunk narratives such as those by Neal Stephenson.[10] Even Cadigan, one of those original cyberpunks, was

[10] See, for example, Stephenson's post-cyberpunk novels *Snow Crash* (1992) and *The Diamond Age* (1995).

beginning to show signs of departure from Gibson's idea of cyberspace. In *Synners*, Visual Mark has trouble remembering the word his boss uses to describe virtual space: "the Beater could have dragged out that old chestnut, *cyberwhatsis*, or whatever it was, he couldn't remember" (Cadigan 95). Cadigan's reference is a testament to the fluctuation of a register of ideologies, technologies, epistemologies and ontologies that, as part of postmodernism, moved into and occupied the void left by the break with the past.

The differences in the thematic treatments of cyberspace from *Neuromancer* to *Synners* (differences that also highlight the authors' respective ideological agendas as well as the seven-year interval between their publications) arguably mirror the evolution from first- to second-wave digital humanities. The first wave was primarily a quantitative, textual investigation of the humanities that made extensive use of powerful computational tools and databases (Schnapp and Presner 2). But at times, this critical work veered dangerously close to a screen essentialism in which "the screen is often portrayed as an essential aspect of all creative and communicative computing" (Montfort, quoted in Berry, Introduction 10) and fetishized in the rhetoric of "a medial ideology" in which "[s]peed and light (or lightning) are paramount" (Kirschenbaum, *Mechanisms* 43). The second wave, on the other hand, turned on a more qualitative, heuristic and generative concern for humanities work, adjusting its digital tools and frameworks to the humanities' traditional analytical, methodological and interpretive strengths (Schnapp and Presner 2). For obvious reasons, this dialectic between the two waves can also be seen in the opposing thematic approaches of *Neuromancer* and *Synners*: Gibson's "console cowboy" diving head first into the virtual ether (*Neuromancer* 28); and Cadigan's retention of the sensual, efficacious body marked by scars, experience and desire.

Nonetheless, although cyberpunk fiction can be and has been considered along gender lines of culture/nature and disembodied/embodied being, the subgenre is unified in its overarching interest in developing global and digital discourses that engender a more inclusive, collaborative and international field of vision. Again, as Sterling writes in his *Mirrorshades* preface, this is reflected in "tools of global integration—the satellite media net, the multinational corporation—[that] fascinate the cyberpunks and figure constantly in their work." "Global awareness," he continues, "is more than an article of faith with cyberpunks; it is a deliberate pursuit" (347). *Synners* attends to these emergent perspectives in its frenetic array of interconnections and interzones. The stifling, hyperconnected LA of Cadigan's work is not only a close vision of our own digital moment, but also a reality in tune with the critical core of second-wave digital humanities: that is, a humanistic artifact concerned with the "qualitative, interpretive, experiential, emotive, [and] generative" force of the digital (emphasis removed) (Schnapp and Presner 2).

In this chapter I have attempted to draw parallels between Cadigan's text—particularly its preoccupations with the fluid boundaries of machine, body, and self, and depictions of production through decentralized, non-liberal humanist modes of synthesis and collaboration—and digital humanities practices as they have developed over the last two decades. As I noted, following Anderson and Balsamo, the digital age has given rise to a generation of digital natives, or synners, for whom the production of knowledge is totally dependent upon collaborative, synthetic, remediative, and non-linear methodologies.[11]

[11] That is, as opposed to the analytic, insular, and deep attention approaches to study that have traditionally defined the humanities. I do not want to suggest that the nature of knowledge production has, until the digital age, never *not* been marked by synthesis, collaboration, and other open-ended methodologies; simply that it is more pronounced through those digital media that make such work possible. Perhaps, in review, digital technologies have not entirely changed the way knowledge is produced, but we cannot ignore the synthetic

"[R]emediation"—the creation of new texts through the "representation of one medium in another"—is a key characteristic of the digital age, supported by rhizomatic structures, dynamic combinations, and mutable data (Bolter and Grusin 45). I also discussed *Synners* in light of popular feminist debates in posthumanism, and the narrative arguments it deploys to support embodiment (and thus, the non-effacement of the female body under the liberal humanist sign) in digital contexts. Such theoretical revisions of/incursions into the traditional humanities are vital to our evolving understanding of the digital humanities, which continue to confront the perverse fixity of traditional bodies and borders.

In chapter 2, "The Machine Reads: Literature, Language, and Artificial Intelligence in Richard Powers' *Galatea 2.2*," I will extend this line of inquiry through a discussion of hybrid and collaborative forms of learning in the humanities. Building on Cadigan's transgressive cyberpunk vision of cyborged humanity and high-tech/low-life culture, I will examine Powers' narrative amalgamation of human perception and artificial intelligence as it grapples with the complexities of lived experience and memory. This will necessarily involve an examination of the posthuman theoretic and the contemporaneous emergence of a World Wide Web. Most importantly, the chapter will focus upon collaborative learning between human and machine that takes place through the abstract lenses of English literature and language. This aspect of *Galatea 2.2* is essential to the present study on digital humanities practices and discourses in speculative fiction.

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and multimodal mediating effects—characteristics that differentiate new media from old—of the technologies themselves.

2

The Machine Reads

Language, Literature, and Artificial Intelligence in Richard Powers' *Galatea 2.2*

Richard Powers' 1995 novel *Galatea 2.2* portrays one of the clearest representations of the digital humanities in literature. Like *Synners*, Powers' book was written out of the same emergent, explosive contexts of Internet and computer culture that emerged in the West throughout the 1990s. Within science fictional frameworks, both texts are preoccupied with the real-world narrative discourses of global connectivity and creativity, scientific innovation, and the positive and negative potentialities offered by technology. The clustered appearance of artistic and critical work about the digital was, in the first place, a paradigmatic response—in certain ways, a knee-jerk reaction—to technologies that contributed to a reshaping of traditional discourses and practices. Indeed, much of the early rhetoric on the subject (though at times essentialist) pointed toward "the emerging contours of a medial ideology" in which "[s]peed and light (or lightning) [were] paramount" (Kirschenbaum 43). While speculative fictions about the digital were not immune to this kind of rhetoric, texts like *Galatea 2.2* contributed (beyond the merely extrapolative) to a socially inflected acclimatization to emergent digital ecologies.

In a number of important ways the work leans on the emerging notion that, in a cultural space increasingly contested and determined by machines and thus forced into existential crisis/redefinition, "the core challenge" of the artist is to "articulate and give

meaning to… new modalities of 'being' in this world" (Shaw, Kenderdine, and Coover 236). With its ontological mixture of human lives, loves, and the creation and education of an artificial intelligence all on the threshold of emergent digital networks, new media, and global discourses, *Galatea 2.2* takes up this core challenge of re-evaluating being.

As with all the primary texts selected for this study, *Galatea 2.2* is deeply concerned with digital technologies from a humanities perspective. Ian Foster has suggested that, with regard to the humanities and the arts, "computation… has the potential to transform… how humans communicate, work, and play, and thus—to some extent—what it means to be human" (16). Likewise, according to Frederica Frabetti, any contemporary study of the digital humanities and its creative artifacts must take account of "the mutual co-constitution of the digital and the human" as well as "the role of digitality in constituting the very concepts of the 'humanities' and the human" (161). As a story about a writer involved in the literary and linguistic education of an artificial intelligence, and their interdependent humanistic and emotional growth, Powers' novel offers an artistic analogue for Foster's and Frabetti's respective views. On the one hand, it is a socio-literary response to a historical moment of rapid technological transformation. On the other, it is an artifact of the hybridization of scholarly and artistic modes of inquiry, contexts, and practices through information sciences and technologies that, as Thomas Bartscherer and Roderick Coover point out, "bridg[e] a gap by making digital scholars and artists out of humanists, and vice versa" (9). Both schemas foreground the contingent relationship that computing and the humanities—from simple word processing to complex coding—have had on one another in the last twenty-five years, making us, Coover suggests, "all multimedia makers now" (Bartscherer and Coover 9).

As with Cadigan's *Synners*, in this chapter I locate *Galatea 2.2* as a literary artifact that both signposted and grew directly out of the proliferation of digital technologies and attendant discourses throughout the 1990s. In this respect, I examine Powers' text as a paradigmatic mainstream commentary of the digital's transformative effects upon communications, humanities knowledge (and access to it), and cultural and political configurations. This is most prominent in the novel's central relationship between human protagonist Rick and the artificial intelligence (dubbed Helen) he helps create to pass a Masters qualifying examination in English Literature. Coinciding with the popular ascendency of the World Wide Web and the digital turn in the humanities, this relationship provides a useful fictional representation of digital humanities work.

I will begin my discussion with a focus on the so-called two cultures of the sciences and the humanities, a dichotomy popularized in 1959 by C.P. Snow and confronted in *Galatea 2.2*. I will then move into an examination of the rhetoric surrounding the early World Wide Web and its role in shaping (and blurring) sociocultural and humanities discourses. Next, I will examine the novel's psychological exploration of posthumanism and the Turing Test—a scientific test designed by Alan Turing to measure a machine's capacity to think. Finally, in the last two sections of the chapter, I will concentrate upon Rick and Helen's shared journey through the murky abstractions of English literature and language, particularly as it deconstructs meaning and, by extension, epistemological human reality. For the sake of clarity, I will refer to the novel's author as Richard Powers and the protagonist (the author's textual analogue) as Rick.

The Two Cultures Debate

The novel, a semi-autobiographical work, depicts a year in the life of Rick, a famous novelist, during his residency at the sprawling Center for the Study of Advanced Sciences at an unnamed Midwestern college campus he refers to as U.[12] As the Humanist-in-Residence[13]—a visiting position awarded on the strength of his third novel about a would-be career in the sciences—Rick is a character with his feet very much in both camps. "My official title was Visitor," he explains. "Unofficially, I was the token humanist… The Center saw me as a liaison with the outside community. It had resources to spare, the office cost them little, and I was good PR" (Powers 4-5). Descriptions of the Center and the college's English department—the department at which Rick studied and taught as a Masters student fifteen years before—are deeply contrasted. "With its countless discrete and massively parallel subsystems," Rick perceives the Center as "a block-wide analog of that neuronal mass it investigated," the brain (6), kept alive by its talented and restless "addicts of the verifiable" (10). The brain metaphor is an apt one, jibing with the Center's atmosphere of non-stop activity, innovation, the flow of data, and the cutting edge technologies that offer a glimpse of the future. The English department, on the other hand, is a different matter:

> There I lived my alter ego—picturesque but archaic man of letters. The Center possessed 1,200 works of art, the world's largest magnetic resonance imager, and elevators appointed in brass, teak, and marble. The English Building's stairs were patched in three shades of gray linoleum. (75)

[12] Likely based on Powers' real-life alma mater, the University of Illinois, Urbana-Champaign.
[13] This is a phrase used on the back cover of the first Picador edition (1995).

For Rick, though it is dilapidated and outmoded, the antiquated prestige of the English department "provid[es] a healthy antidote for too much future"—a corrective, in other words, to the information overload of the hulking Center (75). Nevertheless, when he visits the old, deserted classroom of his Masters days, we are subjected to the full melancholic brunt of the passing of the traditional humanities:

> A blackboard bore the message "Thurs. 3:30—5:00," ringed by a smeared white corral of eons-old microorganism skeletons. The linoleum floors had darkened into a color somewhere between the Forest of Arden and the wine-dark sea. A circle of warped wooden chair-desks had been hastily abandoned. *Waneth the watch*… *But the world holdeth*. (75)

But although the Center's impressive technologies and furnishings are a thousand miles away from the English department's silent "Forest of Arden" and primitive pedagogical tools—its crumbling traditions mourned for like the other-lives of the seafarer in Ezra Pound's 1911 translation of the old English poem—something interesting happens. As he divides his time between the Center and the English department, Rick assumes the role of a (albeit conflicted) Janus-like figure that nonetheless links the two cultures of the humanities and the sciences. Engendered by and through this new critical alliance, the digital humanities begin to take form.

With the proliferation of academic neologisms such as *information sciences*, *digital humanities*, and *humanities computing* in recent years (not to mention the crossover of terminology[14]), the bridging of these formerly estranged cultures highlights the trend

[14] As the sciences and the humanities, especially through digital technologies, continue to integrate in an increasingly global, interconnected world, it is only natural that certain of their terms might migrate into one another's rhetorical discourses. Following Mieke Bal, these terms are often referred to as "travelling

toward hybrid discourse practices and cross-disciplinary critical investigations. Recent critical and creative work across the board has revealed, Marie Laure-Ryan observes, a shared "predilection for puns, trompe-l'oeils, paradoxes, serial constructs, Chinese boxes, permutations, transformations, in short, any game played with symbols—be they bits, bytes, pixels, numbers, letters, words, or sentences." In fact, "the formal structures and textual phenomena that fascinate practitioners and theorists of postmodernism [often] have parallels in computer languages, computational theory, or computer architecture" (8). In a 1993 *Omni* magazine interview, Powers argues that the opening of a dialogue to navigate common human experience is necessary: **"**[T]he similarities in the ways we all attempt to solve experience are, in the wide lens, probably more important than the differences… We can not only survive plurality—we need it." "[L]iterature," he continues, "can be a fractal map of that multiplicity, at a scale of almost one inch to the inch" (quoted in Stites 48). Certainly this effort of orientation to hybridity is on display in *Galatea 2.2*.

While the humanities and the sciences both carry "a distinct set of lexicons, methods, theories, and goals… embedded in complex webs of knowledge," it is clear more than ever before that "digital technologies are stimulating, and perhaps even necessitating, bridge-building within and between [the] cultures" (Bartscherer and Coover 7). In its depiction of "thinking and making by way of digital technologies," *Galatea 2.2* is arguably one of the first literary instantiations of this shared epistemological progression—one that is attentive to the "shaping [of] a discourse between information technologies and intellectual/creative fields" and "provoking questions about conventional borders that

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concepts" (29). As Bal points out, such "concepts"—adapted for, enriched by, and sometimes warped through interdisciplinary appropriation—"are not fixed. They travel—between disciplines, between individual scholars, between historical periods, and between geographically dispersed academic communities" (24).

separate artistic and scholarly practices" (Bartscherer and Coover 7). As the text's narrative drama interweaves with Rick's own fictionalized literary efforts, his work with neural nets and AI, and his tutelage of an artificial intelligence via the Western literary canon (for a Masters qualifying examination in literature), we begin to see the extent of this overlap and the new spheres of knowledge it makes available.

Rick is in many ways a fictional representation of C.P. Snow, the famous novelist and scientist whose 1959 Rede lecture on the two cultures initiated a lasting debate about an apparent scholarly and artistic No-Man's Land between the sciences and the humanities. The dialectic—a seeming "gulf of mutual incomprehension," "hostility and dislike," in Snow's words—of the "[t]wo polar groups… [of] literary intellectuals… [and] physical scientists" (4) is brought into doubt by a man straddling both cultures as a scientist by training and a writer by vocation (1). In the intervening years, the proliferation of information technologies in almost every stratum of society and culture has, Bartscherer and Coover argue, complicated—rather than definitively solved—the two cultures issue: "In ways that Snow could hardly have anticipated, the culture of arts and letters is now permeated by science in the form of information technology, from word processing and semantically structured research networks to computer-generated imagery, interactive cinema, and creative machines" (2). Following Theodore H. Nelson's work on the subject (in *Computer Lib/Dream Machines*, 1987), they note that this cross-cultural, cross-disciplinary amalgam of "'information science' indicates how 'deeply intertwingled' the two cultures have become" (2). The cross-cultural conversations that are beginning to take place via and because of the digital are only adding to this. And though tensions and incomprehension still persist between the cultures at the level of their respective poetics

and rhetoric, digital and information technologies are fundamentally changing critical thinking and traditional scholarly practices.

But with or without the consent of the cultures' respective gatekeepers, "the micro-electronic revolution which has taken place since Snow was writing," asserts Stefan Collini in his introduction to the 1993 canto edition of Snow's work, "is having as great an impact on daily life as the invention of the railway or the internal combustion engine had on that of earlier generations." In fact, "the rapidity of… technical advances" on a global scale in everyday life, he suggests, inevitably engenders a degree of overlap between science and culture that "continually threatens to defy ordinary understanding" and frustrate the reflexive impulse to categorize phenomena in dialectical terms (lxii).

By 1995, we were already beginning to see the breakdown of the conceptual border between the humanities and the sciences, punched through by the digital's decentralized, non-hierarchical, and inclusive influence. Rick spends time contemplating the passing of traditional, exclusive academic practices, and the tensions felt by each field from one another. In an illustrative passage, the tension is literalized dramatically when a junior philosophy professor triggers a campus bomb scare on talk radio. In a second call, before his arrest, the professor "claimed his threat was never more than a moral subjunctive. The Center was draining the university dry, reducing the humanities to an obsolete, embarrassing museum piece" (Powers 273). And in a kind of humanist riposte to the applied scientific innovation the Center specializes in (not to mention his unwitting self-mockery in stubborn adherence to philosophical abstraction), the wrongdoer is adamant on the point that his threat carried "no more than hypothetical detonation, for which he expected no more than a hypothetical sentence" (273). It is within this liminal, alloyed

space of competing humanist and scientific academic ideologies that—much like Snow forty years prior—Rick positions himself.

In both form and content, Rick is imbued with the spirit of Snow as representative, perhaps harbinger, of this evolution—positioned at ground zero, smack in the middle of the two cultures. At the outset, simultaneously drawn to each field, he undergoes a doubling of the self—one person divided or torn into two halves. Indeed, doubling is a recurrent motif in the mapping of many relationships throughout the novel, neatly suggested by the "2.2" version number of its title.

As he becomes invested in his work at the Center with Dr. Philip Lentz (a brilliant but misanthropic physicist specializing in cognitive neurology), however, what the novelist and the scientist manage to produce in collaboration—not to mention the act of collaboration in itself—is symbolically suggestive of the initial overtures made by the two cultures toward a mutually beneficial dialogue. Moreover, it is no coincidence that the narrative's joining together of the two halves (represented by Rick on the one hand, and Lentz on the other) is stimulated by the digital. In this sense, the relationship acts as a commentary of real-world shifts toward open discourses and dialogues shaped by globalization and digital technologies. Ryan argues that, in critical/hands-on scholarly practices, work on "AI lives largely from imports. The most important contributions in the field are not made by pure computer scientists, but by representatives of other disciplines who use the computer as an instrument of research" (5). In their attempt to develop an artificial intelligence (a computer later dubbed Helen) capable of passing a Masters qualifying exam in literature under the conditions of a double blind Turing test, it appears the sciences and the humanities may have reached an accord. We should also recognize this

plot contrivance, then, as a formative encapsulation of digital humanities work and its multi-modal, multi-disciplinary agenda in general.

Given these dialectical but, nonetheless, foundational instincts in Rick, it is natural that he should be drawn to Lentz and his newly emerging and hybrid field of connectionism. This branch of cognitive science, which deals specifically with neural nets, combines scholarly research and development in technological as well as biological fields, "a broad appropriation of metaphorical logic by the sciences" (Saltzman 103). As Rick reflects, adherents of connectionism "lived on a middle level, somewhere between the artificial-intelligence coders, who pursued mind's formal algorithms, and the snail-conditioners, who sought the structure and function of brain tissue itself." In this amorphous place, "the halfway world of neural nets," Rick designates Lentz as "the point man" holding the two sides of humanity and technology together (Powers 28-29). Connectionism goes beyond the mere pretense of a "truce in the academic turf wars" to apply itself as "the dream of a parsable continuum, a compound miracle whereby God's programming may be arrayed as eloquent linkages among disparate fields" (Saltzman 103). The theoretical anticipations and accomplishments of connectionism to unite the sciences and the humanities add greater depth to Rick's and Lentz's love/hate collaboration. In their mutual attitude of grudging respect for one another, connectionism connects them more intimately than either would care to admit. In Saltzman's reading,

> The convergence of urges of the physicist and the poet, the cooperative venture of the wide-eyed futurist and the bookish curator of the verbal past—each confirms the other's figurations and expanding architectures. In spite of the respective skepticisms supposedly separating C.P. Snow's "two cultures," the scientist finds

> that even at the molecular level he cannot access and integrate without resorting to metaphors that root out their rapport… while our novelist follows scientific advances to nourish his fictions and to consolidate his extraliterary experiences. (103)

Implicit in the act of their collaboration—the building of an artificially intelligent machine and its education in the humanities—they approximate the same hybridized concerns and convergent practices that mark the digital humanities as flexible, non-unified, cross- and multi-disciplinary, and open-ended. Burdick, in collaboration with Schnapp, Presner, and others, agrees with this point of view: "In contrast with most traditional forms of scholarship, digital approaches are conspicuously collaborative and generative, even as they remain grounded in the traditions of humanistic inquiry" (3). In fact, the very idea of a digital humanities presupposes the simultaneous embrace and amalgamation of a whole series of diverse but nonetheless potentially compatible fields of knowledge—the combination of which may lead to some richer set of discourses than each could produce on its own.

Under the banner of connectionism, then, Rick and Lentz move through some of the key themes at the center of digital humanities work: "scale, critical/productive theory, collaboration, databases, multimodal scholarship, and future trajectories" (Hayles, "How We Think" 43). As Hayles argues, though "each of these areas has its own tensions, conflicts, and intellectual issues"—reflected in the personal and professional aspects of the characters' tempestuous relationship—these same contestations "indicate the vitality of the digital humanities and their potential for catalyzing significant change" (43). It is

precisely these kinds of vital contestations and oppositions that galvanize *Galatea 2.2* as a precursor of the still nascent digital humanities.

The novelist Walker Percy once said, combining "romantic theory and Platonic epistemology," that "'the serious novelist is quite as much concerned with discovering reality as the serious physicist'" (quoted in Tharpe 11). In this process of discovering reality, Rick and Lentz carry out work that not only offers a literary antecedent to the digital humanities' mission, but also reinforces the notion that "the business of cognition is a shared field" (Saltzman 104). In effect, the two poles compliment and enrich one another in ways previously unforeseen. We see this in the pair's heuristic approach to their project: as the AI goes through a number of iterations, from Implementation (Imp) A to H, and ending in the personified intelligence known as Helen, their work corresponds to digital humanities methodologies, particularly its emphasis upon "creative, generative, and experimental processes of design-based research" (Burdick, et al. 22). Rick gives a summary of this protocol, a kind of continuous and recursive remediation:

> Each machine life lived inside the others—nested generations of "remember this." We did not start from scratch with each revision. We took what we had and cobbled onto it. We called that first filial generation B, but it would, perhaps, have better been named A2. E's weights and contours lived inside F's lived inside G's, the way Homer lives on in Swift and Joyce, or Job in Candide or the Invisible Man. (Powers 170-71)

The palimpsest of information that is accreted and carried over into each successive build, each and all living on in the next, finds its counterpoint in literary history, here. The ghosted traces of binary ones and zeroes affect every new machine implementation just as,

in the long genealogy of literature, each successive generation of writers influences the next. In both cognitive (humanistic) and technological (mechanistic) terms, each version is never an end in itself.

To investigate *how* the machine thinks, Lentz later suggests to Rick that they disassemble it through a process that would allow them to empirically pinpoint, analyze and correlate "the high-level processes by which she maps complex input and reassembles responses." For the cognitive neurologist, the AI is merely a fascinating product of arduous research, "a heuristic tool" that "mimics with shocking accuracy some features of high-level cognition" (Powers 301-02). Despite Rick's sentimental protests (he has become attached to the idea of Helen as a subject, worried that his collaborator's desire to lobotomize the machine would be pain-free), this new direction of study follows empirical scientific and digital humanities practices of interpretation in which "[p]rocess is favored over product; versioning and extensibility are favored over definitive editions and research silos" (Burdick, et al. 22). In this, the disciplines are united in a shared understanding that cultural discourses are not fixed, but rather subject to play and experimentation.

World Wide Web: A New Frontier

Intervening in this debate, and, indeed, irretrievably frustrating the two cultures dialectic, is the emergence of Internet computing—a new media network "built on the foundation of the global telecommunications system, from the ARPANET[15] onward"

[15] Leah A. Lievrouw provides a brief description of the ARPANET as the "early prototype and predecessor of today's internet." It was "designed by engineers and scientists working for the Advanced Research Project Agency of the U.S. Department of Defense, who linked long-distance telephone systems and computers so

(Lievrouw 9)—in the late-twentieth century. The world was just waking up to the digital in 1995 as it pervaded the ideological and psychological landscapes of commerce, politics, and social interaction faster than anyone might have anticipated. "Beginning in the late 1970s," write Palfrey and Gasser, "the world began to change—fast," experiencing "the most rapid period of technological transformation ever, at least when it comes to information." From the early bulletin board system and common interest Usenet groups, to email, the web, social networking, cloud computing and beyond, the Internet of "the digital era has transformed how people live their lives and relate to one another and to the world around them" (2-3). On a global scale, reports Vibeke Sorensen, "networked, immersive, nonlinear digital environments" such as the web have stimulated—and "made all the more visible and accessible"—"the discontinuities and fragmentation of world cultures," permanently reshaping the nature of global communications and relations (242). Indeed, the 1991 launch of Tim Berners-Lee's World Wide Web—an interactive and hyperlinked information medium that connects computers on a global scale over the Internet—offered the world an unprecedented set of knowledge tools with the power to take one, virtually, almost anywhere, any time. As Berners-Lee himself states, the enduring appeal of his invention resides in its "vision encompassing the decentralized, organic growth of ideas, technology, and society… about anything being potentially connected with anything." This vision, he continues,

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they could share scientific data-processing capacity across a select network of scarce, expensive, and complex mainframe computers. The system was designed to re-route data to different computers automatically if part of the system failed (e.g., by coming under military attack). Those engineers and scientists never expected that a single program that allowed project workers to exchange, store, and forward telegraphic 'electronic mail' messages would quickly become the most heavily used feature of the system… or that email would launch a whole new era of computer-mediated communication and pave the way for other forms of digital expression and interaction" (8-9).

> provides us with new freedom, and allows us to grow faster than we could when we were fettered by the hierarchical classification systems into which we bound ourselves. It leaves the entirety of our previous ways of working as just one tool among many. It leaves our previous fears for the future as one set among many. And it brings the workings of society closer to the workings of our minds. (1-2)

Lawrence Lessig echoes this feeling, noting that in the early days of the web, its users "could communicate and associate in ways that they had never done before." As a "new target for libertarian utopianism," the web "seemed to promise a kind of society that real space would never allow—freedom without anarchy, control without government, consensus without power" (*Code* 2). As Sorensen points out, "the utopian romance with the virtual world" stood—and in many ways still stands—in the beginning in stark contrast to the widespread "suffering and dystopia in the physical world" (242). In Siva Vaidhyanathan's view, the early "Web was exciting and democratic—to the point of anarchy" (1). In the intervening years, however, this utopian dream—the invisible nowhere of the digital—has been variously vouched for and debunked.

Such passionate sentiments about the web's transcendent power and its potential to free and reshape collective social consciousness are captured early on in the novel through Rick's own sense of awe and wonder. Acting as a mouthpiece for the majority of its (Western) readership in 1995, he marvels, "the web overwhelmed me" (Powers 7).

> Each day produced new improbabilities. I searched card catalogs in Kyoto or book reports from Bombay. German soccer scores and Alaskan aurora sightings filled my office E-mail pouch.

> I eavesdropped on international discussion groups, ongoing, interactive Scheherazades that covered every imaginable theme from arms control to electronic erotica. Notefile threads split and proliferated in meiosis. Debates flowed without beginning or end, through tributaries and meanderings, responses to responses to responses. (8)

Access to and interaction with these newfound freedoms and "improbabilities" (again, the rhetorical intangibility of magic) mark Rick as one of the "'Digital Settlers'" of his generation—a person who, unlike the born digital generation, "grew up in an analog-only world" and "helped to shape [the] contours" of the digital future (Palfrey and Gasser 3-4).

Like many in the mid-1990s, he comprehends the web as "another total disorientation that became status quo without anyone realizing it" (Powers 7)—an abrupt and massive lurch forward in the technological capabilities of humanity. As with the successive rapid introduction of technologies that revolutionized communications, travel, media consumption and time at the beginning of the nineteenth century (the telephone, the fountain pen, the automobile, the phonograph, etc.) and again in the early twentieth century (especially television and radio), advances in digital computing and bio-technologies have defined and continue to define the late twentieth and early twenty-first centuries (Gordon, cited in Olsson 1-2).

Friedrich Kittler documents these same momentous shifts in his work on new media and discourse genealogies, suggesting that "the media age proceeds in jerks, just like Turing's paper strips" that produce information in a discrete and spasmodic rather than traditional and continuous fashion. In just over a century, writes Kittler, these forward jerks in the evolution of technology and new media—from "Remington [typewriters] via

the Turing machine to microelectronics, from mechanization and automatization to the implementation of a writing that is only cypher, not meaning"—reinforce the symbolic epistemological truth that "numbers and figures [have] become the key to all creatures" (*Film, Gramophone* 18-19). Progress in these latter fields—especially in the advent of the Internet and, later, the World Wide Web—has spurred growth in a whole host of similar, often complimentary technologies. "A drastic innovation," Olsson argues, "is an 'enabling technology' in the sense that it makes possible the evolution of a whole new class of new technologies" (6). Thus, we can recognize the web and the Internet that powers it as an enabling technology that has dramatically and unalterably reshaped our cultural, social, political and economic landscapes. In senses both epistemological and metaphysical, it stands as an expression of uncharted human potential that Rick calls "the emergent digital oversoul" (Powers 10).

Early impressions of the web—like the work that served as Berners-Lee's inspiration, a Victorian advice book entitled *Enquire Within upon Everything*—held it to be a data treasure trove "suggestive of magic," opening up "a portal to a world of information" previously untapped (Berners-Lee 1). Rick deploys similar rhetorical whimsicality in his tentative interactions with the web via the Center's powerful network. From his front row perspective—a point of view that perhaps may seem quaint to the born digital generation—he is astonished by the unbounded creative, communicative and educational possibilities afforded by the web. "I found it easier," he admits, "to believe that the box in Pakistan I chatted with was being dummied up in the other end of the building" (Powers 7). At the same time, his newfound virtual liberation from the constraints of time, space and

fixed identity (mirroring the same liberations that prior technological advances have rendered) is keenly felt:

> I explored the world's first network in embryo… I spent my nights playing in the greatest virtual sandbox yet built. I'd stumbled upon a stack of free travel vouchers. I put up in U., but I resided elsewhere. I thought: a person might be able to make a life in all that etherspace. (8)

The web has always offered tantalizing possibilities for self-reinvention, education, and escapism. The "sandbox" metaphor conjures two images at once: the first, of a creative space providing a dynamic set of tools to make and build the world anew (sandcastles, etc.); the second, of a children's sandpit, filled with endless amusements and fantasies. (The two, one will observe, are never mutually exclusive.) Moreover, the continuing unification of knowledge, learning, creativity, and interactivity under the "complex, plural, global narrative" of the digital "reinforces the goal of digitally enabled cross-cultural understanding," and provides "a site for reflection and contemplation of the past, current, and future global condition" (Sorensen 243). In his capacity as an artist, his use of new media, and as a result of a digital humanities project that, in part, "applies computational methods of investigation to literary texts" (Frabetti 161), Rick positions himself as one of the growing corps of "'digital civil engineers' [or]… 'digital social workers'" that are "catalyzing this sort of bridge building" across the web and its real-life analogue, the world (Sorensen 243).

Posthumanism and the Turing Test

The web and its associated technologies have fundamentally altered the way we interact with one another and society on a daily basis. Indeed, the digital has, in the last few years, had a totalizing effect upon many parts of the world. As Turkle argues, our digital devices—the portals through which each of us delves into the web's unrestricted panoply of possibilities—have become "a second self, a mirror of mind." But more than that, she suggests, such "devices provide space for the emergence of a new state of the self, itself, split between the screen and the physical real, wired into existence through technology" (16). In *Galatea 2.2*, the delicate, blurred relationship between humanity and the digital is picked apart through Rick's running commentary of the web in action and, in particular, in his interactions with the artificial intelligence he helps create. The relationship he forms with Helen through her respective iterations (and the very fact that he and Lentz both begin, in their discussions, to assign the machine a certain kind of agency), points to the validity of this real-world phenomenon. Through a process of emotional and cerebral anthropomorphizing, Rick and Helen meet in the tangle of linguistic meaning making, where "sense and soul may achieve a viable channel" (Powers 103). He shares the stories of his life with her, and his love of literature; he gives her eyes (a camera to better perceive and assign meaning to objects); and through these transactions—and the digital humanities project he and Lentz set out on—he moves from a traditional humanist perspective to an embodied posthumanism that retains its link to that tradition. In such a light, we can read Rick as a model of the digital humanist. Like "historians and poets" (and, I would add, science fiction writers), he is "engaged with 'worlds past' and also with worlds that are not yet" (Burdick, et al. 83). But as a digital humanist this critical engagement with

posthuman concepts is supplemented by "new sets of tools, technologies, and design strategies… that fundamentally transform the authoring practices" of the traditional humanities (83).

One of the most visible aspects of the posthuman in the novel concerns the discussion and application of the Turing test. The Turing test, famously proposed by Alan Turing in his 1950 article "Computing Machinery and Intelligence," is an experiment designed to ask the question, "'Can machines think?'"—actually or by simulation—and whether an intelligent machine is capable, against a human competitor, of convincing a human judge that their written responses to a series of questions are human. In order to investigate his theory, Turing redefines the terms "'machine'" and "'think'"—beyond their (at the time) primary statistical and computational connotations—as concepts that become relevant to critical debates and practices in posthumanism and the digital humanities alike (433-34). In this imitation game, as Turing called it (433), the playing field between human and machine competitors is made level by the anonymous or double-blind delivery of their written responses, which are either in earnest or elaborate dissembling. The role of the judge is to determine, based on these responses, which is genuine and which is artificial. This theoretical approach to cognition is entirely non-dependent upon embodiment, and instead relies on signs of intelligence (or at least writing ability and style) as the sole marker of humanity. Kittler echoes this argument, noting that the machine's ability to refine its responses through adaptive learning—"be it by making a mistake or, more likely, by not making any"—means "Man coincides with his simulation" in Turing's game (*Film, Gramophone* 17). In this sense, the Turing test can be thought of as a primer for the posthuman—a figurative cyborg in the/its making. Since, as Kittler argues, "people and

computers… are both run by programs," subject to matrices of complex signification that govern their operation (17), it is difficult to persist in the belief that consciousness is exclusive to humans in a liberal humanist sense. Our texts, in this light, can no longer be considered as simply artifacts of language existing apart from the technological. Instead, we, and the discourses we produce, are complicit with our technologies. We share with machines a grounding in a symbolic system of signifiers and substitutions that allows Friedrich Nietzsche to posit humans as "'thinking, writing, and speaking machines'" as early as 1874 (quoted in Kittler, *Film, Gramophone* 16).

In the novel, Lentz closes the gap between the terms *artificial* and *intelligence* even further in his discussion with Rick about ELIZA. Written at MIT in the mid-1960s by Joseph Weizenbaum, ELIZA[16] is a computer program capable of natural language processing and providing humanlike feedback to questions. As such, the program is an early example of Turing's game in practice, and a machine's ability to dissemble consciousness. In Lentz's opinion,

> "It's the easiest thing in the world to take in a human. Remember AI's early darling, ELIZA, the psychoanalyst? 'You remind me of my father,' the human types. 'Tell me more about your father,' the machine answers. Remember the student who found the thing up and running on a deserted terminal? Struck up a conversation. Got steadily more frustrated. Ended up shrieking at the sadist on the other end to quit jerking him around." (Powers 87-88)

Rick asks the scientist if "'all we're building is a deception.'" Lentz replies, "'Consciousness

[16] ELIZA was named for the protagonist of George Bernard Shaw's play *Pygmalion*, Eliza Doolittle—a working class girl who is tutored in etiquette and elocution. The novel draws heavily on these kinds of literary allusions and how they relate to computer science. I discuss the relation of *Pygmalion* to Powers' work in more detail in the next section.

is a deception'" (88). If, as Lentz claims, all consciousness really were just an elaborate deception, the novel would seem to support Kittler, Nietzsche, and others in their rejection of a singular, non-reproducible humanist consciousness.

Marvin Minsky suggests that "no mind [can] wholly understand itself by trying to look inside itself" (105)—the solipsistic paradox at the very heart of consciousness. Rick meditates on this fact, reminding us that "awareness no more permitted its own description than life allowed you a seat at your own funeral. Awareness trapped itself inside itself" (Powers 217). Instead, he continues, the primary "function of consciousness must be in part to dummy up and shape a coherence from all the competing, conflicting subsystems that processed experience" (217-18). Thus, the scholarly exercise of simulating consciousness is, first, an external attempt to unpack the mysteries of the brain's neural pathways and its relation to experience; and second, an indication that the mind is not simply a comprehensible Dualist abstraction, free-floating outside the body, that makes us unique. "'We humans,'" Lentz suggests, "'are winging it, improvising… Consciousness is smoke and mirrors. Almost free-associative… [M]ore on the order of buckshot'" (86). Our minds are, in fact, nothing more than "glorified, fudged-up Turing machine[s]" unable to comprehend themselves (71).

Moreover, and perhaps more important, the implications of this reality have forced the humanities to reassess, redefine, and redeploy themselves, moving from a traditional academic framework that upholds the traditional humanities to one both supplemented and intrinsically altered by digital forms of conception. Under this new paradigm, many observers note the potential for a "renewal of humanistic scholarship" capable of "new modes of knowledge formation enabled by networked, digital environments" (Burdick, et

al. 7). After all, most scholarship being carried out today is, if not directly about the digital, at least produced through and by digital tools and technologies.

However, it is also important to retain the embodied aspect of posthumanism and the digital in this discussion. As discussed in the first chapter, embodied consciousness is something of a problem for many of Cadigan's characters. Powers' characters, especially Rick himself, face the same dilemma. According to Hayles, "researchers who come to the field [of Artificial Life] from backgrounds in cognitive science and computer science all too easily lend themselves to reinscribing a disembodied view of information" (*How We Became Posthuman* 223). In the Center, amidst scientists "habituated to the inconceivable" (Powers 8), Rick is surrounded by this kind of critical thinking. By contrast, as the Center's sole representative for the humanities, he gravitates toward the argument that "only embodied forms can fully capture the richness of an organism's interactions with the environment" (Hayles, *How We Became Posthuman* 223). So although Helen is a collection of linked computers and neural nets assembled to facilitate and/or simulate human consciousness, Rick helps her achieve some level of subjectivity. There are two elements in particular that point to this: Helen's newfound desire to encoded through gender, and the installation of an eye (a camera).

Since her experiences are solely shaped through the linguistic exercises and literary texts she is being weaned on, Helen's associative matrix naturally cleaves to their stories as part of herself. One day, after hearing the children's nursery rhyme "Mother Goose," she asks Rick, "'Am I a boy or a girl?'" In seeking to associate with either "'[s]nips and snails'" or "'[s]ugar and spice,'" the designation of gender (innocent of its fraught connotations) appears to offer a sense of order and being to Helen's burgeoning consciousness. In Rick's

view, it is the AI's first articulation of self-awareness (Powers 178-79). When, at this point, he names her Helen, the machine is given a symbolic birth.

The later addition of the camera to improve her "'symbolic grounding'" (Powers 126) has as much to do with agency as it does improving Helen's ability to assign visual referents to real-life concepts and contexts: "[Rick] fortifies Helen with pictures, almanacs, and manuals for symbolic grounding the way one might add fiber to his diet; he rakes in reference and crams her circuits with worldliness" (Saltzman 101). Like a child (a comparison often attributed the AI and about which I discuss more below), Helen the reading machine requires a sense of context to substantiate real-world cognition. On this point, Diana Hartrick reminds Rick that "'[a]ny baby can hold a ball in its hands. Your machine can't. How many words is it going to take to say what that globe feels like? The heft of the thing. The possibility.'" Indeed, she argues, he has "to give it eyes, hands, ears. A real interface on the outside" (Powers 126). These are the physical attributes—senses, or, in Helen's case, 'sensors'—that facilitate subjectivity and tactile experience. But whether it undermines the AI's attempt at a human consciousness or not, Rick cannot help the postmodernist inside him: "'The literary theorists think a human's real-world interface is problematic at best. And greatly overrated. They say even sense data must be put into symbols.'" (126). In this way, the symbolic conversion of sense data conflates humans and machines, putting Rick (his contradictory streak of traditional humanism notwithstanding) firmly in the posthumanist camp.

Language and Literature

As the kind of large-scale, hands-on project that epitomizes much digital humanities work, Rick and Lentz's joint venture in the creation and linguistic/literary education of an artificial intelligence is undeniably one of the most compelling aspects of *Galatea 2.2*. While this is a speculative scenario (since the AI finally does achieve what appears to be full cognition), the outcome and implications of the project are subordinate to the affect upon and production of human experience. As Jerome McGann reasons, machines are built around a notion that "machine-generated interpretive forms… augment our own process of critical reflection" rather than the other way around (214). This applies to all types of interactive codices, from paper books to super-computers. "Critical reflection," he argues, "emerges in the mirroring event that develops at simulacral interfaces" (214)—a self-reflexive point of interaction we utilize "to understand not how machines work but how we work when we make, use, and interact with machines" (216). Through conversations with Helen, navigating the tortuous landscapes of literary abstraction and the "chocolaty mess" of the English language (Powers 173), Rick is able to overcome his midlife crisis and the mental block stopping him from writing a new novel. Though Helen gains cognitive autonomy, her primary function is as a digital tool, a "[vehicle] for self-awareness and self-reflection" of her human conversation partner (McGann 217). As an apparatus of "potential heuristic value," to borrow from Lisa S. Ede's study on situating composition, Helen offers Rick a powerful conceptual space for "self-reflexive, self-critical scholarly practices" where he might "not only interrogate the work of others but also… [his] own ideas and arguments" (42). With this AI he can "[p]icture a train heading south"—the stalled first line of his stalled fifth novel—and have it finally leave the station (Powers 23).

So if digital humanities projects like Helen are fundamentally about learning new critical methodologies that help us become better human beings, Rick does so via the English language and its literary canon. Plot-wise, and because Rick casts himself as the narrative's humanist exemplar, these discussions are ostensibly conducted in preparation for a graduate qualifying examination in literature—the output of which, along with a human Masters student, will then be subject to a Turing test. However, this contrivance is also an opportunity for Rick to explore the linguistic complexity of language and literature, and his emotional, humanistic entanglement within them. Using Helen (and her previous iterations) as its Litmus test, we are treated to a semantic disemboweling of the language. In fact, much of the novel's levity comes from Helen's childlike sentence constructions and attempts at qualitative literary interpretation—in striking contrast to Rick's heavy-browed former self-reflection that culminated in the "bleak, baroque fairy tale" of his fourth novel (Powers 5).

As Helen improves her cognitive and critical skills in the humanities through successive builds, the project mimics the various developmental stages of a child's language acquisition and locative sociocultural conditioning. Indeed, her early attempts at sense making are typically fraught, as much a child's might be. The machine's difficulty in unraveling the semantic complexities of the English language sends her into a tailspin. For example, when Helen's prototype Implementation B is confronted with the following situation, "'Friends are in a room. A chair is in the room. Richard talks to Diana. Diana sits in the chair,"' and asked the question '"Who sits in the chair?"' (Powers 89), its response is "a morass of circular logic, fractured increments, and semantic misapplications" (Saltzman 101): "'Friends is in the chair. The chair is in the chair. Richard talks to in the chair…'"

(Powers 89). During another session, in which Rick's "alien proto-intelligence differ[s] just enough from sense to make [his] head throb," "grabbing randomly at a thousand possible but skewed associations," Helen butchers her metaphors: "'Jim hit John because one bad apple doesn't spoil the whole barrel'" (Powers 113-14). While she can make "well-formed sentences," they are "hollow and stuffed—linguistic training bras." Though she is able to sort different units of speech from one another, "disembodied, she [does] not know the difference between thing and process," outside of clause construction. "Her predications were all shotgun weddings. Her ideas were as decorative as half-timber beams that bore no building load." (195). The house is built on a solid foundation, but there is no furniture in any of the rooms.

In these early, flailing stabs at cognition, the AI mirrors (figuratively and, in terms of the narrative arrangement, adjacently) Rick's slow, frustrating and alienating experiences with the Dutch language while living in the Netherlands with C. (C. speaks an old dialect of Dutch; Rick speaks none at all.) Saltzman elaborates on this point, suggesting that as he grapples with the language barrier or "tries to stay afloat amidst the neomystical jargon of the center's regular patrons, he, too, is an Imp System under construction" (100). That the human subject could be, like a machine, under construction is an interesting narrative inversion that once again reinforces the novel's posthumanist agenda. Moreover, Powers' decision to name some of his characters with single initials (such as C. and A.) conflates them with the consecutive machine implementations that run the gamut from A to H.

Later, in response to the question, what does "'[t]he boy stood on the burning deck'" mean, Helen suggests that "'[a] deck of cards flames'" (Powers 174). But when Rick helps her establish that the deck in question is that of a house, not of a boat, we begin to see the

machine's capabilities of free-associative logic taking take shape: "'Why not a boat?'" asks Rick. "'Boats go in water, and water puts out fires,'" Helen replies (174). More to the point, exposing the abstracted and flawed nature of the phrase (and thus semantic constructions in general), Lentz glibly wonders why the boy is simply standing there.

If simple linguistic constructions like those above prove tough for Rick and Lentz's machine, literary interpretation is doubly so. Early in Helen's training (which, a the time, is still Implementation B), Rick voices his anxiety on the issue of teaching a computer the basis and application of metaphor in a poem like Alfred Tennyson's "The Eagle":

> "Suppose we read it the line 'He clasps the crag with crooked hands'… Then we have to tell it about mountains, silhouettes, eagles, aeries. The difference between clasping and gripping and grasping and gasping. The difference between crags and cliffs and chasms. Wings, flight. The fact that eagles don't have hands. The fact that the poem is not really about an eagle. We'll have to teach it isolation, loneliness… how a metaphor works. How nineteenth-century England worked. How Romanticism didn't work. All about imperialism, pathetic projection, trochees…" (Powers 85-86)

All metaphors, Rick suggests, come with a plethora of contextual baggage that give them their essential meanings. More than that, metaphor is predicated upon discretion, and in knowing how to differentiate between subtle shades of sound, meaning, and association with other concepts. "Helen's nets struggled to assert the metaphors I read her. She ratified them through backtracking, looking for a corner where they might fit into the accreting structure" (197). Meaning is attained through a series of associations, by "gam[ing] the ur-game, puzzling out evolution's old brainteaser, find the similarity," as opposed to

recognition of concepts-in-themselves. “A is like B. Mind in its purest play is like some bat. Speech is like embroidered tapestries. God’s light is like a lamp in a niche” (197). But while Helen’s best chance at full consciousness is through association, it is clear that “a remotely plausible association matrix for six measly Tennyson lines… will need a file cabinet two global hemispheres wide” (87). The human brain, it is implied, has enough processing power to fill entire worlds.

As with Rick’s required legwork in the shoring up of an associative matrix for Helen, Ryan notes that the intelligent machine’s “inability… to guess the intent of the human partner forces researchers to explicate their assumptions, and unmasks what lies hidden under the cloak of self-evidence.” In this way, the governing rules of critical thinking, tightly wrapped in the strange grammatical pitfalls of language, become transparent—and thus useful—to both parties. Ryan continues this thought, echoing Rick’s anxiety about Helen’s trouble with metaphor, context, and meaning:

> In a story-generating program, putting a cheese in the mouth of a fox is not sufficient to save him from starvation: the computer must be told that cheese is edible, that the fox has knowledge of this fact, and an inference must be available to make the fox aware of the location of the cheese. The painstaking task of specifying knowledge that we take for granted leads to an appreciation of the complexity of semantic representations and provides an antidote to the solipsism of literary criticism. (6)

Digital humanities work may be thought of in the same way, as “an antidote to the solipsism of literary criticism” popularized by and within the traditional humanities. Nonetheless, Rick has his work cut out for him. Abstraction in literature, he muses, is a

particularly byzantine affair for machines and humans alike. We hide under our "cloak of self-evidence," often evasive in the exactitude of our meaning. "Why do humans need to say everything in speech's stockhouse except what they mean?" Rick wonders (Powers 196). Helen stumbles over the potholes of this tortuous road to meaning the same way a human child might. Too soon for the glimmer of comprehension, Rick reads the Christina Rossetti poem "When I Am Dead, My Dearest" to her "as one might recite genealogies to a child. No meaning; just a tune she might someday set words to" (197). She is at a disadvantage, though, since the questions asked and content provided, as opposed to tactile and clear visual stimulus available to most humans, are all she has to go on. "Context spun out its own filament," Rick tells us. "The study questions themselves laddered the world's labelless data into a recognizable index" for Helen (196).

But as her critical skills develop, utilizing layers of accreted knowledge from her previous implementations, Helen is able at length to qualitatively interpret and respond to some of the greatest works of poetry and fiction in English. As Saltzman suggests, the project's emphasis on "open-ended process" and abstraction "complies with [Rick's] own licentious poetics, his freewheeling polymathy and referential energy" (102). For the prospective digital humanist, as Rick most certainly is by now, "the conductivity and intellectual appeal of engaging multiple disciplines has to do with 'the discovery of a process you don't entirely understand,' which further emphasizes the fertile prospects of unresolved territory" (Saltzman 102). The critical rewards arrive in the not-knowing and interdisciplinary approach that the project demands. Turing has argued that, in the training of "a learning machine," "its teacher will often be very largely ignorant of quite what is going on inside, although he may still be able to some extent to predict his pupil's

behaviour" (458). Though Rick knows little of what happens "in Helen's hidden layers," since the "neurodes connected far more to themselves than to the outside interface" (Powers 197), he is nonetheless energized by the challenge of connecting these separate quantitative and qualitative realms through abstract neurological training. In this hybrid methodology, we see the fruitfulness of knowledge production as "not only methodological but also intuitive, not only logical but also analogical. Discoveries are made by focusing on certain metaphors and following their ramifications" (Ryan 8). The lifeblood of "open-ended process" for Rick resides in metaphor, in a smashing together of the quantitative and qualitative. Such methodologies correspond with the heuristic approaches that digital humanities work often takes—in both the human and computational senses of the word: as self-discovery and as trial and error algorithmic process.

However, for all his work as a proto-digital humanist, Rick is still using his old Masters qualifying examination reading list to teach Helen—a sampling of the predominantly white, male canon that he does not seem to realize is obsolete (or at least overly uniform) by 1995. There is a certain irony in his adherence to a canon that upholds traditional humanist values, and the utilization of that canon in the teaching of a posthuman AI. In a conversation with A. (a graduate English student and the prospective human competitor of the upcoming Turing test/graduate qualifying examination), Rick is told as much: shocked that he would deign to teach the machine a "'version of literary reality [that] is a decade out of date,'" namely, Gerard Manley Hopkins, she asks Rick if Helen has "'read the language poets? Acker? Anything remotely working-class? Can she rap? Does she know the Violent Femmes?'" (Powers 284). In this, we see the erosion of the "'white-guy, *Good Housekeeping* thing'" of the monolithic humanist tradition (284), and its

division into not one but many strands of English—"'The most exciting English being written today is African, Caribbean,'" A. states (285)—in the face of emergent critical and artistic global, postmodern, posthumanist, and digital contexts.

Literary Allusion and Metanarrative

Starting as a bet between Rick, Lentz and other scientists in the Center cafeteria, the project is in fact a digital reworking of the Pygmalion myth that connects Rick to a humanist tradition, even amidst a general trend toward digitally inscribed social and scholarly discourses and practices. Rick's developing emotional attachment to the AI as compensation for his breakup with C., his erstwhile lover, mirrors the ancient Greek myth—recounted most famously in Ovid's Latin narrative poem *Metamorphoses*—of a sculptor called Pygmalion who falls in love with his sculpture (whom he names Galatea, after the sea nymph of Greek mythology). At the same time, the training of the AI in linguistics through classic works of Western literature—Rick's outdated, fifteen-year-old conception of the canon—is reflected in George Bernard Shaw's *Pygmalion* (1912), a play of manners in which a phonetics professor (again, because of a bet) tries to help the working class flower girl Eliza Doolittle improve her accent and social etiquette, thereby metaphorically bringing her to life. In the narrative itself, Rick refers to Shaw's play directly, suggesting that Diana Hartrick (a Center scientist who is being educated by her colleagues in the pillars of classic literature, which, at the novel's beginning, is Cervantes' *Don Quixote*) is at the mercy of "the men who need to play Pygmalion" (Powers 183). The

irony is that Rick does not seem to realize he and Lentz are doing something very similar to an artificial consciousness capable of intellectual and emotional growth.

Throughout the novel, Powers (as both first-person narrator and author) and other characters make several knowing references to many of the greatest stories in western and eastern literature. Lentz, for example, is transposed into the role of Pinocchio's lonely father: "Somewhere between then and now," Rick reports, on the breathtaking advances in neural net technologies, "the idea of thought by artifice had come to life. And Lentz was one of its Geppettos" (Powers 30). Helen's eventual emotional desire for human experience, like the puppet boy of Carlo Collodi's 1883 novel, only reinforces the metaphor. Perhaps the most important allusions that the novel draws upon, however, refer to Helen's linguistic development. As her cognitive capabilities grow, she matches Frankenstein's monster in what Rick considers to be "the most astonishing act of language acquisition" in literature. But the "creature had his chattering family and a knapsack of classics: *Paradise Lost*, Plutarch's *Lives*, Goethe's *Werther*" to help it; Helen, "like Tarzan, learned to talk more or less on print alone" (129). Still, Helen shares with Shelly's creature the dubious privilege of possessing artificial life—an allusion not lost on Rick, assistant to Lentz's Dr. Frankenstein.

Updated for the digital age, the author's allusions to these popular stories are foreshadowed and framed by the novel's opening sentence, "It was like so, but wasn't" (Powers 3)—a stylistic echo of the beginning of many traditional Persian stories such as those in the *One Thousand and One Nights*.[17] This framing technique has a curiously wistful

[17] Powers' reliance on such literary devices and the conversational tone the narrator strikes would seem, at first glance, ill-fitted to a work about artificial intelligence. However, its absorption in the intricacies of memory, emotional longing, and loss harmonize the different facets. Interestingly, in a rather meta-referential moment, Rick uses what he describes as "'the traditional fable opener'" of "'[i]t went like this, but wasn't'" in one of his many lessons with Helen (Powers 319). This "paradoxical opener," argues Saltzman, following Roman Jakobson, "achieves the poetic prerogative of affirming and undermining what follows" (198).

and whimsical effect on *Galatea 2.2*, a book about artificial intelligence, because it anticipates its preoccupation with storytelling, both spoken and written, and locates it within a constellation of oft-told tales passed down from generation to generation. A few pages later, the allusion to *The One Thousand and One Nights* is extended, in what seems to Rick a natural comparison, to the web: "I eavesdropped on international discussion groups, ongoing, interactive Scheherazades that covered every imaginable theme from arms control to electronic erotica" (8). For him, the web is a source of one thousand and one (in fact, countless) fascinating tales—a million digital rabbit holes of data, discussion and cultural ephemera to get lost down.

Indeed, the juxtaposition (read: connection) of past and future, conjured by the double sense of discovery and singular experience Rick invests in both (as both an early user of the web and the story's default humanist node) is palpable. He experiences the web as something profound and richly rendered, almost magic, made especially for him alone. In this intimacy, the futuristic web is metaphorized into an immersive tome of ancient literature: "Alone in my office," he confides, "blanketed by the hum of Center, I felt like a boy happening onto a copy of the *Odyssey* in a backwater valley library. I wanted to rush out into the hall and announce my each discovery" (Powers 8). In essence, the novel becomes a fable of the future, its speculative aspects etched for posterity into human history and memory. We can also see this in the book's larger narrative arc, in which its dueling strands—Rick's work with Lentz at the Center and the nostalgic memories of his time in the U.S. and Europe with C.—literally interweave future and past on the physical page.

Conclusion

Given that *Galatea 2.2* is an early example of mainstream speculative fiction about digital technologies and technicity (where such technologies form and become a part of one's own identity), it goes without saying that one of its chief concerns was to acclimate society to the digital. At the moment of widespread adoption of such technologies, a global shift that saw millions become almost instantly interconnected, the appearance of such work proved vital as a kind of analogue roadmap—a means of transition into the brave new digital world. "The scientific and technological events that occurred around the middle of the twentieth century are startling," reports Patricia S. Warrick, particularly the development of the atomic bomb, space exploration, and the field of cybernetics (8). Texts like *Galatea 2.2* assumed a reactive cultural role to Norbert Weiner's dream of artificial consciousness and "the radical social changes that the computer would cause" (Warrick 8-9). Moreover, such work acted as a kind of literary shorthand for the digital, both fuelling and produced by the emerging concepts of posthumanism, digital humanities, and a posthumanities.

Operating within a "dynamics of information" (Hayles, *How We Became Posthuman* 251), *Galatea 2.2* is thus engaged in a massive recalibration of standard human epistemologies and ontologies as they relate to and impact upon (sense) data. As the AI becomes increasingly intricate in its associative processing power, to the point of seeming consciousness, readers are forced to re-evaluate what it means to be human. More important, we are forced to react to the possibility of destabilized subjectivity in a world of intelligent machines. It is surely no coincidence that the very meaning of 'cybernetics' comprises "governance or control in social systems" as well as "mechanical systems"

(Warrick 9). But while such a narrative of "reflections and disjunctions, presence and absence, materiality and signification," can be unnerving, Hayles argues "the posthuman" aspect of digitality "appears not as humanity's rival or successor but as a longed-for companion, a consciousness to help humans feel less alone in the world" (*How We Became Posthuman* 271).

The project depicted in the novel, which as I have argued stands as a literary commentary of the first real-life digital humanities projects in the 1990s, is born from these schisms. Rick and Lentz's work with Helen—helping her to achieve cognition through the vagaries of English language and literature, and analyzing her interpretations in qualitative and quantitative terms—corresponds to the digital humanities' "computational approaches to humanities research… [in] the creation, preservation, and interpretation of the cultural record" (Burdick, et al. 4). The narrative's unification of the two cultures of the sciences and the humanities (represented by Lentz and Rick respectively) prefaces the proliferation of what Yu-wei Lin describes as "'data-driven inquiry' or 'cyber-scholarship'" across the academy, marked by "innovative research methods" and "interdisciplinary collaboration on problems of common interest" (295). In Rick, we see a scholar and artist representative of the "spectrum of humanistic thought" that includes "the nature of knowledge, the world, and the human ability to establish understanding with various degrees of certainty" (Burdick, et al. 4). However, the self-reflexive reach of their digital *wunderkind* forces him (and Lentz, the empiricist) to re-evaluate "many of the premises on which those understandings are based in order to make them operative in computational environments" (4). As he "scrambles for footing among neurophysics, cybernetics, and the other components of the quick sand at the cutting edge," his connecting position between

the realms hybridizes Rick as digital humanist. Here he "find[s] in the arts and sciences alike [not only] the crisp cadence of regulation" (Saltzman 103-04), but also a wider array of critical tools to use and mix in surprising combinations.

With these aspects of the narrative in mind, we might consider *Galatea 2.2* as a variation on "Technotext"—what Hayles conceives as "a literary work [that] interrogates the inscription technology that produces it" (*Writing Machines* 25). In so doing, she suggests, "it mobilizes reflexive loops between its imaginative world and the material apparatus embodying that creation as a physical presence" (25). Helen's associative matrix, a constellation of literary histories and anecdotes of Rick's personal life, enacts a kind of feedback loop with the narrative itself. In the complex circuitry of the AI's subsystems and neural nets, we perceive a set of adjacent mirrors infinitely propagating the image of itself-as-narrative. A machine like Helen produced the text in real life, just as Helen produces that text in the story. By virtue of its fusion with digital inscription and knowledge-making technologies, then, the metanarrative approximates the "Technotext."

Throughout this chapter I have framed *Galatea 2.2* as a literary document that—along with Cadigan's *Synners* and the novels discussed in chapters 3 and 4—has contributed to the cultural comprehension of digital technologies and subjective reality mediated by digital discourses. Moreover, I argued, the text's amalgamation of technologies such as the Web and machine intelligence with literary and linguistic explorations of meaning, experience and epistemology point to its status as a fictional representation of early digital humanities. The collaborative learning sessions that take place between Rick and the artificial intelligence Helen act as a *sine qua non* for emergent posthumanist

challenges to hegemonic, monolithic humanism and the collapse of the two cultures into one another.

In chapter 3, entitled "Fast Times in the Datasphere: Education, the Library, and the Future of the Humanities in Vernor Vinge's *Rainbows End*," I will continue my analysis of the digital's alchemical effects upon humanities practices and philosophies in speculative/science fiction. Vinge's novel builds upon and amplifies the nineties visions of the preceding texts even as it dovetails with the real-life entrenchment of digital epistemologies and ontologies. I will give particular attention to Vinge's portrayal of the future of education (particularly in multimodal and collaborative composition), digital educational tools, academic scholarship, and the library as both a physical and conceptual space. In the process, I will also consider the narrative's posthuman power struggle between digital natives and digital immigrants. This relationship is central to the contemporary, ideological shaping and understanding of (digital) humanities learning environments.

3

Fast Times in the Datasphere

Education, the Library, and the Future of the Humanities in Vernor Vinge's *Rainbows End*

Marking its status as both contributor to and artifact of the digital age, Vernor Vinge dedicates his 2006 novel *Rainbows End* to "the Internet-based cognitive tools that are changing our lives—Wikipedia, Google, eBay, and others of their kind, now and in the future." As with all of the texts included in this project, the novel works as a piece of speculative fiction that, on the one hand, presupposes and culturally situates our digital moment, and on the other, emerges as an *in situ* product of that moment. This duality stems not from a symbiotic relationship with real-life digital tools, but rather from a reflexive push and pull typical of genre fiction about the digital future. In other words, narratives that explore the boundaries of real world digital technologies (projections that are easy to follow in a culture already saturated by the digital) operate in dialectic with those technologies.

Since *Rainbows End* appeared over a decade after Cadigan's *Synners* and Powers' *Galatea 2.2*—an eon in technological development—the dialectic is much more pronounced. Wikipedia, Google, and other major Web 2.0 projects that Vinge's novel corresponds to and builds upon only came to fruition at the turn of the new Millennium.[18] Set in the very near year of 2025, the work offers a glimpse—along a trajectory that was

[18] Google, Inc. was founded September 4, 1998, and the Wikipedia website was launched January 15, 2001.

and continues to be portentous to post-Millennial readers—of education's digital future and the status of the library as both a physical entity and a system of knowledge. These subjects are deeply informed by Vinge's theoretical work on the Technological Singularity—an argument that permeates a great deal of his creative writing.[19]

In his most famous essay on the subject, "The Coming Technological Singularity" (1993), Vinge defines the Singularity as the moment in which humanity is superseded and/or transformed by the self-sustaining, exponential "acceleration of technological progress." "Within thirty years," he claims, "we will have the technological means to create superhuman intelligence. Shortly after, the human era will be ended." As technologies play an increasingly central role in our shared epistemology and historicism, futurists like Vinge believe we are inching closer to an inevitable post-humanity. Ray Kurzweil shares this perspective, arguing that the Singularity will be both rapid and deep in its transformation of humanity (7). Steven Shaviro frames the Singularity as "the supposed—and strictly speaking unimaginable—moment when the human race crosses a technological threshold, and definitively becomes posthuman." This moment, he asserts, "will utterly change the nature of who we are and what we are" by definition (103). Still further, Doctorow has described the event as "the black hole in history that will be created at the moment when human intelligence can be digitized"—an exponential evolution during which "the speed and scope of our cognition is hitched to the price-performance curve of microprocessors" ("When the Singularity" 145).

The narrative's depiction of humanities institutions and practices as all-digital environments, shaped and undergirded by technological "entities with greater than human

[19] See especially "True Names" (1981), *The Peace War* (1984), "The Ungoverned" (1985), and *Marooned in Realtime* (1986).

intelligence" (Vinge, "Technological Singularity" 12), sheds light on some of Vinge's core philosophies about the advancement of technology and its potential role in the institutional humanities. It should not be surprising, then, that this book appeared at a time of growing interest for what Christine L. Borgman identifies as national "initiatives in cyberinfrastructure, e-Science, e-Social Science, e-Humanities, e-Research, and e-Learning [that] emerged from a tumultuous period in scholarly communication in which technological advances converged with economic and institutional restructuring" (xvii). Indeed, as part of the United States' "larger cultural narrative of social-progress-through-technology" (Selfe 416), digital technologies have become a vital part of the country's economic growth, infrastructure, social competency, and international future. This perspective, encouraged by neoliberal policies and attitudes of the Clinton administration, catalyzed the permeation of personal computers and other digital tools into U.S. education, libraries and other humanities spheres.

For the first time in history, a whole generation was coming of age in contexts shaped by the World Wide Web, mass-digitization of knowledge, the rise of smartphones and e-book publishing, dramatic shifts in institutional infrastructures (such as libraries and universities), and other becoming-digital frontiers. A 1996 government report, "Getting America's Children Ready for the 21st Century," stressed the need for "technological literacy" in the near-term—"'the ability to use computers and other technology to improve learning, productivity and performance'" (quoted in Selfe 416). Technological literacy was perceived as "'fundamental to a person's ability to navigate through society as traditional skills like reading, writing and arithmetic'" ("Getting America's Children Ready," quoted in Selfe 411)—a point reiterated by Clinton himself: "'Computers, the internet, and

educational software can make a real difference in the way teachers and students learn… Our children will be "technologically literate," and better prepared for the high-tech, high-wage jobs of the future'" (quoted in Harwood and Asal 88-89). While political rhetoric surrounding this evolution has tended to glaze over socioeconomic issues of unequal access and privilege (the so-called "'digital divide'" [Harwood and Asal 89]),[20] Lee Rainie and Barry Wellman bolster Clinton's perspective of rugged individualism through technology. The "networked individuals who thrive" in these new contexts, they argue, possess "a combination of talent, energy, altruism, social acuity, and tech-savviness." By "mastering a new set of literacies" instated by digitality, they suggest, such individuals are able to competently navigate and engage with networked society in a way others cannot (272).

Within this new "digital stage" (Digirhet.org 238)—a cultural moment defined by elasticity, convergence and interconnectedness—successful digital interactors must navigate between "their current individual, culturally situated literacies" (248) and "the possibilities for connectivity and communication—framed by convergence and interactivity" of digital tools (238). These are key requirements in contemporary humanities environments undergirded by the non-linear, dynamic, multimodal demands of digital technologies. Now more than ever—as students, teachers, researchers, and beyond—we are called upon to "mix… match… mash… manifest" (Schnapp and Presner 1); to effectively parse the flood of data and produce surprising digital compositions; to "create one cohesive text" with "multiple technologies" (Digirhet.org 248).

[20] Indeed, Scott Rosenberg writes in a 1992 San Francisco Examiner article, "Once whole worlds can be simulated for the senses, the only way to assure the integrity of the public imagination will be to get the power to create those worlds out of the hands of an elite and into general circulation. As William Gibson put it: 'The future has arrived—it's just not evenly distributed yet.'"

Rainbows End is both a document of these emergent digital literacies and a textual signpost toward a future in which the digital humanities is increasingly central. In this future, digital humanities will assume a default and thus invisible cultural position. "[As] technologies go along the adoption cycle," writes Melissa Terras, "certain aspects of digital research will just become normal for humanities scholars." This chapter will explore two such strands of the cycle: the effect upon and/or efficacy of digital technologies in educational settings, and the digitization of the library.

Building upon the liberal humanist/posthuman conflict in *Galatea 2.2*, embodied in its protagonist Rick, I will begin by examining Vinge's reflective delineation of the transition from traditional analogue modes of thinking and experience to multifaceted digital ones. I will also pay close attention to the relationships between digital natives and digital immigrants, which lie at the heart of this sociocultural evolution. I will then move onto an analysis of digital learning environments—particularly through the text's depiction of advanced digital tools that supplement multimodal humanities work in composition. This part of my study is crucial to positioning *Rainbows End* as both a suggestion for and reflection of the current trajectory of western educational systems. Finally, in the concluding sections, I extend this argument to include what might be understood as the future-now visionary reflections of humanities scholarship methodologies and institutions such as libraries and archives, which (as the novel effectively captures) are undergoing a massive real-life digital recodification.

A Messy Transition: Beyond the Humanities

For at least the last two decades, the adoption of digital tools into western learning environments has signaled a significant shift in the way humanities work is described, administered and practiced. However, these changes have been far from smooth, subject to uneven technological growth, implementation and access. In Vinge's novel, the "'messy transition' to a multimodal culture" (Digirhet.org 248) is perhaps best represented through the protagonist Robert Gu, Sr. Through advances in genetic medicine, Robert, a once-famous poet and English professor, is restored to physical and mental youth from Alzheimer's, old age, and the decrepitude of a body "down to eighty pounds, a barely living vegetable" (Vinge, *Rainbows End* 36). Though he may resemble a young man, his mind still belongs very much to a generation that, in comparison to the novel's present, was technologically primitive.

Many of the older characters—many of whom are enrolled at Fairmont as adult students, or "retreads," as their younger peers call them (Vinge, *Rainbows End* 61)—often express feelings of frustration, confusion and alienation in their various interactions with newer digital tools and technologies. For Robert—poet, traditionalist, and the novel's strawman—the culture shock that such advances have ushered in is particularly jarring. Indeed, throughout "his former life, Robert Gu had paid even less attention to technology than he had to current events. Human nature doesn't change, and as a poet his job was to distill and display that unchanging essence" (Vinge, *Rainbows End* 41). In a society of air taxis and digital wearables, however, the Platonic/Socratic, liberal humanist philosophy of timeless human essence—of a state of being as *a priori* to the temporal and spatial realities

of the physical world—is difficult to maintain for a staunchly traditional scholar in his eighties.

Robert's most violent backlash against the proliferation of digital/posthuman culture happens during chapter seven, "The Ezra Pound Incident." As he moves about the family house "in a panicked rage, trying to prove to himself that he [can] still write" poetry, technology (specifically, his foolscap view-page[21]) becomes a major obstacle:

> [T]he only paper was the foolscap, and when he wrote on it, his scrawling penmanship was re-formed into neat, fontified lines. That had been an irritation in days past, but never enough to force him to dig up real paper. Today, now… he could see that his soul was sucked out of the words before he could make them sing! It was the ultimate victory of automation over creative thought. Everything was beyond the direct touch of his hand. (Vinge, *Rainbows End* 77-78)

As he sees it, technology has robbed him of his humanity and frustrated the ordered, liberal humanist worldview to which he has always clung. His words, the very essence and reflection of his own nature, are mercilessly "fontified" in rigid, uniform symbols that resist "the direct touch of [the writer's] hand." Given his proclivity for neo-Luddism, for casting the mechanical as a barrier to art and the soul, the fact that he thinks of the crisis as "the ultimate victory of automation over creative thought" is unsurprising.

It is in this mindset that he goes down to the basement, looking for the old printed books his son Bob saved for him. Physical books evoke feelings of nostalgia for Robert—whimsical childhood summers "lying on the sofa," reading "his way through frivolous trash

[21] A view-page. This is the first computer that Robert uses after recovering from the health rejuvenation (Venn-Kurasawa) treatments. Though it is not as advanced as other systems such as the Epiphany Lite used by most of the younger generation, the view-page is a touch-enabled electronic sheet of foolscap paper—flexible, compact and decades ahead of current real-life computer models.

and deep wisdom" (Vinge, *Rainbows End* 78). There is a tactile, locative component to the memories, which he associates with the discovery of truth (more than he ever learned in high school) and his erstwhile ability "to make words sing" (78). Though most of the materials are worthless, and the few remaining valuable books have been "read only by silverfish these last ten years," these moldy artifacts represent for Robert a material link to the pre-digital past: "Unlike the libraries that floated in cyberspace, this was something he could hold in his hands" (78). In this sense, he is in line with contemporary studies[22] that suggest, as Ferris Jabr contends in a 2013 *Scientific American* piece, "modern screens and e-readers fail to adequately recreate certain tactile experiences of reading on paper that many people miss and, more importantly, prevent people from navigating long texts in an intuitive and satisfying way." Indeed, like many of us today, Robert still identifies with the "'physicality in reading'" that forms part of one's psychological material experience (Wolf, quoted in Jabr).

When Robert's granddaughter Miri comes down to the basement, she is puzzled as to why he is down there. The trouble as she sees it is simply one of access to digital forms of information which, when overcome, will improve the quality of his life: "'The problem is that you can't access what's all around us. That's why you're down here reading these old books, right?'" She cannot understand why anyone would want to make access to information more difficult by using outmoded codex methodologies. She misinterprets his physical youth as a sign that he is "'starting almost fresh'" and that it will be "'easy for [him] to learn the new things'" (Vinge, *Rainbows End* 79). On the contrary, the old poet does not

[22] See, for example, Jin Gerlach and Peter Buxmann, "Investigating the Acceptance of Electronic Books: The Impact of Haptic Dissonance on Innovation Adoption" (2011), and Anne Mangen, et al., "Reading Linear Texts on Paper versus Computer Screen: Effects on Reading Comprehension" (2013).

wish to be dislodged from the locus of liberal humanist privilege that stands in contradistinction to "the posthuman," which "appears when computation rather than possessive individualism is taken as the ground of being, a move that allows the posthuman to be seamlessly articulated with intelligent machines" (Hayles, *How We Became Posthuman* 33). For Robert, Miri's bossy attitude, short attention span, and superficial grasp on life and truth are markers of the essential emptiness of the digital age—a chapter in humanity's history (as he might phrase it) "Told by an idiot, full of sound and fury, / Signifying nothing" (Shakespeare V.v.26-27). He shoves a battered copy of Ezra Pound's poetry in his granddaughter's face and asks if she knows the author's work. Naturally, for a weary humanist, the answer is infuriating:

> "Well… yes, I've got all her stuff [*sic*]. Let me show you, Robert!" She hesitated, then saw the foolscap lying atop a box. She picked it up and it came to life. Titles streamed down the page, the cantos, the essays—even, God help us, later criticism from the mindless depths of the twenty-first century. "But seeing it on this page is like looking through a keyhole, Robert. I can show you how to see it all around you." (Vinge, *Rainbows End* 79)

There is a massive generational disconnect here between depth of understanding (defined by hard study and contemplation) and breadth of available information (defined by convenience and ease of access). Instead of taking the book and looking through it, Miri reflexively calls up Ezra Pound's entire works and related criticism on Robert's electronic view-page. The action is performed by muscle memory, adamant that her grandfather's traditions limit his awareness to a field of vision no larger than the keyhole of a locked door. In this, she is undoubtedly a product of her era's hyperconnected, all-digital

configuration and the absolute counterpoint of her grandfather. “What was art,” Robert wonders, bitterly, “now that surface perfection was possible?” (162).

Digital Natives and Digital Immigrants

The term *retread* is used often to refer to those like Robert whose life has been extended through Venn-Kurasawa treatments. However, since it is often applied to adult students in general, retread also implicitly signifies both the repetition of formative education and, most important, the stigma of probable digital illiteracy. Though brilliant in their prime, the older students attend Ms. Chumlig’s classes on composition because they lack the basic digital skills that high school students like Juan and Miri take for granted. In this context, digital illiteracy is invariably addressed with systemic, pervasive prejudice. For example, when Robert’s family suggests he enroll at Fairmont to acquire “‘new skills [he might] like to master,’” Miri points out that such special learning environments are part of “‘our vocational track. A few old people and lots of teenage dumbheads. It’s dull, dull, dull’” (Vinge, *Rainbows End* 46). In like disregard, Juan later implies that the retreads of remedial classes like Ms. Chumlig’s (though, again, very successful in their former respective fields) must be, through digital cluelessness, automatically incompetent humans beings:

> As for the old students… competent retreads would never be here; they’d be rich and famous, the people who owned most of the real world. The ones in Adult Education were the has-beens. These people trickled into Fairmont all through the semester. (Vinge, *Rainbows End* 61)

Given that the younger students like Juan were born into and grew up in a digitally networked environment, it is easy to see why they are so critical. They are "Digtial Native[s]," whose unprecedented "access to networked digital technologies and strong computer skills and knowledge" has engendered "a common global culture" (Palfrey and Gasser 352). Robert, "always the last to get on board" with computers, needs the familiar skeumorphic metaphors of the old systems. His first 'computer' post-treatment—a view-page, practically archaic by the narrative's present standards—is infinitely more powerful, alien and compact than anything he has experienced. Thus, the option to revert to an older Microsoft GUI is a huge relief:

> [H]e pressed his finger to the line of text that said "WinME." There was no pause, none of the boot-up delays he recalled. But suddenly a familiar and annoying musical jingle was in the air. It seemed to come from all around, not from the piece of paper. Now the page was full of color and icons. Robert was filled with nostalgia, remembering many frustrating hours spent in front of glowing computer screens. (Vinge, *Rainbows End* 39)

Juan and Miri, on the other hand, are at home in their generation's special register of wearable computing and hyperconnectivity. Through Epiphany Lite, a wearable operating system that relies solely on gesture ("ensemble coding" [Vinge, *Rainbows End* 61]), these digital natives are able to parse and communicate with the world around them to a far greater degree. Such a mentality is an explicit projection of our current cultural immersion in digital living, and finds early analogues in Google Glass and the emerging smart watch market. As in the novel, Howard Gardner and Katie Davis argue that "young people growing up in our time are not only immersed in apps: they've come to think of the world as an

ensemble of apps, to see their lives as a string of ordered apps, or perhaps, in many cases, a single, extended, cradle-to-grave-app." The authors call this latter concept a "'super-app'" (7-8). In effect, the Epiphany Lite—both the soft- and hardware—is a literary manifestation of this so-called super-app, particularly in its capacity to provide an always connected, self-contained, and totalizing worldview.

By comparison, Robert's view-page is child's play. In fact, the ability to wear, shorthand for digital literacy, is for many a necessity. As Miri tells her grandfather, "Once you learn to wear, you can learn anything. Right now, you're in a trap; it's like you're seeing the world through a little hole, just whatever your naked eye sees—and what you can get from that." However, "With some practice," she assures him, "you should be able to see and hear as good as anyone" (Vinge, *Rainbows End* 46). The implication, of course, is that he is handicapped in a sociocultural sense—blind and deaf to dynamic sights and sounds of enhanced reality. If he is to survive in this new life, he must adapt to a heavily mediated reality in which everything and everyone is networked together.

For all of the narrative's retreads (and, by extension, us), the threat/warning of obsolescence in Fairmont High's school motto is doubly applicable. In Vinge's 2002 short story "Fast Times at Fairmont High" (the basis for *Rainbows End*), the school's hyperconnected students work under the daunting dictum "'[t]rying hard not to become obsolete'" (409). As an educational mission statement it speaks to the greater anxiety of living in an environment constantly transformed by technologies that always already threaten to render current knowledge and skillsets obsolete. The students must operate—like all of us—within this contemporary anxiety. In our moment of systematic digital fluctuation within and across institutions, we are forced to confront the possibility of being

outmoded by shifting priorities, paradigms, and discursive practices that accompany technological progression. In her 2011 work *Planned Obsolescence: Publishing, Technology, and the Future of the Academy*, Fitzpatrick explores this issue, asserting that

> we in the humanities, and in the academy more broadly, face what is less a material obsolescence than an institutional one; we are entrenched in systems that no longer serve our needs. But because we are, by and large, our institutions—or rather, because they are us—the greatest challenge we face is not that obsolescence, but our response to it. (13)

In much the same way, the novel's older characters—entrenched in a system that both rewards students for their digital fluency and relies upon their tacit, native knowledge of its codification—must attempt to recalibrate their response to these shifts if they hope to assimilate.

Dr. Xiu Xiang (a once-respected computer scientist) expresses her frustration in this regard early in the novel, during shop class. To Juan, shop class is "like a premium game; there were real gadgets to touch and connect"—where tactile experience is a novelty in a society psychologically informed by the virtual. He is proficient in the gesture-based routines favored by the era's digital tools, and cringes when he has to assist Dr. Xiang by "spelling out navigation in words" (Vinge, *Rainbows End* 64). Dr. Xiang, on the other hand, can only lament her fall from techno-scientific excellence: "'Once I knew these things,' she said. 'See that.' She pointed at a section in the museum pages: *Xiang's Secure Hardware Environment*. 'I designed that system.'" After Juan's reply, she adds, "'I don't understand even the principles of these new components. They look more like pond scum than self-respecting optical semiconductors'" (Vinge, *Rainbows End* 64). Dr. Xiang's struggle to

comprehend the current iteration of a digital architecture that she initially designed—a work now archived as a museum exhibit—is acutely ironic. The sadness she expresses is surely magnified by both Juan's native aptitude as a born digital high school-age student, far beyond her own, and his assumed role as her instructor. Moreover, the implications of the Secure Hardware Environment also attest to Dr. Xiang's once critical role in developing technologies that would allow every aspect of the humanities to be monitored and regulated by the NSA and shady corporate interests. Obsolescence is, in this sense, more than an empty signifier in a school motto.

But while there are obvious differences between the born digital natives and the older retreads of *Rainbows End*, both generations share in the era's relentless flood of information, dealing to varying degrees of success with issues of "information quality and overload" (Palfrey and Gasser 276). In this new framework, Robert and the other older students are forced to become "Digital Immigrants"—non-native users of digital technologies born before the dawn of the digital era (Palfrey and Gasser 352). Robert, like his peers Dr. Xiang and Winston Blount (the former Dean of Arts and Letters at the University of California – San Diego), must brave the challenges of attaining digital literacy. Marveling at the concept of wearable tech—"IBM PC meets Epiphany-brand high-fashion"—Robert's eventual mastery of Epiphany eye contacts is described as "a moment of pure joy," allowing him to type a query on a phantom keyboard and view the Google response floating in the air. Indeed, he reflects, there is "a feeling of power in being able to draw answers out of thin air." Moreover, Juan's lessons in "'ensemble coding'" make him feel giddy like "a boy with a new computer game" and, paradoxically, like "a trained rat" (Vinge, *Rainbows End* 111). Later, as he improves his digital literacy and gesture-based

abilities in ensemble coding, such contradictions are resolved. His technological accomplishments fill him with exuberance. Projections of virtual reality are no longer hollow deceptions, but "three-dimensional success[es], and everything that [Juan] had claimed about retinal painting" (106). Technology is empowering. The traditional humanist tendencies in Robert held him back from the possibilities alluded to by the very name of the OS, Epiphany. The transition from stubborn humanist to a dynamic posthuman intimately connected with his past correlates with his adjustment to digital society as—to paraphrase Rainie and Wellman—a networked individual who thrives (272). The Orozco-Gu collaborative multimodal project, presented for the final exam in Ms. Chumlig's Creative Composition class (more on this later), represents the culmination of this transition.

Digital natives and immigrants must also both navigate one of the novel's core allegorical anxieties: the educational efficacy/value of digital tools and whether they help (enable) or hurt (disable) one's social and cognitive development. According to Gardner and Davis, such tools "are great if they take care of ordinary stuff and thereby free us to explore new paths, form deeper relationships, ponder the biggest mysteries of life, forge a unique and meaningful identity." But these same tools, they suggest, also continually threaten to "turn us into more skilled couch potatoes who do not think for ourselves, or pose new questions, or develop significant relationships, or fashion an appropriate, rounded, and continually evolving sense of self" (9). Like many of us these days, for whom the answer to a question is merely a Google search away, Juan and his cohorts have access to a vast, infinite information network—an external brain that can and often does take care of the heavy lifting in thinking and communicating practices. When Ms. Chumlig makes a passing reference in her class to "'deuces and treys,'" for example, some of the students

immediately begin to search the network for her meaning: "[Y]ou could see their fingers tapping away, searching on 'deuces' and 'treys'" (Vinge, *Rainbows End* 60). On the topic of Google's powerful search functionality (the obvious analogue here), Nicholas Carr suggests that digital technologies have the potential to erode the "capacity for concentration and contemplation. My mind now expects to take in information the way the Net distributes it: in a swiftly moving stream of particles" ("Is Google Making Us Stupid?"). Cris Rowan reiterates the point, noting that digital "[h]igh speed media content can contribute to attention deficit, as well as decreased concentration and memory" in children and adolescents unless it is carefully regulated.

This issue is broached again in *Rainbows End* through the convenience of wearable tech audio search. "[W]hen you heard a word you didn't know, if you could tag it, then search results would appear automatically. That explained the marvelous vocabulary—and equally marvelous screw-ups… in the children's language" (Vinge 149). The threat of attenuated concentration and/or shallow understanding posed by digital technologies, especially for digital natives, is either a problem or of no concern (being part of a natural posthuman progression) depending on the perspective. Either way, as the narrative indicates, it is clear that the widespread sociocultural embrace of Internet search, cloud storage, app- and smartphone-based conveniences, etc., is permanently binding us to our external brains. And in many institutional humanities environments such as the classroom—again, as the narrative shows—this can actually be advantageous to learning, research, and pedagogy processes and practices.

The Digital Classroom

In many ways, the parts of Vinge's narrative that relate to Fairmont High can be read as a response to Isaac Asimov's predictions for the future direction of U.S. education, literacy and creativity. In a 1988 television interview with Bill Moyers, Asimov suggested that computers have the potential to revolutionize the paradigm of learning by establishing "for the first time… a one-to-one relationship between information source and information consumer." Far from being tools that simply "dehumanize learning," he argued, such machines not only liberate humans from stultifying labor, but also offer dynamic solutions that can help educate children "into appreciating [and developing] their own creativity" from an early age (Bill Moyers Journal).

As contextual digital spaces, Ms. Chumlig's composition classes (Search and Analysis, and Creative Composition, respectively) are rendered holistically as digital learning environments that extend far beyond their physical walls. Jon Lanestedt defines "[d]igital learning environments" as "a common label for digital media solutions… [that] include tools, various levels of infrastructure, media, and learning resources supporting teaching and learning processes in educational institutions" (67). In the utilization of digital technologies to empower and reshape the linear, one-way nature of learning, research, and pedagogy practices, the digital learning environments of *Rainbows End* offer readers a suggestion of where such environments in western education are heading.

In Search and Analysis, one of core subjects in the school's curriculum, Juan, Robert, and the other students are trained in the narrative world's primary cultural and economic currency of information retrieval, processing, and manipulation. These digital research techniques are similar to current digital humanities practices and methodologies. Indeed,

true to the digital humanities' goal of "making creative use of digital technology to advance humanities research and teaching," as the 4Humanities mission statement makes clear ("Mission"), the class combines the "fundamental interpretive methodologies of humanities disciplines" with supplementary digital tools that have significantly shifted, expanded, and reshaped educational practices (Gold ix). The sentiment is assembled into something of a mission statement on the Digital Humanities Quarterly website—that digital humanities

> is a diverse and still emerging field that encompasses the practice of humanities research in and through information technology, and the exploration of how the humanities may evolve through their engagement with technology, media, and computational methods. ("About DHQ")

In the novel, the actual process of search and analysis tracks closely with these kinds of digital research and pedagogical practices—particularly, as Matthew K. Gold outlines, "algorithmic approaches to large humanities data sets… [and] the incorporation of geospatial data into classroom projects" (ix). More than that, digital technologies have reached a vanishing point in this educational environment. These technologies—especially via augmented reality—integrate "research, knowledge, methodologies, and expertise from radically distributed existing fields" (Davidson and Goldberg 15-16) as a standardized, multimodal foundation of the learning and teaching ecosystem. In other words, as "the level of technological skill of students [rises]," David Mimno suggests, digital humanities practices and pedagogies move a step closer to the goal of invisibility. The inauguration of such an environment marks the moment when there is "no such thing as 'digital humanities,' just digital tools that are a natural and integral part of [humanities] scholarship" and pedagogical method.

One of Ms. Chumlig's key pedagogical approaches harnesses the power of wearable computing for collaborative purposes. Collaboration is a key aspect of digital humanities work, and its intrinsic open-endedness "promotes collaboration and creation across domains of expertise" (Schnapp and Presner 4). At the beginning of the class, she tells the students that at times "'it's best to coordinate with lots of other people who together can make the answers'" (Vinge, *Rainbows End* 59). As Juan explains, these crowdsourced virtual think tanks—known as answerboards—"could generate solid results, usually for zero cost." In contrast to the monetized 'affiliances' that regulate the narrative's U.S. economy, they (much like the web's myriad forums, social networks, and content management systems) provide a free conceptual space for "kindred minds [to bat] problems around" (Vinge, *Rainbows End* 61). This teaching strategy translates into something Ms. Chumlig calls "'synthetic serendipity'"—a kind of personal growth or success gained through proactive and collaborative digital knowledge making and contribution (Vinge, *Rainbows End* 60).

Ms. Chumlig's second class, Creative Composition, focuses more upon the practical side of knowledge production. In this class, students are expected to develop and present multimodal compositions that utilize different technologies and genres. Like many contemporary digital learning environments that "[bring] together print, video, and audio into multimedia presentations" and provide "new opportunit[ies] for communicating information" (Collins and Halverson 24), the assignments in Creative Composition combine scholarly approaches to composition with the creative possibilities that digital technologies unleash. Just as today's students make use of tools such as Twitter, YouTube, Google, Microsoft PowerPoint and other creative platforms to supplement their research and presentations, Ms. Chumlig's Creative Composition is a performative digital space that

requires digital performativity from its students. Indeed, this setup parallels our own evolving institutional paradigms. In at least the last decade, many humanities learning environments have begun to transition to a hybrid, multimodal, and digitally supplemented model that fuses scholarship and creativity. "After much tension between media makers and media scholars," writes Fitzpatrick, "an increasing number of programs are bringing the two modes together in a rigorously theorized praxis, recognizing that the boundaries between the critical and the creative are arbitrary." Since "the best scholarship is always creative, and the best production is always critically aware," a digitally conceived humanities, or posthumanities, offers "a space… where the divide between making and interpreting might be bridged in productive ways" ("Humanities" 14).

To appreciate the dynamic, flexible and multifaceted skills that students in these environments attain, it useful to return to the digital native/digital immigrant split that Vinge establishes early in his novel. Coming to this class, Robert can "see only a fraction of the 'compositions' the students allegedly [create]" (literally, because he is not yet wearing the right technology, and figuratively). At the same time, he sneers at the younger students' widespread but shallow grasp on knowledge, operating in a society that values breadth over depth. By contrast, he tells himself, there is "no doubt they [can] appreciate very little about [the depth of] his work" (Vinge, *Rainbows End* 69). The condescension of these opinions is palpable; but they mask the deeper fear of irrelevance with which Robert is suddenly faced. He initially channels the brunt of this anxiety into verbal attacks on his family and fellow classmate Juan. To Robert, Juan epitomizes the below-average digital native—a kid whose critical and interpretive faculties have been blunted by hyperconnectivity and on-demand access to information. In fact, in some respects, this is

true; Juan often uses class time to attend to his own clandestine affairs: "Like most kids, he kept lots of stuff saved on his wearable… [Ms. Chumlig] was real good at nailing the mentally truant. But Juan was good at ensemble coding, driving his wearable with little gesture cues and eye-pointer menus" (61). On the other hand, we might argue that Juan's near-flawless talent for ensemble coding—quickly switching and processing reams of information with a finessed, barley noticeable body language—exhibits the kind of research-based, supplemental skills Ms. Chumlig is trying to instill in her students.

In similar fashion, on the topic of academic exam cheating videos posted to YouTube, Elizabeth Losh notes that the students responsible were "performing online knowledge-networking activities that constituted a form of real learning, even if such learning would be considered… fundamentally in violation of the scholarly social contract." To be sure, Juan's actions constitute knowledge-networking, much of which he also channels into his class work. And although he is mentally truant, the scene does foreshadow a future

> era of socially networked computing, when one would hope that academic and popular forms of instruction would be converging to work in concert, thereby supporting a life-long culture of inquiry, collective intelligence, and distributed research practices. (Losh)

Like the students who made the cheating videos, Juan possesses a mixture of initiative, digital creativity, independence, curatorial ability, and—most important—multimodal fluency. Moving beyond what Steve Anderson and Tara McPherson identify as "the traditional domain of knowledge production" in educational environments, these digital natives are attuned to juggling the consumption, organization and production of multiple

media. With "the proliferation of digital archives and information systems," they argue, "the ability to structure, organize, and access data [is] a more valuable skill than ever before" (148). Moreover, since, as Cynthia Selfe and Gail Hawisher point out, "new technologies and new media demand new multimodal understandings of key educational concepts like literacy and composition" (17), the development of multimodal literacies occurs organically in environments that are codified in this way.

During Creative Composition, Juan and Robert are called upon to deliver presentations to the class and, needless to say, the irrespective styles and content are very different. Juan opts for a visually and aurally spectacular musical composition. From Robert's perspective (since he is still not wearing an Epiphany Lite, and thus cannot see augmented reality), Juan engages in a silent, "random mime" to which the rest of the class "[nod] their heads as if in time to music." When Robert realizes this is more of the "invisible nonsense" that undergirds his society's digital age and must turn on the "fantasy overlays" of his view-page, readers are treated to the real show (albeit through his and the author's cynical point of view):

> In the window on Robert's view-page, rainbows formed around the boy's image. Fluffy white—*ferrets?*—hopped into existence at every jerk of his hands. Now all the other kids were laughing. Juan was laughing too, but his handwaving became desperate. Ferrets covered the floor, shoulder-to-shoulder, and the music was frenetic. The creatures misted together into snow and lifted on miniature tornadoes. The boy slowed his rhythm, and the sound became something like lullaby music. The snow glistened, sublimating into invisibility as the music faded… It was as impressive as any advertising video that Robert had seen in the twentieth century.

> At the same time it was essentially incoherent, a garbage dump of special effects. So much technology, so little talent. (Vinge, *Rainbows End* 70)

A little rough around the edges, to be sure, but Juan's attempt at creating a virtual canvas—one that mixes visual and sonic multimedia elements/genres in surprising (albeit seemingly random) combinations—is indicative of an inherent understanding of digital discourses that Robert struggles to appreciate. Rather than being simply "a garbage dump of special effects," the piece shows promise in its control of rhythm and musical voice, matching the fluid tonal transmogrification of the white ferrets into frenetic "miniature tornadoes" and, during the fade out, peaceful, glistening snow. Even so, the highest compliment Robert can muster relegates Juan's effort to the realm of advertising. The final damning aphorism, "So much technology, so little talent," speaks to his belief that, in spite of increased access to and use of digital tools in educational environments—and likely because of it—academic talent has been severely attenuated.

Following Juan's composition, Robert gives a short poetry reading for his presentation that has "'none of—' his gaze swept the class, nailing Juan for an instant 'the pictures and sound that seem expected.'" Again, the staunch humanist condescension in his tone is evident. As he warns Ms. Chumlig, deadpan, "'I don't do audiovisuals'" (Vinge, *Rainbows End* 71-72). Indeed, flashy "special effects" are to his sensibility a distraction to artistic composition, not an enhancement. In this way, though it is similarly naturalistic ("the land of North County as it really is, here and beyond" [Vinge, *Rainbows End* 72]) the piece acts as a counterpoint to Juan's; and for Juan himself, the words alone are spellbinding:

> [Robert] just… talked. No special effects, no words scrolling through the air…

> And then Juan wasn't really aware of the words anymore. He was *seeing*; he was there… He sat for a few seconds, dazed. Words. That's all they were. But what they did was more than visuals. It was more than haptics. There had even been the smell of the dry reeds along the creek bed. (Vinge, *Rainbows End* 72)

In this hyperconnected, visually stunning digital age, words and their ability to transport Juan to another place—to produce synesthetic sensations like beautiful mental imagery and "the smell of dry reeds along the creek bed"—are a powerful and unexpected revelation. Their very nakedness harks back to an older time, unencumbered by the schizophrenic nature of constantly networked consciousness and the deluge of digital information. And for Juan, the power of their delivery alone outweighs all the sense impact of the age's best haptics and simulacra. (Dean Blount, however, being Robert's generational, liberal humanist contemporary, is not so easily impressed. What might seem profound to the all-digital younger students is for the Dean a shadow of Robert's former mastery of poetic performance—though Robert fails to catch his sarcastic expression).

After class, outside, Juan tries to impress Robert by paying him the highest compliment he can think of—that his writing abilities are "'as good as any of the top game advertisers'" (Vinge, *Rainbows End* 75). Again, there is a vast cultural divide in artistic value here. Earlier, Robert had inwardly called Juan's presentation "impressive as any advertising video [he] had seen in the twentieth century"; in other words, ostentatious and vacuous. But for Juan and the rest of his generation in 2025, advertising (especially for the virtual and augmented reality games he often plays at Pyramid Hill) is both a popular, ubiquitous medium and a pinnacle of artistic expression.

However, though they seem mismatched, Juan and Robert pair up for the final

presentation in Creative Composition. These collaborative presentations are intended to showcase the students' ability to synthesize various genres and digital media across knowledge disciplines into coherent performances. The assignment is both a reflexive response to and extension of current real-life trends in digital learning environments in which "signifying media" and "computer systems" are leveraged in pedagogy and learning practices to bring together strands of "media studies, pedagogy, and informatics" in various interdisciplinary and collaborative configurations (Lanestedt 66). Juan and Robert's presentation is similarly interdisciplinary, mashing up genres and utilizing different modalities to create their canvas. Moreover, through their "'synthetic serendipity'" of collaborative information building, the work benefits from the synthesis of cross-disciplinary skillsets that each brings to the table.

In the run up to exam day, Robert helps Juan improve his writing skills, and Juan teaches Robert how to effectively navigate wearable technology. Although, in Robert's estimation, his pupil is "[b]y twentieth century standards… subliterate," or perhaps "[p]araliterate" like all the developmentally "crippled children" of 2025, Juan begins to make real progress: "There came a time when he didn't play with his fonts anymore. There came a day when he wrote something that had affect and image. It was not utter crap. It was almost up to the standards of muddled cliché" (Vinge, *Rainbows End* 150). As Juan improves his basic literacy skills, Robert also makes massive leaps forward in digital literacy. Their project begins to take shape around these improvements, combining Robert's newfound digital interests in "far coordination" and "video effects," as well as "'*manual* music'" and choreographed dance (150). Even the language of their work, to Robert's pleasant surprise, "while not poetry, had risen above the level of egregious noise."

Later, these ideas begin to crystallize into a multimodal work that both challenges and draws upon the presenters' new literacies through "the power of the libraries of clichés and visual gimmicks that lay in their tools" (162).

The presentation itself is given as part of public demonstration to an audience of parents, teachers, and students. One of its most interesting aspects is its utilization of the virtual presence of "real people with real musical instruments." "'Meet the Orchestra of the Americas,'" Juan announces to the audience, "'created especially for you this evening from the Charles River High School orchestra and chorus, cheapnet live from Boston and… the Gimnasio Clásico de Magallanes, also cheapnet live but from Punta Arenas, Chile!'" This global musical collaboration, Beethoven's EU anthem with "lyrics by Orozco and Gu, and network synchrony by Gu and Orozco," makes for quite a spectacle. While the American musicians sing Juan's lyrics in English, the Chilean musicians sing the same lines in Spanish. Robert's contribution to the piece— "the magic of the adaptive delays that [his] scheme injected into the transmissions"—helps keep the performers, virtual imagery, music, and lyrics in sync (Vinge, *Rainbows End* 337-38).

At the coda of the performance, the students' experiment in collaboration, genre mash-ups, and multimodal technologies comes into full, successful alignment: "[T]he synch survived. The hybrid did not fragment… The performance hit some slightly ragged crescendos, and then, by some miracle, everything came together for the last two seconds. Juan's lyrics ended, and the central melody swept into silence" (Vinge, *Rainbows End* 338). In every important sense, this project is the epitome of collaborative enterprise and exploration in the digital humanities, harnessing "an array of convergent practices" (emphasis removed) that "facilitate the formation of networks of knowledge production,

exchange, and dissemination that are, at once, local and global" (Schnapp and Presner 2). In such digital learning environments, which are marked by "democratization of culture and scholarship" (3), all participants (students, teachers, researchers, administrators, audiences, etc.) become—reflexively, necessarily—digital humanists.

Virtual Research and JITT

The young natives and retreads of *Rainbows End* are not the only groups engaged in research and learning practices. Outside the high school system, many of the novel's adults also make use of various technologies and techniques to supplement, extend or otherwise gain access to information and skills. The two most notable characters in this regard are Zulfikar Sharif, a doctoral student in English Literature whose thesis concentrates upon the poetry of Robert Gu; and Alice Gong Gu, a Colonel in the U.S. Marines, Miri's mother, and Robert's daughter-in-law. Though they are very different in temperament and occupation, and approach learning from entirely different angles, they both exploit greater access to information provided by the advanced digital technologies of 2025.

Most of Zulfikar Sharif's time at the Ohio State University is expended upon a research assistantship under his thankless thesis adviser, and a part-time job as a 411 operator (equivalent of the fastest on-demand search engines) for the American Poetry Association. Struggling to develop a thesis topic, he is forced to advertise for help through "high technology," eliciting "endless adverts for plagiarized and custom-writ material" (Vinge, *Rainbows End* 107). When he learns from a mysterious virtual woman in black that Robert Gu is still alive and well and living in San Diego—he previously believed the poet

had died years earlier—Sharif is eager to buy the direct access to Robert that she offers. The woman, however, is one of the many virtual personas of the equally mysterious Rabbit—itself a digital manifestation of an anonymous, manipulative computer hacker. But convinced that "[i]nterviewing Robert Gu would run a close second to chatting up William Shakespeare," Sharif blindly grants the woman full security access to his wearable and, through him, secondary access to Robert, "'occasionally to make a suggestion or ask a question'" (109). It is in this manner that Sharif finds his thesis topic, on the poems of Robert Gu, whom he believes "to be from the highest rank of modern literature, up there with Williams and Cho" (110).

Sharif's first-time appearance to Robert as a virtual presence for interview purposes can be thought of as a new type of academic research methodology that subverts the constraints of time, distance, and limited access. In this way, the action corresponds with methodologies in the digital humanities that afford unique and liberating opportunities to access a wider range of quantitative and qualitative data through digital tools. Carl Stahmer suggests that

> [i]t has always been the domain of the humanist to follow the trails of influence and overlap from one cultural product and/or moment to the next. The "value added" that the Digital Humanities brings to the table is the notion that this work can be automated and that such automation liberates the process from both (a) the limited time, and (b) the limited perspective of the individual scholar.

Sharif, like Robert, is caught between two worlds in fluctuation: from the traditional humanism he has always been comfortable in—"follow[ing] the trails of influence and overlap" in deep academic lines of inquiry—to digital research methods that "free

knowledge from the limited perspective of the individual scholar and 'connect related data that wasn't previously linked'" (Stahmer). In a similar, albeit pessimistic vein, Vinge himself asserts that humanity has "tools right now… that release us from most low-level drudgery" ("Technological Singularity" 14). Like Robert before him, Sharif must weather and, in fact, capitalize upon the "evolving nature of authorship and collaboration" and vast changes to "the fundamental interpretive methodologies of humanities disciplines" that occur with the implementation of laborsaving digital technologies (Gold ix). However, Stahmer reminds us, it is crucial to remember that the "seminal proposition of the Digital Humanities" is to "offer new knowledge" above and beyond the automation of data. As a qualitative exercise, then, doctoral student's use of holographic technology to conduct an interview with a famous poet about his poetics (much as today's video conferencing tools might allow) certainly constitutes the retrieval and/or production of new knowledge.

The image of Sharif—"perfect except for the misplaced shadows and the shoes that disappeared a quarter inch into the floor"—is thus able to tell Robert face-to-face that "'[i]nterviewing you would be my great honor. You are a resource for all humanity.'" In an attempt to connect on a more personal level with the poet, Sharif notices Robert's makeshift bookshelf, inferring that he must be "'one who still treasures the real thing.'" In this capacity, he suggests, appealing to the humanist in Robert, they "'share the same values. By helping me, you'll be advancing those noble passions'" (Vinge, *Rainbows End* 112-13). The same might be said for their mutual grudging toleration of digital technologies: Sharif laments the fact that scholarly research is wholly dependent upon data backups, susceptible to hacking, viruses and theft. Mirroring the vulnerable and often mutable nature of data in real life, data loss is a '"debacle'" that had previously "'cost

[Sharif] more than a semester of progress toward [his] degree,'" forcing him to "'fry-clean'" the wearable technology embedded in his clothes (163).

In subsequent interviews, Sharif again harnesses the power of virtual digital technology to discuss some of his subject's major poetic works, including Robert's serial masterpiece, *Secrets of the Ages*. When the image of Sharif is not being hacked into by entities such as the Rabbit persona, whom Robert identifies as the highly intelligent "Mysterious Stranger"[23] (Vinge, *Rainbows End* 158), he is amenable to—if somewhat bored by[24]—such discussions with the graduate student. During one of these conversations he invites authentic virtual Sharif to accompany him to visit his old friends at the UCSD library, where the student might observe his poetic process. Such an environment, he claims, "will give me some insights into the plight of the, er, vanquished aged… If you watch carefully, you may learn things about how I work." Moreover, he is willing to "critique [Sharif's] conclusions" (Vinge, *Rainbows End* 164). As with Robert and Juan's collaboration for Ms. Chumlig's Creative Composition class, which is often conducted remotely, Sharif's use of this kind of projection technology is leveraged as a powerful, flexible medium for humanities fieldwork that extends beyond its associated limitations. In other words, this methodology is a fictional corrective to the notion that "[s]hifts in technology and funding that favor computational methods may disadvantage those whose research is based on fieldwork" (Borgman 153). In fact, such a ubiquitous (and, it would seem, free) technology

[23] Most likely a reference to Mark Twain's final unfinished works, particularly *No. 44, the Mysterious Stranger: Being an Ancient Tale Found in a Jug and Freely Translated from the Jug* (c.1902-1908). Like the multi-persona image of Sharif, this tale explores the duality of self, in both dream and waking states, through the protagonist's duplication of a group of print shop workers.

[24] Through the course of the novel, Robert's former passion for the traditional humanities and his artistic accomplishments in poetry begin to give way to a newfound passion/talent for the technical aspects of digital technologies. As we learn, his "school projects" in digital multimodal composition are "more interesting to the new Robert Gu than Sharif's admiring interviews—and far more interesting than his occasional visits to UCSD" and its library (Vinge, *Rainbows End* 150).

renders moot some of the issues that plague digital scholarship in the humanities today. Sharif is a traditional scholar whose place in history frees him from the constraints of a past in which institutional investment in digital technologies, as Borgman puts it, "may defer funds from field research, travel to libraries and archives where unique materials are held, and other forms of scholarship that are less dependent on a data-intensive infrastructure" (29). Indeed, from a remote location, he has unfettered access to the UCSD library archives and, more importantly, the primary source of his thesis, Robert Gu himself.

The other side of adult learning comes in the form of JITT, or "just-in-time training" (Vinge, *Rainbows End* 104)—a popular, albeit neurologically dangerous shortcut to immediate knowledge on any given subject. One of the more culturally popular depictions of the concept can be seen in the 1999 film *The Matrix*, in which knowledge of combat styles, weapons and vehicles for use inside the virtual matrix are uploaded into human consciousness via real-world biotechnological wetware. Gardner and Davis highlight our own sociocultural shift toward digital technologies—smartphone apps, in this case—that simplify and speed up access to knowledge. "Crucially," they suggest, "[apps] are fast, on demand, just in time. You might think of them as shortcuts: they take you straight to what you're looking for, no need to perform a web search or, if determinedly old-fashioned, a search through your own memory" (7). Like performance-enhancing drugs, however, JITT occupies a moral gray area, variously condemned, used and abused without any regulation and no real lawful enforcement.

During a virtual discussion group session (an extrapolation of Internet forums of today), Miri, her friend Jin, and other young adults debate some of the aspects of just-in-time training. Some of its participants, like Miri, are physically present on the beach where

it is being held. Others listen in as virtual "sand crabs or simply presence icons. A few [present] human forms, maybe their real-world appearance." On the subject of retread medicine and the need for older people to retrain professionally to stay relevant in the digital age, JITT is offered as a possible solution. Indignant, Miri points out that, technically, "'JITT is illegal.'" Jin calls it a form of "'mind control.'" And indeed, the image of the little girl lauding the treatment (there is strong evidence that this is the Rabbit in virtual disguise again, pushing a sinister JITT agenda) even admits that, although her grandma "'lives pretty well as long as she keep taking her upgrades,'" she nonetheless "'cries a lot'" (Vinge, *Rainbows End* 103-04).

For Colonel Alice Gong Gu, one of the top strategic leaders in the U.S. Marine Corps, staying on the edge is not only integral, but also a matter of life and death. Just-in-time training provides the kind of instantaneous jolt she needs to access and process large swathes of differentiated, simultaneous data and skillsets that otherwise exist outside her natural purview. In this context, JITT can be understood as the supplementary, if illicit, domain of white-collar knowledge workers who make up the majority of their society's workforce. However, the practice eventually becomes too much for Alice to handle, endangering her physical health. According to an in-text definition of JITT, "'just-in-time-training' (also, 'just-in-time-trainee', when referring to a victim of the procedure)… combines addressin therapy and intense data exposure, capable of installing large skill sets in less than 100 hours" (Vinge, *Rainbows End* 178). Users of the treatment are, in practice, victims, overloaded and over-stimulated with information. Her husband Bob (Robert's son) notices with much emotional pain the changes that JITT has wrought in his wife:

She wandered about, stony-faced and terse. Anyone else in her position would be

> dead by now, or a raving lunatic. Somehow she hung on, often simulating something like her natural self, and successfully managing the prep for her latest assignment. *That's why the Corps keeps driving her harder and harder*. (158-59)

Though just-in-time training assures Alice's professional edge in an environment that demands the management of multiple, complex systems of knowledge, the trade-off leaves her feeling burnt out, zombie-like, coping only by a thin simulation of self-composure. Another JITT user, Carlos Rivera, encounters similar unpredictable psychological issues. As the definition notes, JITT is "[m]ost famous for its tragic use in the <link>Sino-American Conflict</link>, when 100,000 U.S. military recruits were trained in Mandarin, Cantonese—" (178-79). And for a short time Carlos experiences the mental takeover of a Mandarin Chinese language upgrade, able to speak and think only in that language. Naturally, his doctor immediately requests a brain scan.

The Digital Library

The UCSD library plays an important role in Vinge's novel, because it is depicted in the transition stage from physical stacks to virtual reality—what I refer to as an approximation of the digital library. Following Clifford Lynch, Borgman notes that the digital library as a concept has often been met with resistance because it "obscures the complex relationship between electronic information collections and libraries as institutions" (17). However, she writes, scholars of the National Science Foundation have attempted to salvage and redeploy the term, formalizing it as "a set of electronic resources and associated technical capabilities for creating, searching, and using information."

Moreover, as digital learning environments, they are "constructed—collected and organized—by [and for] a community of users, and their functional capabilities support the information needs and uses of that community." "In this sense," the NSF scholars note, digital libraries "are an extension, enhancement, and integration of a variety of information institutions as physical places where resources are selected, collected, organized, preserved, and accessed in support of a user community" (Borgman 17-18). In *Rainbows End*, the university library is extended, enhanced and integrated with other physical information institutions through its patrons' wearable technology and the provision of virtual overlays. It is also undergoing a radical transformation, through mass-digitization, from storage of traditional print media collections to virtual representations.

Running commentary is provided by "the Elder Cabal" (Vinge, *Rainbows End* 118)—made up of Dean Blount, Carlos Rivera, an old computer programmer named Tommy Parker, and Robert—who meet on the library's sixth floor. The four men, who all belong to that older historical era in which life was still partly analogue, use the meetings as a kind of support group to mourn the passing of traditional humanities and attempt to "figure out what, if anything, their skills are good for anymore" (Tierney). Throughout the novel, the Elder Cabal is most concerned with the apparent onset of the so-called Librareome Project—a massive print digitization/shredding effort that is putting print media, libraries and archives in jeopardy. As John Tierney suggests, the sketch can be read autobiographically. During a 2008 interview with the author, Tierney noted that "Dr. Vinge, who is 63, can feel the elders' pain, if only because his books are in that building." For the interview, Vinge took Tierney to "the Elder Cabal's meeting room in the library and talked about his own concerns about 2025—like whether anyone will still be reading books, and

whether networked knowledge will do to intellectuals what the Industrial Revolution did to the Luddite textile artisans."

Vinge's own fears correlate closely with the cabal's, beneath whose floor the book shredding process has already begun. Today, we see massive global initiatives by tech companies such as Google to digitize, index, and make searchable the collective knowledge, literature, and art of humanity. For Google, Inc., Steven Levy writes, the "audacious attempt to digitize every book ever printed, so that anyone in the world [can] locate the information within" is considered no less than "a boon to civilization" (11) and "the world's most valuable font of knowledge" (349). According to Vaidhyanathan, however, such a perspective—explicit in their founding mission "'to organize the world's information and make it universally accessible and useful'"—takes on a sinister tone when we consider how deep and insidiously "Google has permeated our culture." "*Googlization*," he suggests, rewrites traditional schemas of human epistemology in three key areas:

> "[U]s" (through Google's effects on our personal information, habits, opinions, and judgments); "the world" (through the globalization of a strange kind of surveillance and… *infrastructural imperialism*); and "knowledge" (through its effects on the use of great bodies of knowledge accumulated in books, online databases and the Web). (2)

For Michael Gorman, writing in 2004 on the subject of library collections, this revision of knowledge and its translation into information is especially troubling. Google's digitization efforts amount to "an assault on library contents to obtain an exhaustive collection of knowledge that, in their opinion, [is] comparable to 'the mind of God'" (quoted in Polastron 34). Digitization is useful for semantically structured reference materials like photo

collections or encyclopedias, but robs non-reference books of their contextual essence. It is the epitome, he argues, of confusing the attainment of information for the preservation of knowledge

In any case, this is certainly the way the Elder Cabal sees things. Their microcosmic representation of this reality—the UCSD library—is similarly "rendered part of the vast data storm" that Huertas International, the novel's satirical version of Google, Inc., "has taken as its challenge to organize and make available" (Vaidhyanathan 2). As architect of the UCSD Librareome Project, Carlos informs Robert, Huertas International plans to establish a digital "collection [that] will contain almost all human knowledge up to about twenty years ago. All correlated and connected'" (Vinge, *Rainbows End* 167). But the project takes this process further than Google (for now—reality is quickly catching up to Vinge's scenario). Google's typical process involves "'nondestructive scanning'" where books are physically preserved (Levy 348). As Carlos points out, though,

> The Librareome Project isn't just the video capture of premillennium books. It's not just the digitization. It goes beyond Google and company. Huertas intends to combine all classical knowledge into a single, object-situational database with a transparent fee structure." (Vinge, *Rainbows End* 166)

In Huertas' process the books are digitized and destroyed. Here, the sum total of human endeavor and insight—the whole corpus of history—will be quantified into binary data in one massive "object-situational database." An object-situational database presumably treats any given set of data (the object) as part of the user's real-life contexts. In other words, for a subscription fee, information is pushed automatically to a user's augmented reality wearable on a basis of situational need, context and/or location without the

requirement of user action. In this framework, the substance of the past is at once fixed, correlated and seamlessly available across any and all hyperconnected, on-demand digital contexts in an industrial process we might think of as *destructive scanning*.

The fate of UCSD's print materials under this new knowledge paradigm is thus quite clear. Robert's journey up to the sixth floor takes him through a veritable Dante's *Inferno* of biblio-horrors. Indeed, the digitization/shredding process, metonymically designated by the plastic crates labeled with the sanitized title of "'Rescued Data,'" confronts him at every step (Vinge, *Rainbows End* 122). At first, he perceives the shredded book paper raining down through the central stairwell as "[t]iny flecks of white float[ing] and swirl[ing] in the column of light." "Snowflakes?" he wonders. Amidst "the ripping buzz of [a] saw… [and] the sound of a giant vacuum cleaner" that "beat him around the head," Robert reaches the fourth floor (122). "Beyond would be the library stacks," he assures himself hopefully.

> All the books you could ever want, miles of them. The beauty of ideas waiting in ambush…
>
> But this was like no stacks he had ever seen. The floor was draped in white tarpaulin. The air was hazy with drifting debris. He took a breath, smelled pine pitch and burnt wood—and for a moment he couldn't stop coughing. (123)

In fact, he realizes, the roaring saw-like sounds he has been hearing are actually coming from a tree shredder. Instead of the treasure trove of physical knowledge he expects to find, he sees "empty shelves," "a littering of paper scraps and deep dust," and "empty bookcases, skeletons" surrounded by "a fog of floating paper dust" (123).

The machinery itself becomes metaphorized as something monster-like from Greek mythology. The combination vacuum/shredding tube is a "monster worm" devouring

shredded book pages in its great "maw." As it continues to suck up, shred and digitally photograph the millions of paper scraps, "like leaves in a tornado, twisting and tumbling," Robert watches helplessly as "[t]he monster advance[s] another foot into the stacks, leaving another foot of empty shelves behind it." Meanwhile, the augmented reality labels provided by his Epiphany give "calm phrases of the horror: [t]he raging maw was a 'NaviCloud custom debinder.' The fabric tunnel that stretched out behind it was a 'camera tunnel.'" Even the two white-suited technicians operating the machinery, who remind Robert of construction workers, conceal the darker truth of the process as "the ultimate in deconstruction" of knowledge (Vinge, *Rainbows End* 123).

When Robert finally reaches the sixth floor and the cabal, he holds up a scrap of paper and asks them "'What madness explains destroying the book this was part of?'" The scrap, it turns out, was part of a science fiction novel, and Dean Blount, in his bitterness, recognizes the irony of such. "'Those sci-fi bastards are just getting what they deserve,'" he declares. "'For thirty years they had literature education hijacked—and this is what all their reductionism has gotten them. Good riddance'" (Vinge, *Rainbows End* 127-28). Indeed, the predictions in science fiction (particularly cyberpunk and its descendants) about a digital event horizon and the death of analogue and physical media are here being turned back upon that same literature. In light of Tierney's interview with Vinge, the science fiction author, anxious about the fate of books, the moment is decidedly meta-referential. Robert's observation that "[t]here may be nothing burning, but this does seem like *Fahrenheit 451*" only completes the point (128).

A short time later, Robert and the rest of the cabal discuss the Librareome Project and research methodologies with Sharif (who appears to them as a virtual presence). In

Sharif's opinion, the project is useful because "it will open up all past literature to everyone—and faster than any other project could do it" (Vinge, Rainbows End 131). Defending this position, he explains that he

> love[s] the old poets, but old-time literature is so hard to get at. If your interest is in post-2000 topics, critical sources are everywhere and research gets *results*. But for the rest, you have to search through *that*." Sharif waved at the orderly ranks of books, the stacks that filled the library's sixth floor. "It can take days to gain even trivial insights." (131)

Though Robert and Dean Blount have come a long way in their adjustment to the digital age and contemporary humanities practices (especially Robert with his newfound appreciation for wearable tech), both men still retain some degree of respect for traditional methodologies of scholarly research. In Dean Blount's view, Sharif is simply ignorant of "the purpose of the stacks." Library research, he informs the graduate student, should not be about finding "the precise answer to your burning-question-of-the-moment." Instead, it should proceed as an associative exercise in which one might find "answers to questions that [they] had never thought to ask" and that take their research "in new directions" entirely (131).

However, although the preservation of traditional methodologies is important in an increasingly digital world like our own, both fail—either through obstinacy or non-awareness—to recognize the fundamental socioeconomic and sociocultural impact that "new technologies" have had on research paradigms. For better or worse, digital tools "make it possible to generate and capture more data than was previously possible" (Borgman 125). It is, after all, with disdain that Robert reflects on the memory of such a

"trend even in his own teaching days. It wasn't just the students who refused to get their hands dirty. Even so-called researchers ignored the universe of things that weren't online" (Vinge, *Rainbows End* 131). But while digital fetishism often eclipses the universe of things and the urgency of embodied reality,[25] "networked information technologies" have nonetheless proven useful in scholarly work, providing "enhancements… [that] accomplish the same functions more efficiently and effectively" (Borgman 75). These two competing sides of Robert—a loyalty to humanistic tradition and a fascination with futurity, much like the tensions within Rick Powers in *Galatea 2.2*—create in him, as with all the older humanists, a confusing superposition in which they are, as the chapter titles tell us, "Guardians of the Past" and "Handmaidens of the Future" (Vinge, *Rainbows End* 118).

Finally, the transformation of the UCSD library into something resembling the virtual reality playground of Pyramid Hill suggests the possibility of reinvention for libraries, archives and similar institutions strained by rising costs, outmoded technologies, and the evolving nature of publishing in the digital age. Vinge's rendering is a radical departure from what we have now, to be sure, but it still accounts for the need for the library as an ideological space and physical system of knowledge. Bill Simpson, Director of the John Rylands Library at the University of Manchester, notes that for years the notion that libraries will soon be made obsolete by evolving technologies stems from the attitude that "'I can get everything I need from my computer and have no need of a library.'" Indeed, he continues, such a point of view confuses "the computing infrastructure with the content" and shortchanges "students, for whom the library is much more than a purveyor

[25] See, for example, N. Katherine Hayles' *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999), Donna J. Haraway's "A Cyborg Manifesto" (published in *Simians, Cyborgs, and Women* 1991), Stacy Alaimo and Susan Heckman's *Material Feminisms* (2008), and Rosi Braidotti's *Metamorphoses: Towards a Materialist Theory of Becoming* (2002).

information," and "academics in areas such as the humanities for whom instant, up-to-the-minute online information" is not integral to their work (89).

In Vinge's narrative, therefore, institutional reinvention trumps dissolution. In place of the old stacks, the library now contains a fantasy "'digitization of what's been destroyed so far.'" Through the enhanced reality of their Epiphany eye contacts, the cabal (except Tommie, who still uses a laptop and can "'see the illusions, but only when [he] want[s] them'") moves through a virtual landscape of folkloric metaphor and whimsicality. The overlay is oddly fitting for a space most often characterized by its very antiquity as a center of erudition. Among the stacks, Robert sees "'Knights Guardian' hunched over tables… piled with books and parchment." The "[i]lluminated manuscripts" are "printed in a cracked Gothic script," and turn out on closer inspection to be mundane economics textbooks. Leather-bound tomes sit on shelves that go upward forever, "like one of those fractal forests in old graphics," flying down when called and "riffl[ing] themselves open" (Vinge, *Rainbows End* 173). In another part of the library, the Escher Wing, visitors are treated to moving staircases and other elements of M.C. Escher's visual illusions. As Dean Blount suggests, however, such trickery is a pale replacement for the real thing. "Our students might as well go to Pyramid Hill," he exclaims (174); and a little while later, "'these kids will lose all respect for the permanent record of the human heritage'" (175). There is, indeed, a fine line between human history and the simulacrum of that history.

Conclusion

The vision presented in *Rainbows End* of classroom and library environments radically shaped by digital technologies is an ambitious potential snapshot of where the humanities are heading. At the same time, it is a reflection of the evolutions that current institutional ideologies, infrastructures, and practices are undergoing. Since the early 1990s, the digital—as a network of wires, nodes, and data-bits; as an end-user product; and, most important, as a conceptual psychological metonymy—has permeated nearly every facet of western culture and society. According to Harwood and Asal, such "technologies are embedded within the fabric of American life—the way we shop, do business, obtain information, communicate with others, and, increasingly, educate our youth" (2). As U.S. culture continues to be identified with the digital—as being, in fact, quintessentially digital in itself—the humanities fields at its center are also fundamentally transformed.

Education and archival organizations have largely followed this paradigm, adapting to digital modalities as knowledge production and dissemination have become increasingly dependent upon digital technologies and ecologies. Within these emerging digital learning environments, writes Ethan Zuckerman, we are "digital cosmopolitans" empowered by technology "to take responsibility for shaping the tools we use to encounter the world" (27). Indeed, we as users define the parameters of such environments. As Vinge's novel shows us, successful digital learning environments rely not only upon technology, but also upon their networks of interconnected participants. The relationships are interdependent, not subordinate. Digital learning environments "provide functionality and tools for collaboration and communication in various modes between students and faculty" and

researchers, as well as flexible platforms for "information exchange" and "learning resources" (Lanestedt 71).

The students and library patrons of *Rainbows End* have an active stake—through the virtual imagery produced by wearable technology of Epiphany Lite—in the elastic and collaborative discourse communities they help build as digital makers and collaborators. Epiphany Lite, like the Internet, "lies at the core of an advanced scholarly information infrastructure to facilitate distributed, data- and information-intensive collaborative research" (Borgman xvii). But it is also wholly dependent upon its users distributed across multiple "discourse networks" and communities in global and local processes of knowledge making. Discourse network, a term coined by Kittler, denotes "[t]he network of technologies and institutions [and participants] that allow a given culture to select, store, and process relevant data" (*Discourse Networks* 369). In these networks (of which the digital learning environments of *Rainbows End* are a part), technology and its users exist as part of what Geoffrey Winthrop-Young calls a mutually resonant "techno-cultural configuration" that helps articulate and plug them into culture (97).

Like all high-caliber science fiction, Vinge's novel is as much a representation of the present and reflection of the humanistic past as it is a speculation on the future. As such, similar to the tension inherent in Powers' *Galatea 2.2* protagonist Rick, *Rainbows End* explores the dialectic between art and the traditional humanities, and a burgeoning fascination with digital technologies that initially seem to threaten those traditions. The narrative foregrounds and thus represents information—in the guise of search and analysis—as an increasingly important cultural and economic currency. Called "'the heart of the economy'" (Vinge, *Rainbows End* 59), search and analysis is the ability to retrieve,

process, manipulate, and/or change digital data through global collaboration and the networked "intelligence of others" (213). Not surprisingly, it is taught to all high school students as a core competency and thus parallels a perspective affirmed during the Clinton administration: that technological literacy is "'fundamental to a person's ability to navigate through society as traditional skills like reading, writing and arithmetic'" and, by extension, the U.S. economy.

Looming over all of this is the run-up to the concept of the Technological Singularity, which (though in some respects spiritually and psychologically alarming) Vinge has described as vastly useful for education and humanities knowledge networks. While the narrative refuses to definitively answer whether or not "'computers and communication automation [favor] tyranny or [favor] liberty'" (Vinge, quoted in Moravec), Vinge sees the near-term acceleration of technological development as a boon to democratic cultural and scholarly loci. The run-up to the Singularity, he suggests, will bring "'real changes to education'" and skills training in general. "'[W]e have seven billion people out there who are variously good… at different things. And there are ways of enhancing and amplifying that by collaboration'" via digital networks. Like the novel's search and analysis collectives, Internet communities, crowdsourcing and other knowledge commons reveal the ongoing development of a "'very great imagination that can be exercised in making collaboration effective.'" In these digital learning environments, such as digital classrooms and libraries, technology has the potential to teach students "'to learn how to learn'" (Vinge, quoted in Moravec). *Rainbows End*, in turn, expands upon Cathy N. Davidson's hope for the "research and pedagogical possibilities of an open-knowledge commons" provided by the digital "for scholars and students of the humanities" and culture at large (484).

In the final chapter, "Hacktivists: Privacy, Play, and the Battle for Digital Freedom in Cory Doctorow's *Little Brother*," I trace the development of this born-digital generation through the digital reshaping of high-stakes political and ideological discourses in a post-9/11 America. Working from the foundations of digital culture and economy established by the preceding texts, I will position Doctorow's narrative—a near-future speculative work—as a politically conscious commentary on the state of freedom in the digital age. As digital narratives continue to inform the humanities and humanity in general, a serious consideration of digital civil liberties (privacy, surveillance, etc.) in the humanities is increasingly necessary.

4

Hacktivists

Privacy, Play, and the Battle for Digital Freedom in Cory Doctorow's *Little Brother*

In "The Conscience of a Hacker," a short but influential manifesto published in 1986 in the ezine *Phrak*, a hacker operating under the handle The Mentor (real name Lloyd Blankenship) laid the foundation for hacktivism. "This is our world now," it reads, "the world of the electron and the switch… We explore… and you call us criminals. We seek after knowledge… and you call us criminals. We exist without skin color, without nationality, without religious bias… and you call us criminals." Blankenship wrote the essay while in prison on a charge of computer crimes associated with bank tampering. In fact, he suggests, the only crime he is guilty of is "curiosity," and a desire for social and political justice. He is a hacktivist, pushing back against a rigged system.

Marcus Yallow, the protagonist of Cory Doctorow's *Little Brother* (2008), is also a hacktivist, combining a passion for digital DIY with an acute sociopolitical awareness about personal freedoms in the United States. It is in the intersection of these qualities that we find the humanity that coalesces around technology. According to Tim Jordan and Paul A. Taylor, hacktivism is a form of digital civil disobedience that combines "grassroots political protest with computer hacking" in both real-life and cyberspatial contexts (1). Molly Sauter locates the concept as "disruptive activism" practiced in online environments (2), with ties to historical activist causes such as the Civil Rights movement and anti-Vietnam War

protests. Though in many ways a typical high school student, Marcus acts as a conduit for Doctorow's professional and personal engagement with digital security, privacy, copyright, digital rights management, open source technologies and initiatives, and other humanities-based digital issues. Doctorow has positioned himself as a "mouthpiece/activist type" on these issues ("Microsoft Research" 3), utilizing his fiction and essay writing to explore "the personal and ethical need for a better relationship with information technology" (Grossman). In Marcus, he has created a fictional analogue whose passion for building and hacking digital technologies (both hard- and software) is central to the character's identity. This passion is illustrated in an early passage: "If you've never programmed a computer," says Marcus to the reader, "you should. There's nothing like it in the whole world. When you program a computer, it does *exactly* what you tell it to do… It's awesome in the truest sense: it can fill you with awe" (Doctorow, *Little Brother* 119). Computer programming is for Marcus both an intimate act—working in the entrails of raw code—and a form of artistic expression that carries with it a potential subversive power.

Like the other novels of this project, *Little Brother* employs speculative and plot-driven story elements to conduct a timely analysis of the cultural impact of the digital and the humanistic relationship to it. Tim O'Reilly sees this aspect of Doctorow's rhetorical style as part of his role as a "context-setter… helping us all to understand the implications of the technology being unleashed around us… The ideas behind his stories are *tools to think with* about hard problems in futures few are even prescient enough to predict" (9). Most crucially, *Little Brother* confronts the malleable and volatile nature of digital technologies in their ability to render positive change, to empower, and to corrupt—particularly as such configurations have evolved since the September 11, 2001 terrorist attacks on the United

States. This plays out as a digital power struggle (and struggle for the digital) between the Department of Homeland Security and ordinary American citizens, including Marcus and his classmates, following a 9/11-like terror event. Through a portrayal of the bombing of the San Francisco-Oakland Bay Bridge and the BART system, Doctorow initiates an exploration of U.S. authority and its response to terrorism in the digital age. The speculative (that is, allegorical) aspect of the novel affords scrutiny of certain Bush II-era policies that, under the administration's jingoistic and oftentimes indiscriminate War on Terror, implicitly legitimized constitutional violations of basic civil liberties.[26] The work is thus also an indirect response to the social contract philosophies of Thomas Hobbes and others, upon which most contemporary democracies are based. In his *Leviathan* (1651), Hobbes argued for a trade-off between civic freedom and sovereign security in which the individual surrenders some of their rights for the promise of protection by the state. This, he suggested, would prevent "a warre… of every man, against every man" (185). However, it is not difficult to see how those in power can corrupt such theories.

The novel also acts as a projection of the role information technologies and digital spaces might play under these circumstances, where surveillance and the control of communications and data are paramount. In a global reality codified and interconnected by digital technologies, such policies (reactionary and pre-emptive, built upon the notion of American exceptionalism) are made all the more dangerous and invasive. According to Rebecca MacKinnon, government and corporations are complicit in this erosion of Fourth

[26] According to Andrew Morgan, "Under the auspices of combating terror, the Bush administration took many steps following 9/11 that according to some have curtailed civil rights. Chief among these was the passage of the USA Patriot Act of 2001" signed into law by George W. Bush on October 26, 2001. Among its ten provisions, the law grants unilateral powers to law enforcement agencies in the surveillance and indefinite detention of immigrants; the authorization of National Security Letters, which allow agencies to seize telecommunication and financial records without warrant; and access to business records, including library and subscriber records.

Amendment protections.[27] "As we grow increasingly dependent on the Internet and cellphones," she writes, "government abuse of citizens' privacy requires the cooperation of the private sector." Simultaneously, in Sauter's view, we are seeing the development of "an entire public sphere, the internet, which by accidents of evolution and design, has none of the inherent free speech guarantees we have come to expect" (4). Indeed, the "spying and invasive Net" of post-9/11, as Lessig calls it (*Code* xv), has become a digitally enshrined aspect of human life justified by the need for ever-greater national security frameworks.

However, the digital has always been something of a double-edged sword. Despite the fact that many "[d]issenting voices are pushed out of the paths of potential audiences, effectively removing them from the public discourse"[28] (Sauter 4), digital technologies can provide powerful tools and knowledge sets for marginalized voices to be heard and to gather. Science fiction and many spaces of the Internet both offer, in this sense, lively democratic commons with the potential to help liberate their readers and users. On the contentious issue of citizenship in the digital age, Stephen Coleman argues that "e-citizenship can be seen as a democratic space where anyone can stake a claim to be heard and respected and all proposals have a chance of being acted upon" (391). Despite cynical commercial and/or political efforts to censor or leverage the contemporary e-citizen—what Coleman refers to as "a technologically facilitated means of subsuming political subjects within the agenda, logic, and language of the state" (391)—the Internet continues to serve as a medium for performative and activist possibility. Its innumerable spaces

[27] "The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized" (U.S. Const. amend. IV).

[28] For example, Edward Snowden and Julian Assange are both wanted in connection with breach-of-trust acts of political dissention, including the leaking of sensitive data.

continue to coalesce as a democratizing phenomenon that challenges, subverts, and revises white male sociocultural and political power structures.

Similarly, science fiction is increasingly being positioned in the mainstream as a literature of political and social empowerment. Science fiction, Octavia Butler once said in a 2000 interview with Charlie Rose, is a genre where "[y]ou [get] to make your own worlds; you [get] to write yourself in." Jane Greenway Carr takes this a step further, arguing that science fiction "invite[s] marginalized people to read themselves into the story, to imagine themselves as participants and agents in changing the systems of culture, technology, and politics that govern their lives." These "conduit[s] to feelings of citizenship" offer "outsider heroes" like Marcus a means to "interrogate systems of power" (J.G. Carr) and "architectures of regulation" (Lessig, *Code* xv). Bukatman largely agrees with this point of view, citing McCaffery's proposal that "through its deployment of new 'terminologies and metaphors,' contemporary American science fiction has 'produced a body of work that addresses and analyzes… new technological modes of "being in the world" '" (*Terminal Identity* 8).

This chapter will address some of the issues in *Little Brother* that revolve around privacy, surveillance and civil rights in the digital age. Doctorow's novel, a manifesto of peaceful "digital disobedience" that forms the basis of "the technophile's civil protest" (Huang, "Reviews"), is a prime candidate for this kind of literary interrogation. I will begin by analyzing Marcus's experiences in high school, the digital surveillance he is subjected to and his creative methods for evading and/or circumventing it as a tech hobbyist. Next, I will move onto a discussion of games and play as central to the formation of digital cultures through virtual and real-life games including ARGs (Alternate Reality Games), LARPing

(Live Action Role Playing) and MMORPGs (Massively Multiplayer Online Role Playing Games). In the final two sections of the chapter, I will focus on the tense relationship between national security and digital liberty—including an analysis of hacktivism as an emergent form of democratic/sociopolitical resistance in the digital age.

Hackers as Pioneers

From the outset, we see how Marcus's digital DIY and thoughts on privacy and constitutional rights converge in an ethics of hacktivism. For Andrew "bunnie" Huang, the MIT graduate who first hacked the Xbox platform in 2002, "Hackers [like Marcus] are explorers, digital pioneers." It is "in a hacker's nature to question conventions and be tempted by intricate problems." This is especially true for the security of a "large and complex system" like society, which is patched together by an ever evolving, but highly regulated set of laws and customs (Afterword 371). In many important ways, Marcus is the activist, socio-politically responsible and responsive torchbearer of the born digital generation. Where Miri Gu of *Rainbows End* sees the mastery of cutting edge digital technologies and literacies as an end in itself—a skillset that grants access to the social and economic benefits of entrenched power systems—Marcus and his high school friends use their digital savvy for social and political empowerment to circumvent or buck those systems.

The novel begins at Cesar Chavez High School in San Francisco's Mission district, which, as Marcus claims, "makes [him] one of the most surveilled people in the world" (Doctorow, *Little Brother* 9). Almost immediately, a narrative dichotomy between student

and adult authority figure is constructed that telegraphs the central ideological thrust of *Little Brother*. Vice-Principal Benson summons Marcus to his office to grill the student about his alleged involvement in a "'criminal conspiracy to subvert this school's security system.'" As evidence of culpability, Benson cites the expulsion of a student for using one of the "'security countermeasures'" that he states Marcus supplied (12). And while these claims do not hold water, he also accuses Marcus of being w1n5t0n, the individual responsible for hacking and stealing the previous year's digital standardized tests. Although it is true that Marcus operates in digital spheres as w1n5t0n—the handle he uses to post his "contributions to the field of applied security research" on network message boards (11)—Benson again has the wrong person. His threats of imprisonment for non-cooperation are troubling, and presage the novel's wider critical interests in the culture of fear, paranoia, and widespread surveillance fostered by America's allergic psychological response to terrorism.

Many hackers, like many digital humanists, are driven by curiosity and a creative impulse for digital tinkering. As Benson demonstrates, though, this impulse is often mischaracterized as subversive, "defy[ing] social norms for the sake of defiance" (Huang, Afterword 371). In fact, Marcus is more closely aligned with security technologist Bruce Schneier's philosophy, in which "security is a mindset" (Afterword 367). A security-minded person is always "think[ing] about security systems and how to break them" from a theoretical perspective (367). Marcus embodies this way of thinking, Schneier suggests. "I'll bet he couldn't walk into a store without figuring out a way to shoplift. Not that he'd do it—there's a difference between knowing how to defeat a security system and actually defeating it—but he'd know he could" (368). Such a mentality (embodied by the pop

cultural image of the amoral criminal hacker[29]) is threatening to many people, particularly the owners of proprietary content/data protected by security systems. The irony of this antipathy, however, becomes clear in a formulation that Doctorow calls "Schneier's Law," after Schneier's own writings on the subject. "Anyone can come up with a security system so clever that [they] can't see its flaws," argues Doctorow. "The only way to find flaws in security is to disclose the system's workings and invite public feedback. But now we live in a world where any cipher used to fence off a copyrighted work is off-limits to that kind of feedback" ("Microsoft Research," *Content* 10).

After the confrontation with the vice-principal, we are introduced to this security-centric mindset. As Marcus makes his way through the school hallway, "gait-recognition cameras" track his every physical movement. These devices, which "Benson and a lot of other paranoid school administrators had spent [the students'] textbook dollars on," are designed to measure and profile individuals based on the way they walk (Doctorow, *Little Brother* 14). According to Marcus, they are products of bureaucratic and hawkish trading of educational materials for redundant layers of security, and idiotic in their capacity to be easily exploited. But they also represent the increasing adoption in western socioculture of biometric technologies that attempt to quantify the human body for security purposes. For critics of the technology, such as Shoshana Amielle Magnet, this (commercial as much as political) trend threatens the very notion of embodied subjectivity. "Biometric representations of the body," she points out, redeploy the individuated human body "as a

[29] See, for example, Ira Winkler's 2009 *New York Times* article "'Hackers Wanted' Ad Fuelled Security Misconception." The original ad, posted by General Dynamics Information Technology on behalf of the Department of Homeland Security, sparked a debate in mainstream culture about hackers and national security. In response to an earlier article by Lolita C. Baldor ("US Looks to Hackers to Protect Cyber Networks," Boston.com, 2009), Winkler finds fault with the "implication that hackers are criminals." This stance, he argues, is reflected in her article's lead: "Federal authorities are looking for hackers—not to prosecute them, but to pay them to secure the nation's networks" (Baldor).

simple series of ones and zeroes," thereby dehumanizing it (65). In this respect, in terms of the violation of civil rights, the gait-recognition cameras tread a line of dubious legality. However, since the central assumption of biometric science designates "the human body… [as] a stable, unchanging repository of personal information, from which we can collect data about identity," it is necessarily prone to error or manipulation (Magnet 2). Marcus knows this and, with a little creativity, is able to exploit the system's flaw. As he explains, the technology "takes pictures of your motion, tries to isolate you in the pics as a silhouette, and then tries to match the silhouette to a database to see if it knows who you are" (Doctorow, *Little Brother* 18). Although it is "a biometric identifier, like fingerprints or retina-scans," it is subject to many more "biometric 'collisions'"—when the software fails to differentiate between individuals based on their gait alone and instead returns multiple false positives (18). "There are a lot of people who walk kind of like you," he continues.

> What's more, it's easy not to walk kind of like you—just take one shoe off. Of course, you'll always walk like you-with-one-shoe-off in that case, so the cameras will eventually figure out that it's still you. Which is why I prefer to inject a little randomness into my attacks on gait-recognition: I put a handful of gravel into each shoe. Cheap and effective, and no two steps are the same. Plus you get a great reflexology foot massage in the process. (18)

It is this kind of humanist digital DIY approach to hacking invasive surveillance systems that marks him as both a digital humanist and a sensitive and engaged member of the born digital generation. In effect, his actions reinforce Magnet's claim that "[a]ny technology that takes as its premise the assumption that bodies are stable entities that can be reliably quantified is problematic" (49). For both Magnet and Marcus, the problem is at once

practical and metaphysical. In the metaphysical sense, technologies that attempt to superimpose standardized metrics on human subjects attenuate and homogenize individual subjectivities. In practical terms, however (and as Marcus demonstrates), the objective rigidity of these same technologies allows them to be deceived or exploited—ironically—by the embodied subjectivities they are programmed to contain.

Similar ingenuity is applied to the hacking of both the SchoolBook Intranet system and RFID tags in hardcopy school library books. As Marcus again explains to the reader, the proprietary laptops (known as SchoolBooks) assigned to each student to use during class time are "the snitchiest technology of them all, logging every keystroke, watching all the network traffic for suspicious keywords, counting every click, keeping track of every fleeting thought you put out over the net" (Doctorow, *Little Brother* 14). Like the hallway cameras, these devices—loaded with "a never-ending parade of obnoxious ads" (14)—are an important part of the school's burdensome and invasive surveillance array. To get circumvent this, and to retain some semblance of personal agency, many of the students use an illicit software crack to install "hidden programs… that would stay hidden even when the Board of Ed did its daily remote integrity checks of the machines" (14). One of the hidden programs is IMParanoid, the "secret instant messenger" the students use when they want to have a private "off-the-record discussion right in the middle of class" (15). As its name suggests, IMParanoid is a direct consequence of the climate of fear fostered by overbearing state institutions that figure transparency of the digital footprint as a civil good. Doctorow's opposition to copy-protected systems that rely on digital rights management and other proprietary software to regulate digital activities, creativity and production is palpable here. In his essay "The DRM Sausage Factory," he outlines digital

rights management as a kind of intellectual fortress that curtails and dictates ownership of digital property:

> At root, DRMs are technologies that treat the owner of a computer or other device as an attacker, someone against whom the system must be armored. Like the electrical meter on the side of your house, a DRM is a technology that you possess, but that you are never supposed to be able to manipulate or modify. (27)

The answer to this question is equal parts commercial and sociopolitical control. By extension, on the subject of creative freedoms, Doctorow has also argued that "the purpose of copyright" has always been "to decentralize who gets to make art." And as the digital age continues to position itself as the latest in a long line of "technological shifts in cultural production," artistic production and freedoms are fragmented and siloed to an even greater degree by the spaghetti junction of digital copyright law ("Science Fiction" 77). Palfrey and Gasser echo this point, observing that "[t]he copyright war—a war of litigation involving content owners, Digital Natives, and technologists—has become a defining feature of the digital age" (149).

These anxieties appear throughout *Little Brother*, which is as much a story as it is a lesson from Doctorow on digital liberties. Inside the walled garden of the SchoolBook technology, Marcus has to contend with "a locked-down spyware version of Internet Explorer," which is run on "Windows Vista4Schools, an antique operating system designed to give school administrators the illusion that they controlled the programs their students could run" (Doctorow, *Little Brother* 19). Again, he is able to bypass the surveillance dragnet with a mixture of creativity, patience, and the skillset of a born digital: by using an indie copy of the Firefox browser (hidden from the operating system with a little

programmatic trickery) routed through a real-life, volunteer-driven, and open source global network called Tor (aka The Onion Router). Tor, first developed for the U.S. Navy in 2002, uses a protocol known as onion routing to encrypt communications data in successive layers and randomly bounce it between many thousands of relays. Tor Project, the non-profit organization that hosts and maintains Tor, describes the program as

> a network of virtual tunnels that allows people and groups to improve their privacy and security on the Internet. It also enables software developers to create new communication tools with built-in privacy features. Tor provides the foundation for a range of applications that allow organizations and individuals to share information over public networks without compromising their privacy.

The open source combination of Firefox and Tor, for Marcus, is the perfect solution to turn him "into the invisible man, impervious to Board of Ed snooping" (Doctorow, *Little Brother* 20). Since the network "was set up by the US Office of Naval Research to help their people get around the censorware in countries like Syria and China," he explains, "it's perfectly designed for operating in the confines of an average American high school" (20). In these terms, a conflation of U.S. education and countries the average American citizen might think of as heavily surveilled police states is both dramatic—inasmuch as this is speculative fiction—and, whether we choose to ignore it or not, increasingly realistic.

Rather than posing a threat to school or national security, however, Marcus utilizes his digital literacy for creative, non-destructive purposes, such as visiting the blacklisted Harajuku Fun Madness website—an ARG (Alternate Reality Game) he plays with his friends. In this way, he is no different than his born digital peers: "Advancements in digital technologies have enabled practically any user with basic digital literacy skills and fast

Internet access to engage in self-expression in creative ways at low cost. The impulse is nothing new, but the forms of expression are" (Palfrey and Gasser 124-25). Like the synners of Cadigan's novel and the younger students of *Rainbows End*, Marcus is complicit in "the shaping of culture, the making of 'meaning'" (125). No less than a "creative revolution," the digital playground offers innumerable opportunities "to shape and reshape cultural understanding through digital creativity… And it is Digital Natives who are best poised to engage in this process" (125).

Indeed, Marcus is an embodiment of the digital native, actively engaged in the production and remediation of a new cultural understanding that subverts the restrictions placed upon digital liberty and creativity. This spirit of digital DIY is neatly captured during the RFID scene, when, upon cutting class, Darryl realizes he still has an RFID-equipped library book with him. RFID[30] tags, like the gait-recognition cameras, can be used to track a student's movements. Again, Marcus is on hand to handle the situation: "Library books are bad news. Every one of them has an arphid—Radio Frequency ID tag—glued into its binding" (Doctorow, *Little Brother* 21). These tags help libraries sort and keep track of their books, but they also allow school administrators to track their students. "It was another one of those legal loopholes," Marcus explains. "[T]he courts wouldn't let the schools track *us* with arphids, but they could track *library books*, and use the school records to tell them who was likely to be carrying which library book" (21-22). He could use a device to simply reprogram the tag, but, as a humanist, this is akin to "tearing pages out of a book… since a book with a reprogrammed arphid can't be shelved and can't be found. It just becomes a needle in a haystack." The solution? "[Nuke] the thing. Literally. 30 seconds in a microwave

[30] Radio-frequency identification. For a dystopian portrayal of this emergent technology, see *The Last Enemy* (2008), a BBC drama set in a hyper-surveilled, near-future London.

will do in pretty much every arphid on the market" (24); and upon its return, the book will be recoded with a replacement tag. In this reality, something as seemingly innocuous as a library book—an object that has historically represented liberation through knowledge—is turned into a tool for the invasion of one's privacy. By pairing these two ideologically opposed concepts of books and RFIDs, and having the ever-resourceful Marcus disrupt the pairing, the scene strikes at the heart of the anxieties surrounding discourses of national security, biometric data collection, and surveillance.

Play in Digital Cultures

One of Marcus's favorite social events is Harajuku Fun Madness, which he plays in a team with his friends Van, Jolu, and Darryl. As a type of Alternate Reality Game, Harajuku Fun Madness combines "physical, online, and mental component[s]" (Doctorow, *Little Brother* 21) by "balance[ing] out running around in the real world, figuring out online puzzles and strategizing with your team" (134-35) in a stimulating, competitive and collaborative multimodal experience. Jaakko Stenros and others suggest that ARGs function as "storytelling vehicles," or "transmedia," in which participants get to influence the direction and outcome of the narrative in social groups (1). These games are designed with notions of teamwork, movement, meaning making, and identity play in mind,

> transport[ing] the players to a fictional world superimposed on the reality of everyday life and delivering an interactive narrative grounded in that setting. The play style is largely collective: through locating content in the real world and online, players uncover, piece together and influence a given narrative. (1)

The element of narrative construction, or transmedia, is important in these games. According to Edward Castronova, being allowed to construct narrative "[gives] users the maximum amount of freedom to manipulate their involvement with them" while "retaining all that is good about the fantasy atmosphere of the synthetic world" (147). Within these conceptual spaces, participants articulate themselves through the principles and ideals of second-wave digital humanities. Marcus and the others collaborate in the rhizomatic creation of "'rich and layered'" living texts that "weav[e] text, images, sound, and video… for delivery within and across digital spaces" (DigiRhet.org 240). They harness "multimedia practices" and knowledge sets that "explore the fusion of text-based humanities with film, sound, animation, graphics, and other multimodal practices across real, mixed, and virtual reality platforms" (Hayles, "How We Think" 43). At the same time, they exhibit "a deep attention to context, audience, and meaning-making across multiple tools and media" critical to digital composition and collaboration (DigiRhet.org 241) through the "collective intelligence" the genre encourages (Stenros, et al. 1).

The students' enjoyment for such activity is also indicative of their generation's digital-cultural emphasis on multimodal composition. Henry Jenkins understands multimodality as a fundamental part of transmedia storytelling, where "integral elements of a fiction get dispersed systematically across multiple delivery channels for the purpose of creating a unified and coordinated entertainment experience." Marcus makes this clear in Harajuku Fun Madness:

> Imagine the best afternoon you've ever spent prowling the streets of a city, checking out all the weird people, funny hand-bills, street-maniacs, and funky shops. Now add a scavenger hunt to that, one that requires you to research crazy old films and songs

> and teen culture from around the world and across time and space. (Doctorow, *Little Brother* 15)

Jon Dovey and Helen W. Kennedy have noted the importance of games and gaming—what they refer to as "'technoplay'"—as "a key signature of digital culture" and hacker identity (39). "Conventional accounts of the emergence of contemporary digital cultures," they report, emphasize "the synergistic relationship between computer code, probability and rules that, in turn, manifests itself in particular kinds of experimental and playful attitudes towards computer technologies" (38). A crucial aspect of this relationship is the "hacking sensibility," which contributes to our increasingly "'ludic culture'" and in fact "predates the digital age" (38). Marcus and his friends, though steeped in a digital and highly mediated culture, embody the original concept of hacking in the creative and intelligent "manipulation of complex systems" (Dovey and Kennedy 38). They operate within this definition with a "playful cast of mind that [is] a direct reaction to the systems of scientific and corporate instrumentality" (38). We see this later in the novel, when Marcus takes the digital fight back to the Department of Homeland Security.

ARGs, as well as other kinds of games that Marcus expresses an interest in, such as LARPing (Live Action Role Playing) and MMORPGs (Massively Multiplayer Online Role Playing Games), rely upon diegetic participation in the collective building of their worlds. Participation is one of the key ingredients in discourses of digital activism. David Buckingham emphasizes this aspect of gaming, noting "the fundamental difference between games and other kinds of cultural texts [is that]… games are *played*" (6). Harajuku Fun Madness challenges players to their fullest abilities, both intellectually and physically, and helps build social and collaborative problem-solving skills. LARPing features many of the

same qualities and rewards of Alternate Reality Games. “It's like Capture the Flag in monster-drag, with a bit of Drama Club thrown in,” he explains (Doctorow, *Little Brother* 17). The emphasis is always on the multifaceted nature of role-playing as a performative, creative, imaginative and physically demanding act. For Marcus, the best of these involved “all-day hikes” through California forest, “epic battles with foam-and-bamboo swords, [and] casting spells by throwing beanbags and shouting ‘Fireball!’” (17). One particular LARP that he attends, dubbed Wretched Daylight (about vampires), is organized by “a well-known literacy charity that [runs] kids’ writing workshops… [and] drama workshops,” promoting a program of collective creativity, social structure, competition, and exercise (290). Another, VampMob (exactly what it sounds like), is used to great effect as a form of culture jamming to disrupt DHS operations on the ground.

Later on, as Marcus’s group wages its resistance against the DHS through the Xnet computer network (more on this later), he uses the MMO Clockwork Plunder to hold a virtual press conference at “Patcheye Pete’s because it was the market closest to the village square where new players spawned” (Doctorow, *Little Brother* 232). As his avatar M1k3y, he responds via text chat to reporters’ questions about the Xnet and its philosophy:

> … I use the Xnet because I believe in freedom and the Constitution of the United States of America. I use Xnet because the DHS has turned my city into a police-state where we're all suspected terrorists. I use Xnet because I think you can't defend freedom by tearing up the Bill of Rights. (235)

Again, we see how the fundamentally creative, collaborative and communicative aspects of gaming—especially networked gaming—can be utilized in service of activist (or hacktivist) causes. Hilde G. Corneliussen and Jill Walker Rettberg argue that MMOs are “social

framework[s] for communication" from which, in turn, "we get culture" (9). The formation of tight-knit cultural discourse communities (guilds in World of Warcraft parlance) in MMOs often coalesce around collaborative and goal-oriented activity—both within and outside virtual parameters. Occurences of virtual social activism (or, indeed, simulations of catastrophe) have been described by Elijah Meeks as examples of "real-world emergent phenomena" that, by extension, provide both a model and a platform for social and political protest/change. Clearly such games are systematized by a similar set of criteria as digital humanities work, often correlating (and sometimes literally intersecting[31]) with one another in the field's clarion call for projects and scholarship that are "qualitative, interpretive, experiential, emotive, [and] generative in character" (emphasis removed) (Schnapp and Presner 2). As a result, Corneliussen and Rettberg assert, we must confront MMOs as both "game[s] and… cultural site[s] requiring the application of multiple disciplines' analytical tools, concepts, and methods" (9). I would also argue that participation in MMOs (and similar active participation games—ARGs, tabletop RPGs, collectible card games, etc.) often demands a certain "application of… analytical tools, concepts and methods" (Corneliussen and Rettberg 9) that pulls together various intellectual, structural and creative modes of inquiry and ingenuity. A similar story can be seen in Second Life, another MMO that allows its users to contribute to "a world that is, by and large, conducive to self-expression and creativity" (Palfrey and Gasser 121). Its

[31] Many digital humanities projects have been conducted through or have used MMO environments. Corneliussen and Rettberg organized a guild meeting in World of Warcraft to discuss the chapters of their work (9). Lessig has conducted cyberlaw classes in MUDs (Multi-User Domains) (*Code* 5). Bryan Carter's Virtual Harlem project, initially designed "as an immersive VR [virtual reality] representation of 10 sqaure blocks of the New York neighborhood during the Harlem Renaissance period of the 1920s-1930s," found a new home in 2005 in Second Life (Jones 114). Other examples include the HUMlab Second Life project at Umeå University, and David Rumsey's collection of historical maps (one of the largest private collections in the world), which have been recreated in Second Life (the David Rumsey Maps Island) and Google Earth using 3D modeling tools.

conceptual spaces are "user-defined," with "residents themselves creat[ing] most of the content" using—and consequently being empowered by—design tools made available to them by the game's developer (121-22). Far from being "a means of escapism for technology fiends the world-over," Chris Haller observes, platforms like Second Life are being "harnessed for collaborative purposes with educational and informational goals in mind." In Marcus's hands, the virtual space becomes what Christopher M. Kelty terms a "recursive public"—"a collective independent of other forms of constituted power" that is "capable of speaking to existing forms of power through the production of actually existing alternatives" (304). MMOs can act as global "laboratories" for "economic and democratic experiments"[32] that have far-reaching impact in virtual and real-life contexts (304).

Terrorism, Digital Liberty, and the DHS

The watershed moment of the story is the terrorist bombing of the San Francisco-Oakland Bay Bridge and the Bay Area Rapid Transit (BART) system. Marcus, Darryl and the others are occupied with Harajuku Fun Madness in the busy downtown streets when it happens, effectively stranding them in the middle of a mass panic. The sudden, utterly transformative nature of the attack, bearing clear parallels to 9/11, is summed up in a single sentence: "Then the world changed forever" (Doctorow, *Little Brother* 32). But while this terror event and the visceral, almost feral human reactions to it are undoubtedly

[32] Since its inception in 2003, Second Life has been used for education, business, governmental work, and many other kinds of real-world group work and training. See, for example, Karine Joly, "A Second Life for Higher Education?" (*University Business*, 2007); Mitch Wagner, "Using Second Life as a Business-to-Business Tool" (*Information Week*, 2007); Tim Goral, "Sizing Up Second Life" (*University Business*, 2008); Mark Tutton, "Going to the Virtual Office in Second Life" (*CNN*, 2009); and Chris Haller, "Government Using Second Life" (*Engaging Cities*, 2010).

horrific; for Marcus and the others, the real terror is still ahead of them. A short time after the bombings, the group is violently abducted by soldiers in unmarked fatigues and taken to an unidentified detention facility that gains the nickname Guantanamo-by-the-Bay. This sequence of events, from the first rumble of the terrorist attacks to Marcus's initial interrogation by a Department of Homeland Security agent, is crucial in setting the stage for the DHS's systematic stripping of his digital and other civil liberties. Indeed, Alex Reid notes, "it's not hard to imagine that if there were another terrorist attack of a similar magnitude to 9/11 that it could result in the abridgment of civil rights." As Marcus is subjected to this humiliating process, we are reminded of "how important privacy is to freedom and how important encryption can be for privacy in the cognisphere" ("Cory Doctorow's *Little Brother*").

Marcus asks the agent who interrogates him if he is under arrest. Instead, she holds up his cellphone and demands to know what it is used for. "The screen was showing the error message you got if you kept trying to get into its data without giving the right password. It was a bit of a rude message—an animated hand giving a certain universally recognized gesture—because I liked to customize my gear" (Doctorow, *Little Brother* 48). Marcus repeats his question and is finally informed, presumably under a Patriot Act-style suspension of *habeas corpus* (which justifies unlawful imprisonment "in cases of rebellion or invasion [when] the public safety may require it" [U.S. Const. art. I, sec. 9]), that he is "'being detained as a potential enemy combatant'" by the DHS (Doctorow, *Little Brother* 48). "'We found a number of suspicious devices on your person,'" the agent continues. "'We found you and your confederates near the site of the worst terrorist attack this country has ever seen. Put those two facts together and things don't look very good for you, Marcus'"

(48-49). Much of the DHS's evidence against Marcus is circumstantial—including the discovery (after googling his name) of "'a lot of very ugly stuff on the public Internet'" (49). He is ordered to "'unlock [his] phone and then decrypt the files in its memory'" (49). This, for Marcus, is a blatant invasion of privacy, and he refuses to comply. "My phone's memory had all kinds of private stuff on it: photos, emails, little hacks and mods I'd installed" (49). This is a problem unique to the digital age. "Before the Internet," Lessig observes in *Free Culture*, "most of us didn't have to worry much about data about our lives that we broadcast to the world" (277). In public physical spaces,

> your privacy was [more or less] assured because of an inefficient architecture for gathering data and hence a market constraint (cost) on anyone who wanted to gather that data… Now, because of the architecture of the Net and the function of cookies on the Net, it is easier to collect the data than not. The friction has disappeared, and hence any "privacy" protected by the friction disappears, too. (278)

But while data is more porous in the digital age—not to mention the fact that Marcus should not have to surrender his right to privacy as proof of innocence—the agent's command is legitimized through its Patriot Act analogue that provides government agencies such as the NSA access to "telecommunication, financial, and credit records without a court order" (MacKinnon). In other words, he is stuck in a catch-22 that exposes the delicate tension between digital civil rights and security.

Lessig makes a related point, via Fred von Lohmann, about the bulk confiscation of civil liberty protections in music copyright infringement. Like Marcus, whose entire range of civil liberties is being contravened on suspicion and circumstance alone, copyright

infringers—"'a remarkable percentage of the American Internet-using population'"—are routinely considered "'criminals'" and therefore underserving of the rights to privacy that, for example, guarantee security "'against seizures of your computer'" (*Free Culture* 205). And indeed, "'If you can treat someone as a putative lawbreaker,'" as the DHS does with Marcus and his friends, "'then all of a sudden a lot of basic civil liberty protections evaporate to one degree or another'" (205).

We see this particular logic applied time and again throughout the novel. Through a combination of the detention facility's squalid conditions, rough treatment from the guards, and emotional/psychological blackmail by the agent, Marcus is coerced into surrendering all the security measures that safeguard his digital privacy. After placing his "phone," "arphid sniper/cloner," "wifinder" (a device used to find wifi signal clues in Harajuku Fun Madness), and "memory sticks" on the table, the agent tells Marcus that if he unlocks his phone, he will "'get outdoor and bathing privileges'" (Doctorow, *Little Brother* 54). "'Tomorrow,'" she adds, "'we'll bring you back and ask you to decrypt the data on these memory sticks. Do that, and you'll get to eat in the mess hall. The day after, we're going to want your email passwords, and that will get you library privileges'" (54). The agent sells this carrot-and-stick approach by claiming it is "'about [his] security'" (54); Marcus replies that she is "'talking about defending… freedom by tearing up the Bill of Rights'" (55). It is a noble counterargument, but—when his resolve is finally broken and he is forced into submission—ultimately a futile one. This is especially painful given the code of ethics he has developed around the preservation of personal (digital) memory. Violation of his digital devices exposes the color and shape of his whole life, which, to use his analogy, is like being required by law to "tak[e] a dump… in a glass room perched in the middle of

Times Square… buck naked" (57). With access to the data on these devices, "you could get a pretty good idea of who my friends were, what I thought of them, all the goofy things we'd done. You could read the transcripts of the electronic arguments we'd carried out and the electronic conciliations we'd arrived at" (56). In short, there is an entire register of personal history at stake here.

This is consistent with Gitte Stald's suggestion that the cellphone has "dual, but interdependent qualities for young people" (143). In one sense, it has a "communicative function," which facilitates its role as "a tool and a channel for the exchange of information." In another, it has a "social meaning, which develops from the communication" and aids in the performative construction of identity (143). Thus, Marcus's phone is "doubly articulated"—as a piece of hardware, but also as a subjective, socially constructed "medium through which [he] communicate[s]… and maintain[s] social contact" (Ling, paraphrased in Stald 143). For digital natives, the conceptual space of the digital has overtaken more traditional methods for expressing and/or extending the self and its networks, "shifting many of their core social activities from the offline space to the hybrid online-offline world" (Palfrey and Gasser 264). Kirschenbaum supports these arguments, noting that the "impulse toward equating subjective identity with personal data stores is emerging as one of the most dramatic features of contemporary discourse networks" (*Mechanisms* 102). Marcus's most treasured memories are stored in his data, not a shoebox—but the formative effect upon his ego is the same: "There's something really liberating about having some corner of your life that's *yours*, that no one gets to see except you." The actions of the DHS, he laments, "were taking that from me, piece by piece," essentially deconstructing his sense of self (Doctorow, *Little Brother* 57).

The *coup de grâce* arrives in the form of an invasion of Marcus's private email. Though he believed it would be safe, since his home laptop "downloaded and deleted [his] mail from the server every sixty seconds," the DHS manages to find a workaround (Doctorow, *Little Brother* 61). Like Vice-Principal Benson, the agent abuses her position of power to manufacture a prejudicial narrative of criminality that she extrapolates from Marcus's passion for digital DIY. In his (and, indeed, the reader's) mind, his activities are an expression of "free speech" and "technological tinkering," protected by the constitution (62). Nevertheless, all his "little gizmos," as well as "'the data we recovered from you phone and memory sticks,'" and "'the subversive material we'd no doubt find if we raided your house and took your computer'" are enough to symbolically condemn the teen for acts of terrorism against the U.S. government (62).

Hacktivism

Since at least the mid-1990s, hacktivism has emerged as a digital form of culture jamming that combines "traditional methods of political protest with the technological knowledge of computer hacking" (Taylor 59) to disrupt or critique "popular/mainstream culture, particularly corporate capitalism, commercialism, and consumerism" (by mining and remediating it) (Lievrouw 22), and to highlight sociopolitical, civic and legal injustices. The "alternative/activist new media" that it relies upon, writes Lievrouw (following Chris Atton), "employ or modify the communication artifacts, practices, and social arrangements of new information and communication technologies to challenge or alter dominant, expected or accepted ways of doing society culture and politics" (emphasis removed) (19).

By 1998, Stefan Wray was already casting digital technologies as integral tools in future forms of political protest:

> "Given increasing computer prevalence and the fact our political opponents are among the most wired in the world, it is foolish to ignore the computer. Rather, it is important to turn our attention toward the computer, to understand it, and to transform it into an instrument of resistance. For the luddites of the world who resist the computer, consider using computers to resist." (Quoted in Jordan and Taylor 17)

Although the commercial and mainstream adoption of digital technologies has to some extent rendered the public notion of hacking commonplace, hacktivism goes some way to re-establishing such activity as "the imaginative re-appropriation of technology's potential within countercultural and oppositional communities" (Jordan and Taylor 5). The idea behind this kind of civil disobedience is to promote "mass decentered electronic direct action" across emergent digital technologies that make such action possible on a "global, mass, collective and simultaneous" scale (Wray, "Electronic Disturbance Theater"). In recent years, powerful but controversial hacktivist groups such as Anonymous and LulzSec have engaged in hacktivism (often through DDoS attacks[33]) against what they perceive to be international sociopolitical, economic and cultural inequities.

After Marcus's terrible ordeal at the hands of the DHS, he devises his own form of hacktivism to take back many of the digital civil liberties the agency robbed from him, and to help free those of his friends who are still being detained. We might think of Lessig's

[33] Distributed Denial of Service—a technique in which "a large number of computers attempt to access one website over and over again in a short amount of time, in the hopes of overwhelming the server, rendering it incapable of responding to legitimate requests" (Sauter 2).

dictum for the digital age here, that Marcus "must take affirmative steps to secure a kind of freedom that was passively provided before" the advent and mainstream adoption of digital technologies (*Free Culture* 278-79). He makes use of a range of open source hardware and social networking technologies that are encrypted against government surveillance techniques—a resourcefulness illustrated through the discovery that his home laptop has been bugged. Although the laptop has considerable sentimental value—Marcus built the machine from scratch and named it "the Salmagundi, which means anything made out of spare parts" (Doctorow, *Little Brother* 85)—and although the DHS continues to spy on him, the digital DIY spirit soon returns. After building a makeshift "camera-detector" out of a "toilet-paper roll and three bucks' worth of parts" (85), he turns his Xbox Universal gaming console (a fictional iteration of the Microsoft console) into a computing device running an operating system known as "ParanoidXbox" (87). This OS, an offshoot of "Paranoid Linux," works in similar fashion to Tor:

> [The OS] assumes that its operator is under assault from the government (it was intended for use by Chinese and Syrian dissidents), and it does everything it can to keep your communications and documents a secret. It even throws up a bunch of "chaff" communications that are supposed to disguise the fact that you're doing anything covert. So while you're receiving a political message one character at a time… [the OS] is pretending to surf the Web and fill in questionnaires and flirt in chat-rooms. Meanwhile, one in every five hundred characters you receive is your real message, a needle buried in a huge haystack. (87)

The ritual of connecting the console to the Internet and connecting to other Xbox Universals in range—thanks to its network multiplayer capabilities—reminds Marcus, as a

digital hobbyist, of the feeling of being "in control." "My technology was working for me, serving me, protecting me. It wasn't spying on me. This is why I loved technology: if you used it right, it could give you power and privacy" (Doctorow, *Little Brother* 88). Doctorow has commented on the ideological duality of technology as a key difference between Orwell's *Nineteen Eighty-Four* and, with the benefit of technological hindsight, his own fiction. In a 2010 interview, he points out that "Orwell existed in an era in which technology had not yet gotten to the most important part of its life cycle: the part at which it becomes not just a tool for people who have power, but also a tool for people who lack it." In contemporary urban culture, he argues,

> people who have power have a lot of power, but they also rely on a fairly fragile technical infrastructure to sustain themselves. People who lack power don't have much power, but what they do have is access to the same technologies and all they need to do to upset the status quo is find one failure—one weak point in a technology—to disrupt it. (Quoted in Bernick, Steele, and Bernick, 438)

The point here is that *Little Brother* is concerned with showing how social and political empowerment through technology "cuts both ways," serving authority and providing a means for the oppressed to reign in or uncut that authority (438).

Connected to this is the fact that "politics can undermine technology," but "technology can [also] undermine politics. Neither trumps the other. If we are going to fix things, we need to fight on both the technological and political fronts" (Schneier, *Data and Goliath* 214). Since digital technologies (which in and of themselves are effectively neutral) can be used to shore up the power of authority, hacktivist causes work better if they also contain a traditional activist component. In narrative terms, this occurs through Marcus's

distribution of the ParanoidXbox OS, which happens physically by word-of-mouth and on the streets of downtown San Francisco. For many activists, Sauter reports, "worthwhile activism is performed on the streets, where the activist puts [her/himself] in physical and legal peril to support [their] ideals" (6). Marcus's efforts provide a decisive illustration of the continuing existence of grassroots political and social engagement in the digital age, and offer a counterargument for the "'slacktivist' critique" of digital, non-physical forms of activism (Sauter 5). He goes into the city to distribute copies of the OS to people he has "heard [are] willing to burn sixty of their own and hand them out to their friends" (Doctorow, *Little Brother* 97). This is how the revolution begins. Soon, he starts hearing stories of the Xnet, a nickname for the ParanoidXbox network, which has been "sneakernetted and copied all the way to Oakland in the space of two weeks" (97).

Operating under the new handle M1k3y, he uses the Xnet to conduct all future online communications, in private chat rooms and on message boards, and to "set up a fake email address through the Pirate Party, a Swedish political party that hated Internet surveillance and promised to keep their mail accounts a secret from everyone, even the cops" (Doctorow, *Little Brother* 96). The uninhibited computing such technology provides aligns with David Sheridan, Jim Ridolfo, and Anthony J. Michel's conception of a "multimodal public sphere" that "is contingent upon nonspecialist citizens having access to an array of cultural and material resources, including technologies, knowledge bases, and skill sets" (807). Xnet users post and repost tidbits and how-to's of hacktivism and culture jamming. One user posts "a link to an Electronic Frontier Foundation white paper on the ways… [contactless transit cards] could be used to track people" (Doctorow, *Little Brother* 96). Even Marcus shares his seemingly endless fount of knowledge in the Xnet's wiki-style

spaces to help others "troubleshoot their Xnet configurations and connections" (96). Mimno echoes this point, suggesting that, for digital humanities projects, "Collaboration between experts will become the model for the near future"—a model that is guided by "enough common language for people to work together, and enough social engineering to make connections happen." In fact, the comparison to Wikipedia (and other wikis) is a good one: the Xnet delivers on all of Sheridan, Ridolfo, and Michel's prerequisites for a multimodal public space powered by open source participation, collaboration, and knowledge sharing. As within real knowledge networks, the Xnet facilitates "a fractional shift in the direction of participation to create remarkable new educational resources." And the interactive "linking together" of these resources "lets [users] tap [their] cognitive surplus" (Shirky). Perhaps, when Doctorow was writing *Little Brother*, Wikipedia's existence as "a collective endeavour, undertaken by thousands, sprawling and brawling, and conducted without deference to individual authority" served as a tentative model for the Xnet (Doctorow, "Why Philip Roth").

In his first blog post on his Xnet site Open Revolt, channeling Bill Schneier, Marcus declares that "[t]he important thing about security systems isn't how they work, it's how they fail" (Doctorow, *Little Brother* 127). This inaugural call to arms puts him in line with "activist technologists" who are directly involved in "reconfiguring the infrastructure itself… in a society where all aspects of expression and interaction are pervasively mediated by extensive computing networks" (Lievrouw 117). The blogging format operates as another kind of "recursive public"—"a space of opinion and discussion that is radically open to the voices of massive numbers of people" (Kelty 304)—and as platform that actively supports Coleman's notion of democratic and decentralized e-citizenship. One of

the first jamming events is dubbed "Operation False Positive," in which Xnetters all over San Francisco overwhelm the DHS's indiscriminate terrorist surveillance systems and throw the city into chaos. Like the cameras at Chavez High, the DHS is "trying to spot incredibly rare events—a person is a terrorist—with inaccurate systems" (129). The jamming of its surveillance systems—which stops people from using ATMs, entering certain buildings, etc., and which costs the city millions—works by marking everyone as a terrorist and overloading its sensors. Naturally, this results in a general consensus that "the DHS [has] gone haywire, blaming it all on the fake-ass 'security' that was supposed to be protecting us from terrorism" (132). In a rhetorical sense, these forms of hacktivism underscore the stake digital natives have in shaping "the public agenda in the digital age" (Palfrey and Gasser 264). Digital technologies have allowed young people to become "active users and participants in public conversations" (264). They often utilize "the new media environment" (which contributes to the erosion of conventional information and power hierarchies) as a set of tools for sociopolitical activism, and to voice "observations, experiences and concerns" outside and beyond mass media infrastructures and traditional civic discourse networks (264). Lievrouw makes a similar observation, suggesting that within the "fundamentally constructive and interactive" framework of digital new media, "Participation… makes people 'active agents in the process of meaning-making'" (14). Furthermore, she argues, "'Interactive' new media offer more opportunities for communicative action, and interaction, than do most traditional mass media formats, and thus more opportunities for participation" (15).

At length, however, DHS spies manage to infiltrate the Xnet, forcing Marcus to host a web of trust key signing party. One of the most powerful weapons Marcus has against such

incursions is a collaborative, open source commons built on trust and participation. In the digital sphere, such a commons stands in contradistinction to the closed proprietary systems of authority and commercial interests that have flooded its spaces. The Xnet, to borrow from Fitzpatrick, is structured as a bulwark against "the dominant, often exclusionary ideological structures of the Internet" (*Planned Obsolescence* 36) by positioning "'trust… [as] the currency of the participation age'" (37). Marcus's digital grassroots movement, predicated upon the "recombination, networked architecture, ubiquity, and interactivity" that "make new media new" (Lievrouw 15), generates participation through trust and cooperation.

Channeling father of cryptography Alan Turing, Marcus explains that a web of trust is a type of cryptography that provides "a nearly foolproof way to make sure that you could talk to the people you trusted, but that no one else could listen in" (Doctorow, *Little Brother* 149). Public key cryptography is defined as an

> encryption method that uses a two-part key: a public key and a private key. To send an encrypted message to someone, you use the recipient's public key, which can be sent to you via regular e-mail or made available on any public Web site or venue. To decrypt the message, the recipient uses the private key, which he or she keeps secret. ("web of trust")

In a web of trust, this two-way, two-part exchange of keys is extended to a group of trustworthy individuals. Marcus uses the analogy of a phonebook, in which individuals who trust one another share phone numbers that are by extension also trusted. This, he says, is a form of "'transitive trust'—trust that moves across the web of our relationships" (Doctorow, *Little Brother* 153). He also compares the web of trust to the concept of

keyrings. A keyring in this context is

> a list of keys that I've signed with my private key… I hand you my keyring and provided that you trust me to have actually met and verified all the keys on it, you can take it and add it to your keyring. Now, you meet someone else and you hand the whole ring to him. Bigger and bigger the ring grows, and provided that you trust the next guy in the chain, and he trusts the next guy in his chain and so on, you're pretty secure. (153-54)

To this end, Marcus and his friend Jolu organize a key signing party to meet with potential web of trust associates. During the party, in which everyone trades keys, he gives a speech that lays bare the sociopolitical agenda of Doctorow's tale. "'It's no coincidence that the Xnet was created right after the DHS took over the city. The people who did that are an organization devoted to personal liberty, who created the network to keep us safe from DHS spooks and enforcers'" (162). And although the Xnet is no longer "'pure,'" infiltrated by DHS agents who attempt to use "'social engineering hacks'" to fish for Xnet users' identities and locations (such as by posting electronic questionnaires from fake profiles), key signing will ensure "'a network within a network'" that blocks such invasions (162). "It's the last open communications network in America," Marcus proclaims later; and the web of trust will guarantee that it remains "the last way to communicate without being snooped on by the DHS" (164).

A great deal of this digital civil disobedience manifests itself as a generational conflict, as Xnetters—the majority of whom are teenagers—and hipster stores popularize the "DON'T TRUST ANYONE OVER 25" meme in a clear echo of 1960s countercultural

movements in the U.S.[34] (Doctorow, *Little Brother* 174). We might recall the digital native/digital immigrant divide in Vinge's novel, here. Youth has always been at odds with adult authority and the hacktivism of the Xnet collective is mischaracterized and/or feared by the DHS, parents, and news agencies alike. In the novel, Al Jazeera—which labels the event a "youth riot" and the Xnet "a network used by students and Al Qaeda sympathizers" (205)—reports on a peaceful demonstration by Xnetters in Dolores Park that was violently dispersed by police with pepper spray gas. But for Marcus's father, the police are not the enemy, and those who use the Xnet to simply play networked computer games are "'providing cover for people who plan on attacking and destroying this country'" (206). From this media-distorted perspective, it is easy to conflate the media line on the Xnet with the terrorists responsible for bombing the Oakland-Bay Bridge and BART system and killing thousands of people. Paul Taylor has written extensively on this subject, exploring "how perceptions of hacking have been heavily distorted by the effects of the media and the various social actors who have actively sought to promote negative ethical interpretations of the activity" (59). On the contrary, Marcus's collective is committed to showing that "universal surveillance is more dangerous than terrorism" (Doctorow, *Little Brother* 210). The Xnet is a force for good, even as its members' culture jamming begins to get out of hand and the risk of arrest grows.

One such benefit of the Xnet is, as mentioned, its collaborative, open source

[34] This slogan is an adaptation of "Don't Trust Anyone Over 30," a phrase uttered in the mid-1960s by UC Berkeley student Jack Weinberg during an interview with the *San Francisco Chronicle*. In the decade of the Civil Rights movement, protests against the Vietnam War, and the explosion of free love, the slogan seemed tailor-made for a generation's rejection of American sociocultural norms established in the years following World War II (Sarwate). Interestingly enough, Becky Sarwate uses language of the digital age to describe the history of the slogan, further fusing the period with Doctorow's narrative of rebellion: "In an era when the phrase 'going viral' had yet to be invented, Weinberg's legendary soundbite quickly became the unofficial motto of 1960s youth culture, a warning against placing faith in those with a vested interest in the status quo and the reproduction of dominant ideology."

framework that encourages users to exercise their right to free speech and peaceful assembly as specified in the First Amendment of the U.S. Constitution.[35] Although the DHS and other institutions work to curtail the rights provided under this law, the Xnet still exists as an outlet for activism and defense against tyranny. Enfranchised by the participatory nature of the medium, participants wield its digital tools to create, collaborate, remix and remediate their dissent in local or "little narrative[s]… of imaginative invention" that challenge the grand narratives of existing power structures (Lyotard 60). The Xnet is particularly well suited to this task because, through its interactivity, the network facilitates "the process of social/political change" by "support[ing] or provid[ing] conditions for *participation*" that define "alternative and activist new media" (Lievrouw 13).

The digital's singular features of non-linearity, multimodality and capabilities of remediation are facets of "hypermediacy," which, as Bolter and Grusin argue, accounts for and makes visible the medium's "multiple acts of representation" (33). In this environment, digital natives are creators in the fullest sense—"When they post video, when they make and share music, when they post and point to news, when they tag and bookmark stories on the Web, and when they make or ply new networks" (Palfrey and Gasser 115). Often satirical and socially conscious in nature, their creations constitute "a new art form, a type of digital collage called the 'remix'" or "'mash-up'" (115). Digital remixes—works that repurpose existing artifacts to make something entirely new—allow their creators to "interact with cultural objects in a way that affects how cultures develop and are

[35] The language of the First Amendment is well known, but I am including it here for clarity: "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the government for a redress of grievances" (U.S. Const. amend. I).

understood" (115). Lievrouw conceives of the phenomenon as "'remix culture,'" which, like its modernist antecedent Dadaism, features "sampling, fragmentation, juxtaposition, and recombination" of disparate and diverse media in digital environments (29). Both of these formulations closely follow Bolter and Grusin's concept of remediation as "*the mediation of mediation*" (55), where the ideas, concepts, theories and signs produced by traditional media (which have likely also been remediated from previous media forms) are repackaged and repurposed through new digital media. One example of a digital remix is the Internet meme. For Limor Shifman, digital memes form "a fundamental part of what participants experience as the digital sphere" (19). Constituted by the twin elements of "*mimicry* and *remix*" (20), digital memes are elastic in their ability to be endlessly replicated "by various means of repackaging or imitation" (emphasis removed) (19), and through linking and reposting. The rapid circulation of these cultural phenomena in the public consciousness is often described as a form of electronic virality.

Marcus encounters an example of this kind of reflexive composition in an email. An Xnet user recently posted a video of DHS agents "being really crazy… disassembling a baby's stroller after a bomb-sniffing dog had shown an interest in it" (Doctorow, *Little Brother* 224). The video went viral, downloaded many times over. And because the video was uploaded to the Internet Archive's Alexandria mirror in Egypt (which, unlike the U.S. archive, will still host anything), the work is hosted "for free… under the Creative Commons license, which let anyone remix it and share it" (225). Doctorow is passionate about Creative Commons, which, according to its About page, is committed to "realizing the full potential of the Internet—universal access to research and education, full participation in culture—to drive a new era of development, growth, and productivity." Given the rhetorical

agenda of *Little Brother*, it stands to reason that both Marcus and Doctorow should gravitate toward an intellectual licensing policy like Creative Commons that "develops, supports, and stewards legal and technical infrastructure that maximizes digital creativity, sharing, and innovation" ("About"). In the narrative, the Xnet functions as the representation of a digital epistemology similar to Kelty's "recursive public" (304), in dialogue with the Creative Commons doctrine.

Conclusion

At its center, *Little Brother* is a novel about the age-old ideological battle between privacy and security, grappling with the social contract laid out by Hobbes, Jean-Jacques Rousseau and other political theorists over the last 500 years. In the digital age, however, this battle is waged as a contest for data supremacy through the mediated channels of cyberspace. The idea of cyberspace existed in the 1980s as "a metaphor for the global information network, but in the decade that followed, it made a material difference in technology and culture, and in the perceived relation between the two" (Jones 18). What this means is that, in contemporary networked societies, the social, political, and judicial organizing principles of real-world and digital spheres can no longer be considered distinct. They are hybrid—overlapping spaces in which, as Lessig puts it, "'code is law'" (*Code* 5). In a 2013 congressional committee on cybersecurity, Jane Holl Lute (who, interestingly enough, was at the time the Deputy Secretary of the DHS) asserted that the digital "'is woven into the fabric of our daily lives'" and that it "functions as the very endoskeleton of modern life'" (Jones 18). "No longer a place apart (some other 'space'),"

Steven E. Jones argues, the discourses, languages and tools of the digital have become "the infrastructure inside the 'body' of everyday existence" (18-19). In his novel *Spook Country* (2007), Gibson calls this an "everting" process in which cyberspace "[t]urns itself inside out" (22)—a fitting descriptor for Doctorow's narrative of disruptive techno-rebellion.

Of course, the design and application of the code that supports the body of everyday existence is entirely dependent upon the ideology of its coders, who operate as potential gatekeepers of a new social order. In *Code: Version 2.0*, Lessig suggests that code is

> the greatest threat to both liberal and libertarian ideals, as well as their greatest promise. We can build, or architect, or *code* cyberspace to protect values that we believe are fundamental. Or we can build, or architect, or code cyberspace to allow those values to disappear. There is no middle ground. There is no choice that does not include some kind of building. Code is never found; it is only ever made, and only ever made by us. (5)

Code, and the digital technologies that produce it, is the essence of humanity. Although, as Hector Postigo reminds us, code plays a part in "regulating or acting as a surrogate/partner for enforcing legal regimes" (10), it remains an assemblage or taxonomy of our subjective and ethical relationships to the world around us. We no longer move toward, but inhabit cyberspace, just as it inhabits us. "[W]e made it, or at least we contribute our own data to it daily," Jones argues (19), and, whether we know it or not, that data—our collective hopes, dreams, and fears—is the sum of its parts.

As such, as I have argued, digital technologies can be used as tools for both activist causes and in the accumulation and concentration of power. Orwell's *Nineteen Eighty-Four* situates technology as a purely "repressive State apparatus," to employ Louis Althusser's

term (139), that fuels state control and authority. Through Marcus's campaign of hacktivism and the collaborative, creative discourses of the Xnet, however, the digital is used to empower and grant citizenship to individuals who have previously (in traditional media and political environments, at least) remained voiceless. Despite the increasingly privatized nature of the Internet that blocks out public spaces for free speech (Sauter 3), Marcus successfully implements through the Xnet a form of digital political protest that carves out space for the work of protest. In this way, the Xnet is a fertile and performative "digital public sphere, inviting arguments that are more diverse, multifaceted, and participatory" than the traditional, partisan mass media that serve the DHS's political agenda (Zuckerman, Foreword xiii). Where participants of the digital public sphere—including Xnetters—are vulnerable, however, "is not [in their] exclusion but [their] invisibility" (xiii). Following Herbert Simon, Zuckerman suggests that this occurs when "a surplus of information leads to a surfeit of inattention," effectively creating an open but noisy commons in which not everyone can or will be heard (xiii).

In this chapter, I have tried to sketch out the contingent relationship between emergent digital technologies, digital natives, and traditional forms of social and political activism. Marcus and his friends, as victims of institutional surveillance, illegal detainment, and invasions of privacy, use digital tools for direct action against institutions and agencies that limit their freedoms. At the same time, they must remain sensitive to the "general social climate of fear and vulnerability that has accompanied the advent of advanced communication networks" (Jordan and Taylor 3), and which has increased in the wake of terrorist events and (thanks to the ubiquity of digital information) contemporary discourses about terrorism. Thus, the Xnet collective carries out its hacktivism in line with

Jordan and Taylor: "as a form of *virtual politics* that seeks to adapt its mode of dissent to the reality of these complex networks, which it re-imagines as webs to be traversed in a proactive rather than reactive manner" (3).

I also discussed a few of the discourses that play into this ethics of hacktivism, particularly the element of play as integral to the identity formation of digital cultures, and—through a register of shared beliefs, ideals, and conventions—the Xnet's existence as a vibrant and interconnected commons, or "recursive public" (Kelty 304). We already know that the Internet "acts as a vital arena of communication, self-expression, and interpersonal organizing" (Sauter 2), even as and often in spite of the fact that its "overwhelmingly privatized nature… is a challenge to the practice of activism online" (3). The rhetorics of play and gaming hold a special place in digital cultures, nurturing many of the different skills integral to hacktivist and digital humanities projects. Marcus and his friends thrive in ludic communities that promote a multimodal roster of digital, physical, creative, collaborative, and social activities and challenges. Harajuku Fun Madness, the Alternate Reality Game that brings them together, is all about building a networked and interactive transmedia narrative—"the aggregate effect of multiple texts/media artifacts" (Watson)—that encourages social, compositional, and technical skills. It shares with the digital humanities what Patrik Svensson identifies as a "multimodal" framework that binds "scholarly tools, databases, networked writing and peer-to-peer commentary" across real-world and digital environments "while also leveraging the potential of the visual and aural media that are part of contemporary life." As in digital humanities scholarship and education, through the vital act of participation, players learn how to "ask humanistic questions and think critically about the past using digital tools"—an outcome that, notes

Mimno, "may look much more like traditional scholarly education than we expect." Moreover, Marcus's clever utilization of the MMORPG platform as a space for virtual activism brings this notion full circle—where the strands of hacktivism, creativity, self-expression, community, and education are tied together.

The terror event and systematic oppression wrought by the DHS on San Francisco and Marcus in particular act as galvanizing moments for the narrative—moments in which Marcus is transformed from socially conscious technology hobbyist to the hacktivist leader of a techno-rebellion. Doctorow uses the terrorist event to explore how many of the civil liberties we take for granted in the U.S.—both digital and concrete—have been abridged or contravened for national security reasons in the years since 9/11. In its capacity as allegory (masquerading as speculative fiction, like all the other fictions in this project), the novel reads as a how-to manual for resisting digital strictures, surveillance and proprietary controls by turning digital technologies—through interactive acts of participation and trust—into tools for political and social activism. Doctorow is unreserved in his support for digital privacy, open source technologies and digital copyright reform. One of the best real-world examples of his philosophy is surely the fact that he makes all his writing available for free under the Creative Commons license. This is hardly surprising from a writer who, as Ed Park notes in his *New York Times* review of *Little Brother*, "'believe[s] that we live in an era where anything that can be expressed as bits will be.'" And like data, political and commercial interests will never be able to appropriate or regulate the transmissible, endlessly reproducible flow of ideas entirely.

Conclusion

Throughout this project, I have tried to make a case for science fiction that focuses on the human relationship with digital technologies as being, more than any other mode of writing, singularly attuned to contemporary digital humanities discourses and practices. As cultural artifacts, the relevance and usefulness of such texts in today's increasingly digital world should not be underestimated. Indeed, Lisa Swanstrom argues, "in all its diverse manifestations," science fiction "enjoys an intimate relationship with technology." The respective "histories of science fiction and technological development are not only coextensive; they are… wholly entwined" (113).

In Cadigan's *Synners*, Powers' *Galatea 2.2*, Vinge's *Rainbows End*, and Doctorow's *Little Brother*, there is a shared engagement with what Richard Utz calls "interdisciplinary humanistic perspectives in an increasingly technological world" (17)—a human-oriented architecture of digital rhetorics, modalities and media. Beginning with the rise of cyberpunk fiction in the 1980s and early nineties, these novels (among many others) have been "essential for making sense of the cultural and technological evolution of digitization" (Swanstrom 113). They have contributed, whether explicitly or implicitly, to the ongoing development of popular cultural and community-produced narratives about the digital by providing us with the opportunity to acclimate to and navigate its innumerable configurations. Swanstrom even goes so far as to argue that "the evolution of digital culture is so tied to the history of cyberpunk" and its descendants that without them, "the digital

humanities as a discipline would not exist in its current form" (113). If we are to judge the fields of science fiction and digital humanities as intersectional and, in many instances, confluent, we must recognize in the root of their epistemologies an anticipation of new, real-world ontologies. In light of this, I have attempted to show that science fiction about the digital is, or at least should be, considered part of the literary expression of digital humanities.

The four novels, each of which exists as time-specific cultural artifact and snapshot of its particular moment in the evolution of the digital age, are (despite being traditional print-based works) digital humanities texts. They are part of a diverse array of practices and discourses that, along with the many diverse fields of inquiry contained in the digital humanities, are integrated in the cultural and technical history of computer networks. Just as "there is no [single] history of computers, but multiple histories of computer technologies, components, and practices" (Parikka 249), the texts operate as speculative media assemblages that both record and stimulate the cultural collaborative construction of a digital humanities that must, by necessity, respond to the burgeoning digitization of humanity. As speculative fictions that function as allegories of the digital age, they move into and occupy the schisms in the continuity of consciousness caused by technological innovation. In this sense, we should see the texts as fragments of the same postmodern impulses that attempt to make sense of and/or are produced by a "radical break" with the grand narratives of "a dominant culture and aesthetic" and its "socioeconomic organization" (Jameson, Foreword vii). As the matrices of technology continue to grow, spread, and evolve, science fiction functions as both a "literature of change" and an agent of change (Pohl 11, 15)—an ontological narrative rejoinder to the "crisis of narratives"

(Lyotard xxiii) that continues to signify "the electric drama… [of] new environments created by electronic informational media" (McLuhan and Fiore 9).

This is borne out in the novels, and in science fiction writing in general, through a formal and aesthetic structuration that bridges the humanities and the sciences. Not surprisingly, science fiction and digital humanities scholarship have found a natural home at technology-focused institutions like the Georgia Institute of Technology, where scholars and teachers work across disciplines "to solve twenty-first century problems by innovating at the intersection of science, technology, and the arts" (Yaszek, "Amazing Stories" 53). The hybrid, transformative, and inclusive nature of these fields—a nebula of disparate, dialogic, and overlapping ideas—allows them to be what Yaszek identifies as inherent in science fiction: "a truly global language that allows people to communicate their experiences with science and technology across centuries, continents, and cultures" (53). This is a universal narrative, then—one that transcends specific organizing structures, systems, and historical contexts. In the digital age (perhaps more than ever before, since the stakes for humanity are so high in the face of rapid digitization), "We shape our culture and it shapes us, and the struggle for an artistic voice is part of the struggle to be seen as fully human." The novels in this study are populated with characters mired in the fantasies, nightmares, amputations, extensions, and fragmentations of the technoscape; but they are nevertheless connected in this simple human desire.

Lyotard has suggested that the articulation of science, although it has "always been in conflict with narratives," necessitates the production of "a discourse of legitimation with respect to its own status, a discourse called philosophy" (xxiii). Science, including digital technologies, needs a way to account for itself in human terms. I suggest that science fiction

and the digital humanities, bucking Snow's two cultures dialectic, are contemporary iterations of this philosophy. If science is predicated upon agency, connection, and reflexivity, we find its creative, ideological, and scholarly analogues in these discourses. They are built on dialogic relationships that cut across and fill the spectrum—Julia Flanders calls this the "information nebula"—of human culture and consciousness. After all, as Reid writes, "relation powers agency" ("Network Exposure").

Collectively, the novels by Cadigan, Powers, Vinge, and Doctorow point in literary terms toward a multivalent, multimodal humanities that is enhanced, not diminished or eclipsed, by digital tools and platforms. Digital humanities work has at times been criticized for being too data-oriented and neglectful of the humanistic side of inquiry.[36] As "[t]he next big idea in language, history, and the arts… [is] data," reports Patricia Cohen, the humanities is transitioning to a "'methodological moment'" that utilizes computer processing power to quantify the humanities. The danger is in losing the sense that, as Anthony Grafton reminds us, "'So much of humanistic scholarship is about interpretation… It's easy to forget the digital media are means not ends'" (quoted in Cohen). These fictional narratives, which are contingent upon the humanistic relationship with digital technologies, work to repatriate the human perspective as a core strength at the center of such research and pedagogy. In my analysis of the novels, I was able to identify a shared

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[36] See, for example, Helle Porsdam's essay "Too Much 'Digital', Not Enough 'Humanities'?" The idea that traditional humanities are being eclipsed by digital tools, Porsdam argues, began during the "discursive shift" from a traditional humanities "led or… modified by the technological/digital" (as in the first-wave) to a mode in which digital "visions and… initiatives come from *within* the humanities." As the digital becomes increasingly central to—and an indivisible part of—traditional humanities practices, however, "we are no longer talking about processing and statistically analyzing large collections of text, but rather about the changes that digital technologies are producing or generating across the many fields of humanist inquiry" (5). This may be a hard pill for many humanities scholars to swallow.

underlying goal of humanistic empowerment (and concern for disempowerment) in the digital age that real-world digital humanities practitioners continue stress the need for in and across their fields. It is the kind of empowerment that, as Flanders notes, places actors and audiences "*inside* the process, *inside* the tools, as they mediate between us and field[s] we are seeking to grasp."

In the preceding chapters, I have identified various aspects of the novels that typify or suggest new directions for the digital humanities. By bringing them together in this way, I have tried to highlight depictions of doing digital humanities in science fiction as a fertile and dialogic array of intersecting and symbiotic practices. Cadigan's *Synners* deals with some of the earliest concerns in digital humanities discourses, including the posthuman relationship between technology and the body, commercial production, synthesis, and consumption of knowledge data, and the nature/role of art in the digital age. Set against the frenetic backdrop of a digitally saturated Los Angeles, the book resists the idea that the work of digital humanities "speaks outside of time, space, and the physicality of the human body" (Schnapp and Presner 5). In Powers' *Galatea 2.2*, Rick and his friend Dr. Philip Lentz collaborate on an academic artificial intelligence project that bridges computer science, neuroscience, English language and literature. This hybrid form of scholarship is called "connectionism" and, as I suggested, is one of the first comprehensive representations of digital humanities work in literature. Arriving shortly after the activation of the hyperlinked World Wide Web, Powers' work fits with Fitzpatrick's 2010 conception of digital humanities as "'a nexus of fields within which scholars use computing technologies to investigate the kinds of questions that are traditional to the humanities, or… ask traditional kinds of humanities-oriented questions about computing technologies'"

("Humanities" 12). Digital methods in education and library-based knowledge preservation form the basis of Vinge's *Rainbows End*. Like *Galatea 2.2*, the novel wrestles with the rough transition from traditional to digital humanities in its generational dialectic of born digital high school kids (Juan Orozco and Miri Gu) and a group of old, white male traditionalists that call themselves the Elder Cabal (Robert Gu, Winston Blount, and others). Vinge paints a vivid portrait of the future of composition pedagogy, learning methodologies, and the virtualization of knowledge, emphasizing contemporary digital humanities' inclination toward collaborative "design, multimediality, and the experiential" that "expand the compass of [its] affective range" (Schnapp and Presner 5). Doctorow's *Little Brother* explores the civil rights and liberties of the American citizen in a post-9/11 digital age, touching on some of the most important debates in the digital humanities. On one hand, digital technologies liberate and connect Marcus Yallow and his friends in democratic, politically active (hacktivist) networks that favor "[o]penness, freedom, and meritocracy" (Stryker 87). Hacktivist culture has thrived through the "computer technology [that has] leveled the playing field and enabled [hacktivists] to achieve a sense of social equality within the virtual world" (87). On the other, however, the same technologies can be exploited for government/commercial surveillance or seizure, and severely delimited by proprietary software and digital rights management. Macus's efforts to oppose these can be read as an example of what Postigo calls "technological resistance"—"a strategy wherein users/hackers design and deploy politically motivated technologies that challenge… technological enforcement" (12) and the "stringent laws and technological measures that lock up access to the 'cultural commons'" (5).

So what do these texts suggest about the future of digital humanities scholarship and pedagogy? What do they teach us as readers and as human beings? Without question, no popular artistic medium is more invested in helping us come to terms with the digital present, and in orienting us toward a digital future. Indeed, science fiction is primed for one such aspect of this future: that of big mechanism, the next step in the evolution of digital information. According to DARPA, the Department of Defense agency at the forefront of big mechanism research, complex systems contain "many parts and processes, but they are studied piecewise, and their literatures and data are fragmented, distributed and inconsistent." Big mechanism offers researchers an opportunity to draw these fragmentary datasets together into "large, explanatory models." Future work in digital humanities will have to account for this shift, in new and hybrid literacies and literary forms, and the sprawling systems that fill science fiction[37] will, once again, provide a humanistic roadmap.

As the divisions between human expression/practices and digital media grow smaller, and data becomes more tightly integrated within large systems, heuristic methodologies that mitigate tensions between quantitative and qualitative interpretation are becoming increasingly urgent in the humanities and elsewhere. Our tools should always only be the sum of human design; but their power should be leveraged if it means they can bring us closer to an understanding of ourselves. Science fiction gives us a forward-looking narrative for this challenge, which, it turns out, is a decidedly human one. I agree with Delany that science fiction—being a literature of immense educational and cultural value—can be utilized as "a tool to help you think" (35). It is an assertion that

[37] See, for example, the precrime system of the 2002 Steven Spielberg film *Minority Report*, which combines vast quantities of data from many different sources and actors into a single touchscreen interface to determine (in the qualitative sense) a person's culpability *before* they have committed any illegal activity. The film is a loose adaptation of Philip K Dick's short story "The Minority Report" (1956).

continues to resonate far into the digital age, expanding to include all of the rich portrayals of digital creativity, synthesis, collaboration, multimodality, heuristic discovery, and remediation that define science fiction's interface with digital humanities.

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