

**The Cry of the Machine: Sonic Technology, Postmodern Fiction, and the Analog
Humanities**

by

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Abstract

This dissertation analyzes postmodern fiction in terms of the analog technologies that defined the mid-twentieth century. It argues for a mode of reading that attends to the paralinguistic artifacts that subtend linguistic meaning, connecting texts to both biological and technological history. It develops an analogical method that merges semiotics, sound studies, and complexity theory in order to perform readings of two postmodern texts: J. G. Ballard's "The Voices of Time" and Thomas Pynchon's *The Crying of Lot 49*. In chapter one I argue that analogical processes set the limit for what can even be considered experience, in the form of circuits that balance the conscious and the subliminal. I show, using paradigms explicated by Gregory Bateson and Charles Sanders Peirce, that technology is a crucial part of mediating the boundaries between knowledge and intuition. Technology intervenes in human action prior to the codifications of symbolism and convention, and restores the animal grace to human life by reminding us of the continuities of bodily substrata that furnish experience. In chapter two, "The Unseen Powers," I show that symbolically-focused criticism of J. G. Ballard's "The Voice of Time," a central text in the history of postmodern science fiction, has missed the analogical diagram within the text, and I argue that this diagram points us to a consideration of how technology mediates power, entropy, and human progress. I show how the moment of improvised radiological saturation in the story's climax mirrors the discovery of sonic saturation that changed the course of music history. I read these two phenomena through each other to argue that the exacerbation of sensation that they both represent indicates a primordial capacity for living beings to grow into semiotically unintelligible conditions by relying on the basic sense of hearing analog icons. In chapter three, "Filthy Machines," I read Pynchon's *Crying of Lot 49* as an analog of early delay machines to show how information that is caught in feedback loops can not only become life-like, it can become part of the indeterminate nature of life, hybridizing it. At the same time, the indeterminacy is filtered and formed by mechanisms that remember. I argue

that, while there is no solution to the mysteries of the text, there is the possibility of being drawn into the same circuit as its mysterious entities, which is its own solution. Moreover, I show a potential historical source for Pynchon's engagement with sonic technology, the San Francisco Tape Music Center, a connection that both substantiates the sonic reading of *Lot 49* and shows the relevance of the concepts of aleatoric sequencing and feedback within his work. To conclude, I connect the consideration of analog techniques in literature and music to a wider social, cultural, and historical context that includes the competing semiotic paradigm of poststructuralism. I explain the historical benefits that digitalism represents for the advancement of Western modernity. Finally, I offer Robert Johnson and H. P. Lovecraft as examples of artists that deploy techniques that contradict the digitalist trend of modernity, and use Bruno Latour's theory of hybrids to show how the subsequent forms of science fiction and rock music produce and maintain postmodern subjectivity.

Chapter 1 Introduction

Listen to
The sound of my life
My machines
Sing songs for you to live for

—Battles and Gary Numan, “My Machines”

This dissertation explores analogical signs in postmodern literature, and how they connect to the history of sonic technology. It attends to the crosstalk between literary and sonic cultures that is the product of their shared technological context, the development of the transistor. I use the phrase “transistor generation” to describe the historical moment following the development of the transistor in the early nineteen-sixties; a moment that, I argue, is characterized by an expansion of analogical techniques and perspectives. The transistor generation offers a view of a path only partially followed: while the techniques of the mid-twentieth century persist in contemporary subcultures, the cultural dominant of the twenty first century is decidedly digital. Materially, our century became digital through the miniaturization of transistors, a process described by Moore’s law. But before transistors populated computers by the millions, when they were employed only by the dozens, they were not computing but analogizing—amplifying and synthesizing signals. Thus, the transistor generation offers a critical counterpoint to the obligatory digitalism of our own moment, and of Western culture generally, and the way we have retrospectively historicized works that depend deeply upon an analog context, namely American postmodern literature and science fiction’s new wave. I read Thomas Pynchon’s *The Crying of Lot 49* and J. G Ballard’s “The Voice of Time” (examples of postmodern fiction and new wave SF respectively) to show how they derive their logic not from the binarisms of

incipient digitalism but from analogical techniques like modularity, saturation, and feedback, and disintegration. Here I show how underlying analogical forms of meaning are central to all language, but especially to the literatures born out of a time when analog electronics permeated the texture of everyday life.

The pretext for this examination is that the analog dimension of language has long gone under-examined with regard to literature, due at least in part to the West's historical bias toward the structuring binarisms that cleave nature from culture, body from mind, and representation from object. These binarisms share a reliance on what we will call digital representation, which is to say that they fundamentally depend on radical discontinuity. The discontinuity of digits, their quantifiable and abstract difference, is the root of digital semiosis, and the feature that allows for so many of the phenomena we take for granted: math, writing, computation, and economy. The digital is no small thing, and as such it makes sense that linguistics and criticism have prioritized the putative discontinuity between representation and reality. Ferdinand de Saussure's *Course in General Linguistics* codified this discontinuity, positing that language consists of the binary of signifieds and signifiers while also limiting linguistic inquiry to only the structural transformations of the latter. Saussure's semiology is powerful with regard to the texts of culture. But power is in part the problem with discontinuity as an analytical tool. Jesper Hoffmeyer argues that a bias toward the digital, or "digitalism," is inextricable from the Western industrial enterprise since it allows for the acceleration and predominance of plan over articulation. For Hoffmeyer and other biosemioticians, who are part of the Peircian analytical tradition that I employ here, the digital exists as one, albeit powerful, mode of communication among several. In the biosemiotic paradigm, living beings are the products of a universe of semiotic abundance: life, from its most basic to its most complex forms, is necessarily made up of communication. Enzymes communicate with cells, wasps communicate with orchids. But not all of these communicates are of the digital variety. In the context of biology, digital signals are powerful, but also highly limited for mediating feeling, preference, novelty, other-reference, and navigation, which are better expressed using analog signs. So this dissertation is an experiment in using a semiotic paradigm that accommodates the analog for the purposes of literary thinking. Moreover this critical decision was guided by the subjects of my reading, J. G. Ballard and Thomas Pynchon, whose works rely on animal and machine paracommunication, evading digital theorization and challenging binaristic linguistics.

What does sonics have to do with analog semiosis and postmodern literature? Years ago, being a sound practitioner and interested in the history of technology, I made up a timeline of technological changes, recordings, and novels that might comment on the subjectivity of the moment. I found that the 1960s, in music, fiction, science, and philosophy, was observably concerned with entropy. This much was not news: it is common knowledge that advances in information science had a profound effect on the human sciences of this period, and that these advances were coupled with avant-garde experiments in the arts of the moment.¹ But what became even more clear to me than a theoretical indebtedness to entropy was their shared technological texture. The 1960s is a fascinating decade in technological history because of the way it condenses military research into consumer goods. The sudden ubiquity of the vacuum tube and the transistor can be seen from every angle of mid-century history, from the transistor radio to the first commercially available music synthesizer. Historically, the democratized technologies of this decade were predominantly analogical, since fundamental issues of miniaturization and cooling still stood in the way of making digital technology available to the masses. Analog electronics are extremely suited to the purposes of audio and visual applications, so even though the personal computer would take many years yet, there was no dearth in circuits for making and modifying sound. This abundance of new sonic technologies is unavoidable when we look at the avant-garde in both music and fiction. Comparing the work of experimental composers like Terry Riley, Karlheinz Stockhausen, Sun Ra, and Morton Subotnick with early postmodern writers like William S. Burroughs, Thomas Pynchon, and J. G. Ballard, it is clear that they were all deeply engaged with analogical technics and techniques.

Critical reception seems to pass over this teeming period of analog experimentalism in favor of its more mature incarnation. Brian McHale and Len Platt write, “Probably few would dissent from the proposition that the period between the early seventies and the late eighties represents the peak phase of postmodernist culture” (8). Importantly, the technological landscape of the seventies and eighties are quite different from the sixties, seeing the rise of democratized computing, digital networks, and cable television, making early and “peak” postmodernisms rooted in different material conditions. But conversations about technology and postmodern literature lean toward their digital dynamics, privileging cyberpunk subjectivity rather than

¹ See Colin Greenland’s *The Entropy Exhibition* (1983).

earlier representations of tape, synthesis, and amplification: “cyberpunk left an indelible mark not only on science fiction but on popular culture generally, and even, beginning in the early 1990s, on the design of the Internet, whose engineers were manifestly influenced by Gibson’s imagination of cyberspace (a word that he coined)” (McHale 183). The focus on how postmodern literature leads to the internet signifies a gap in criticism where it concerns the form’s early analog years. So, rather than beginning with the computer and moving backward, as many histories of postmodern fiction do, this dissertation begins with analog sound circuits as a point of reference, showing how the early postmodern writers engaged with contemporary technology to represent historical subjectivity.

Other researchers have pointed out the relationship between mid-century musical and literary cultures, but my intervention consists not in the lines of causation from music to literature or vice versa, but the logic that they both evince on account of the technological history that is their context. Casey Rae’s *William S. Burroughs and the Cult of Rock ‘N’ Roll* exemplifies the indeed underappreciated lines of force that literary vision has exerted upon musical history. As Rae notes, Burroughs, an important predecessor of both Pynchon and Ballard, was extremely active in shaping the artistic lives of rock’s most iconic figures, such as David Bowie, Patti Smith, and the Beatles. Others, like Paul Youngquist in *A Pure Solar World* or Jason Heller in *Strange Stars*, have discussed the way that musicians (Sun Ra and Bowie, respectively) have concentrated and literalized science fiction into real cultural practices.² I acknowledge these texts, which elaborate the social intercourse between the mid-century avant-gardism of music and fiction, as essential for a clear historical picture of the period. But I have always wanted another layer of commentary about the period—one that explains the formal innovations that permeate both music and fiction through an examination of the material conditions of the time. Rae writes, “...Burroughs would embrace random elements in almost all of his work, especially his audio experiments, some of which were conducted on tape recorders provided by Paul McCartney in a flat owned by Ringo Starr” (6). The social aspect of Burroughs’ relationship with the Beatles is spectacular enough, but my own analysis begins with the machine: the tape recorder itself. The goal of this essay is to uncover the unique aesthetic, philosophical, and

² Shout out to my fellow Coloradans: Paul and Jason have both been important interlocutors and inspirations about the connection between the musical and the science-fictional. Must be something in the mountain water.

political qualities that were (and are still) fostered by the technological capacities of the nineteen sixties and seventies, and what this means for the criticism of literary works.

How is this to be accomplished methodologically? Alexander Galloway writes, “...as von Neumann and others were building their digital machines, social scientists were constructing their own digital infrastructures. Structuralism and semiotics represent a high-water mark, although the digital paradigm thrived in certain strands of poststructuralism as well” (213). As I have already mentioned, Saussure’s semiology fits into this assessment of the parallel development of digital philosophies. But out of these digital infrastructures came more robust methodologies for analyzing social texts, namely poststructuralism. Galloway writes, “poststructuralism relaxed [structuralist] methods into a more complex mixture of analog and digital elements involving suturing and play, supplement and residue, rupture and accident” (214). Poststructuralism itself accommodates analogical phenomena, but even so it has a hard time escaping the gravitational pull of the digital. Galloway continues, “...by 1992 the notion that *poststructuralism equals digital* was articulated in no uncertain terms by George Landow, who argued that software and personal computing had realized ideas originally developed in French theory” (215). Of course this is not a comment on the methodology’s fitness, nor is it enough to disqualify poststructuralism from conversations about the analog. But this guilt by association does leave something to be desired, particularly since analyses of the postmodern tend to come with a poststructural lean.³ Linda Hutcheon’s *A Poetics of Postmodernism: History, Theory, Fiction* offers an account of the postmodern novel as seen from the perspective of poststructural analysis: acknowledging Allen Thiher’s claim that “Wittgenstein, Heidegger (and Derrida), and Saussure and their ‘critiques of the metaphysics of essence’” had all but destroyed the idea of representation, Hutcheon writes, “I think that what we might find is less a destruction than a productive problematizing of the entire notion of the relation of language to reality—fictive or historical” (141). Indeed, the reflexivity, intertextuality, and irony of postmodern novels seems to perform exactly this “productive problematizing,” of the relation between representation and reality. But in terms of sound, technology, and analog signs, the postmodern works I discuss here also perform a “productive problematizing” of the *disconnection* between reality and representation, positing a radical

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continuity between these concepts. One can take for granted the difficulty inherent in the relation of language to reality, but one cannot take for granted the relation between signal and sense: as Friedrich Kittler writes, “no sense exists—such as philosophy and hermeneutics have always sought between the lines—without physical carriers” (165). And thus, the connection between the postmodern novel and the poststructural interpretation, which has been institutionally sanctioned since the nominal start of either, begins to dwindle when the sonic/mechanical history of a text exerts as much force over its form as does textual play. Such is the case with both Pynchon and Ballard, novelists whose status as postmodern is comfortably solid, but whose texts exceed mere playful questioning of the concept of essence. In both writers, the technics of sound point to another paradigm of reality, not hidden behind signifiers but bursting out of speakers, tape machines, x-ray cannons, amplifiers, synthesizers, radios, and televisions. I argue that this state of affairs, the world of the transistor, returns us to a semiotic paradigm of paralinguistic signaling. This paradigm is cybernetic in that it consists of nonhuman interfaces—machines and animals. To this end, I lean on theorists who acknowledge the parity between nature and culture, particularly Charles Sanders Peirce (whose semiotics supports analogical signs) and his successors, Gregory Bateson, Guy Deleuze, Bruno Latour, and Wendy Wheeler. Which is to say that the pragmatist tradition bears heavily upon this work. While the pragmatists have become a central theoretical resource for this project, so has sound studies in the style of Kodwo Eshun. Eshun’s poetic, technical, and musical adventurousness has served as an inspiration for me ever since I first heard about *More Brilliant than the Sun* (again, thanks to Paul Youngquist). But these two theoretical styles/strains are more sympathetic to one another than may appear initially: pragmatism and sound studies share a commitment to the continuous transformation of signal between resonant media. By analyzing Pynchon and Ballard as/through/with signaling interfaces, I show that the language of postmodern fiction contains a concept of history that is dangerous, indeterminate, wild, but also sympathetic, and deeply human.

It starts with an instrument, an intimation, and a laboratory. I began this line of thinking while working at a music synthesizer company. Because the company was small, I had many roles at different times, including assembly, testing, design, marketing, shipping, cleaning, and demonstrations. Music electronics employ both analog and digital technologies, since both serve important functions in musical applications, and I discovered, in my various roles, the idiosyncrasies and characteristics of each mode. I had just finished my Masters degree in

English, so semiosis was on my mind, but I found myself at a loss when trying to describe either the role of musical instruments in a semiotic chain or the transformations between analog and digital that are implicit in electronic instrument design. The semiotic theory I had learned in college and graduate school had been decidedly structural, emphasizing a dichotomy of signifier and signified that seemed unhelpful in the context of continuous feedback between instrument and player. But, heuristically and tentatively, I began to develop and learn a theory of instruments. I already had experience as a performer and sound designer, but now I felt called upon (both professionally and academically) to explicate the role of the instrument technically and semiotically. My colleague, a gifted software engineer, became an invaluable interlocutor. Together, we would break down instruments into their physical phenomena, create hypotheses for modeling them in the digital domain, or build them in analog to see how they worked in reality. Our experiments and ideas required a great deal of math and physics, but also hunches, preferences, artistic theory, insights from the history of cybernetics and ergonomics, our playlists, tacos, science fiction, dreams, cartoons, and politics. And for what? To make an instrument that feels right somehow, that allows one to feel and manipulate in a complex but intuitive feedback pattern, that is alive and part of life. Later, when I started assembling this project from a pile of transistor-generation artifacts, I was struck by the ubiquity of laboratories in postmodern fiction. The texts that I read here each contain laboratory scenes, as do many others from the transistor generation. Thus, this dissertation is in many ways a lab about labs—what started with hypotheses about the relationship between instrumentation, sense, and subjectivity turned into an analysis of the scenes of experimentation within music and fiction. But there was also a considerable amount of literal lab work: hours distorting sine waves, listening to feedback, and staring at oscilloscopes, in order to find out how basic problems of sonic processing and semiotics *could* work in the historical context of the transistor generation. The results were often wild, messy, and hard to communicate. But they were also worth communicating.

Let's get some definitions out of the way. First, what is analog, what is digital, and how are they different? Alexander Galloway writes,

Analog representation works through continuity or continuous variation, whereas digital representation works through discrete units like letters or integers. At the same time the phrase “an analog of such and such” signifies comparison or

similarity, from the old Greek *analogos* meaning “proportionate.” [...] So digital and analog have a meaning in media and consumer electronics, but understood as synonyms for discrete and continuous they also pertain to long-standing philosophical discussions around similarity, identity, difference, and representation. (212)

Analog signals consist of the qualities of real substrates that continuously move and change, like electricity, sound, or the waves of the ocean. In the same way that pumping water does not require knowing the exact amount of fluid within the pipes, analog electrical circuits operate without concern for exactitude concerning quantity. Thus, in the analog realm, quantities are relative, pragmatic, and transferable across platforms, often as qualities. Consider simple machines that “translate” a quantity from one area to another using pulleys, gears, or levers. The energy or mass of one part of the machine directly and continuously appears as a proportionate representation in another part of the machine, an analog sign. Similarity and compatibility between parts is fundamental to how analog signs function. There is a deceptive simplicity about analog signs, which even practiced thinkers sometimes miss. They are “simple” in that all analog signs are proportional, but this often means that they achieve overwhelming complexity, since *everything matters*, including the proportions of slight or accidental influences.

Digital signs are of a different logical type than analog ones. As Galloway notes, digital signs, like letters and numbers, are not continuous with what they represent. In this most basic sense, digital semiosis is really quite amazing, because it requires a fundamental separation between the world and language.⁴ There are many imaginary explanations for how digital signs evolved, but allow me to add another. One primordial being is attempting to communicate to another of its kind that it requires multiple pieces of material of the same length in order to build a shelter. The second being retrieves multiple pieces of naturally different lengths. The first being has to invent a couple new concepts, the first being “no” and the second being “exact”—it must communicate that the vicissitudes of reality are not good enough for the job, and that only materials of an abstract length are correct. There is some back and forth, and the two entities decide on a rule for how to communicate lengths, in multiples of the length of one of their feet (the foot, probably, of the entity in charge). Thus—almost definitely not exactly like this, but you

⁴ Little wonder then that evolutionary anthropologists have long sought the rubicon of human language, the moment when we evolved the capacity for symbols, since this threshold marks our species’ putative separation from the natural world.

get it—we have the birth of two of digital communication’s greatest virtues, negation and discrete values. With these tools it turns out that you can do this thing called computation, and another thing called writing. Impressive. Digital systems, like modern computers, allow for the manipulation of discrete signs for the purpose of calculating or storing information.

The next thing we need to define are the ways the analog and digital manifest as signs. There are two basic forms of analog signs: icons and indices. An icon is a sign that resembles an object, that shares a defining quality of the object. Feelings, portraits, and models are iconic in their resemblance to the objects they represent. An index is a sign that has been affected by the object, like a weathervane or a highwater mark. Digital semiosis is conducted via symbols, which refer to their object by “by virtue of law.” The law—logic, math, grammar, or lexicon—is essential external to the relationship between subject and object, and regulates how representations function. Symbols are conventional, and rely on the maintenance of codes (Everaert-Desmedt 244).

I draw this trichotomy of signs from Peirce’s semiotics. While he is not alone in acknowledging the importance of analogical signs—many philosophers of language dating to antiquity did the same—his formulation of three signs that have different causal relations to their object differs from Saussurean linguistics, which only applies to symbols. As Nicole Everaert-Desmedt writes, Peirce’s semiotics is general, as “it takes into consideration emotional, practical and intellectual experience; it includes all of the components of semiotics; it broadens the concept of the sign” (241). My analysis of sonic and electromechanical phenomena in and around postmodern literature requires a more general and broad conceptualization of the sign, since it deals directly with the paralinguistic residues that accompany the experience of analog signs. As I will discuss later, the choice to move toward a linguistics that accommodates both the analog and the digital is itself a critique of a predominantly symbolic view of language and human culture.

Analogical processes are particularly misunderstood in the humanities. In contemporary work on technology, the concept of the analog is often characterized as either regressive or facile or both. I recently saw a project that promised to perform digital humanities research using “analog tools,” where the latter are books. As Hoffmeyer points out, prior to the invention of the digital computer, the paradigmatic digital form was books, because they are a vehicle for discrete symbols (78). Thus, the digital humanities project in question used “analog” as a synonym for

technologies that originated prior to the rise of digital electronics, making “digital” a concept endemic only to electronic programming languages. This might seem an isolated case of confused nomenclature, but scholars of technological history have had similar difficulty. David Golumbia, in *The Cultural Logic of Computation*, writes, “There is no mystery here; analog machines are at least as old as digital ones and pose no conceptual obstacles (that they might be arguably a symptom of exactly the computational mania with which this book is concerned)” (22). While Golumbia’s critique of digital logic (which he calls computational) is a defense of the “fuzzy and inexact” aspects of human life that modern technology endangers and represses, he nonetheless treats digital technology as being more “advanced”—requiring more interpretive skill—than analog. In part, this view is justified by the type of complexity that digital technology creates: the arbitrary, dualistic, and hierarchical nature of digital codes lends itself to a mysterious glamor. Recall one of the many scenes in *The Matrix* that depicts someone manipulating or decoding the streams of slime green characters on the screen. These scenes both capture and exacerbate the common experience of digital devices by showing, in the third person, the arbitrariness of the signifying language (and thus the effort required to master it), the starkly dualistic ontology that is a consequence of the digital language’s arbitrariness (you are either in or out of the simulation), and the uneven power dynamic produced by the coder’s access to the interface juxtaposed with the machine’s *native logical efficiency*. The entirety of *The Matrix* mythology can in this sense be reduced to one question: how can one code from within a digital machine? *The Matrix*, as a fable of the digital, introduces us to the aporias that are just under the hood in that domain. Compared to “Lawn mowers, toasters, drills, typewriters, elbow joints, pianos, and jaws,” (technologies that exemplify the analog for Golumbia), the digital is mysterious. So much so that even interrogating its origin seems daunting—something tantamount to finding the origin of god: “we simply do not know whether digital computation is something we have invented out of whole cloth and that is wholly contingent on other facts of our social world, or whether we have discovered a process as fundamental to our physical makeup as is the oxidative process that can culminate in fire” (222). For Golumbia, whose critique of digital logic reveals its “orient[ation] toward binarisms, hierarchy, and instrumental rationality,” the thing that matters is that these qualities are the primary tool of destructive runaway capitalism. The provenance of digital logic itself is thus obscured by our dependence on digital systems, and the appeal of the analog is merely a sign of our alienation from fundamental

material conditions. I argue however that the idea that the analog is without mystery is a greater sign of our information age alienation than the idea that the analog is conceptually difficult. After all, if the analog domain posed no “conceptual obstacles,” then the pre-computational discourse on disenchantment and alienation (from the English romantics to the Russian formalists) would seem redundant: why would one need to make a stone stone-like again (to use Viktor Shklovsky’s formulation of defamiliarization) if its place in analogical human experience was self-evident? In order to supplement what is missing *qua* the analog in the analysis of technological history, I turn to two recent discourses that theorize that domain and its social effects: biosemiotics and sound studies.

Biosemiotics is a transdisciplinary approach whose form is derived from the semiotics of C. S. Peirce and the biology of Jakob von Uexkull. In the words of Jesper Hoffmeyer, the discipline is “based on the recognition that life is fundamentally grounded in semiotic processes” (3): “According to the biosemiotic perspective, living nature is understood as essentially driven by, or actually consisting of, semiosis, that is to say, processes of sign relations and their signification—or function—in the biological processes of life” (4). The term “sign” acquires in biosemiotics, due to its derivation from Peircian semiotics, more flexibility than in the Saussurian usage, since it applies not only to arbitrary conventional symbols, but also icons (resemblances) and indices (causes and effects), which is to say analogic signs. While Golumbia sees the origin of the digital and analog as “simply” unanswered, biosemiotics locates these modes within primary forms of semiosis that permeate life on all levels, rendering them into general modes of communication rather than technology-exclusive codes. The implication here is that the A(nalog)/D(igital) pair is bound to the deep history of life processes, rather than the recent history of industrialization and informatics. This aspect of semiosis, which is confirmed in the empirical literature on A/D conversions within gene materials, by no means explains away the problems of the A (and/or) D effects on technological culture, but it does provide a basis with which to describe the forms of their relationships and effects. The digitality of genes has contributed to a deterministic perception of evolution, particularly evident in neo-darwinist writers like Richard Dawkins and Christopher Hitchens, who perceive the execution of life processes as determined by genetic code. Hoffmeyer writes,

In Western culture we are accustomed to think of digital codes as superior to analog codes. He who masters numbers and letters (or computers!) clearly has a

higher status than he who relies on the less formalized, analog ways of understanding reality. That science accords high authority to digital coding schemes may of course be traced back to the Galilean idea (now so widely adopted) that the language of God, or now reality, is mathematics. But it is hard to escape the feeling that this privileging of the digital representation also somehow reflects the separation between plan and execution that has been such an important principle behind the success of the industrial society. (79)

Here we see an agreement between the biosemiotic position and Golumbia's: digitality is in both cases instrumental in the creation of industrial society and its underlying structures. But in biosemiotic understanding, the "less formalized" analog domain is not merely the deterministically executed product of digital instructions—it is the domain in which freedom at the level of execution is made possible. Hoffmeyer continues,

The understanding that cognitive and biological processes cannot really be comprehended in isolation from their character as somatic processes reflects a growing awareness (in the computer age) of the fact that digital pre-specifications are essentially *dependent* on the agency of autonomous structures and mechanisms acting in space and time. (80)

For Hoffmeyer and the biosemiotic school, digitalism reflects a cultural bias, but one that fundamentally represses the primary role of interpretive freedom in all biological processes—interpretive freedom that is a consequence of analogical semiosis. The glamor that the digital accrues—as seen in Golumbia's reticence concerning its origins, Dawkins' confidence in its determining power, and the Galilean regard for its transcendence—is in this sense a product of its very structure. Digital syntax requires an unknowable exterior, in part to protect memory functions from environmental changes, while analogical signs operate on principles of continuity and similarity (hence, analogy) between interior and exterior. Anthony Wilden summarizes the A/D difference⁵ as follows: While the digital code is "'outside' the sender and receiver and mediates their relationship[,] an analog code is the relationship which mediates them"

⁵ At this point it must be said that the A/D distinction is by no means simple. Hoffmeyer and many others have pointed out that digital codes can be read as analog and vice versa depending on context. In our own time, some refer to the analog as a variant of the digital, and others refer to the digital as derivative of the analog. Neither position is baseless: all things are analog from a thermodynamic perspective, and digital from a quantum perspective. But the very context-sensitive nature of all semiotic phenomena brings us back to the most basic quality of the analog—that it starts, not by cutting sensory data down into smaller bytes, but by being an indivisible part of an environment. Again, this comes much too late.

(Hoffmeyer 87). What is most important in this description is the idea that analog(y) models the subjects of communication, because they are the structural precondition for relationship. This arrangement is the reverse of the digital paradigm, where the plan dictates execution: in the analog paradigm, the processes of execution always speak back to the agencies within/behind (the possibility of feedback necessitates this pairing) them. To use a stock example from complexity science, a butterfly's flapping wings may become responsible for a tsunami across the planet due to the accrual of complex dynamics, but the tsunami may also modify the flight path of the butterfly, which may go on to generate new tsunamis, etc.. The feedback-orientation of the analog paradigm is nowhere more palpable than with regard to sound.

Reading literature in the context of analog processes requires a critical historical method that accommodates not only textuality (texts and references to texts) but also the generators of other kinds of signals—i.e. sound/media technologies. For understandable reasons, scholars of literature have privileged media technologies that are vehicles for digital codes—such as the printing press, typewriter, telegraph, and internet. However, the explosion of analog media in the beginning of the 1960s modifies the prerogatives and determinants of the literary landscape such that messages become subordinated to signals: technologies like the tape recorder, synthesizer, echo machine, and distortion box inscribed new and complex signals onto the Real that called for a literary response. “Mr Ian Summerville of London pointed out the use and significance of spliced tape and all other tape recorder experiments suggested in this book,” writes William S. Burroughs in the acknowledgements for 1962's *The Ticket that Exploded* (Front Matter). Keywords in this acknowledgement are “use,” “significance,” and “experimentation”; the new tape technology was found to be more than a carrier of information; it could be used in provisional, hypothetical, and creative ways, and this capacity for free experimentation introduced significant and determining possibilities for expression and experience. Kittler himself acknowledges this in his essay on Pink Floyd's “Brain Damage”: “In popular culture, the ancient connection between words and music has returned after millennia, no longer via the feet of verses and dancers but as an inscription in the Real” (55). The inscribing process he describes here is literal: the spray of magnetic waves upon tape, the blasting of waves onto air and skin. The synthesizer and the tape machine signify something deeper than a return of the repressed, they herald the return of the Real, through consciousness-distributing capacity of analogic semiosis. Or, in Kittler's words, “Pink Floyd sticks in one's head, simply because people no

longer need to be reminded, simply because machines themselves are the mind” (55). The collapse of mind and machine that Kittler refers to here is, I argue, due to the fact that the sonic mode of analog technological development (in some ways its native tongue), proceeds by finding and reproducing meanings via resonance, making resonance a form of analogy.

Finally, let’s define some of the terms for important analog phenomena: modularity, saturation, and feedback, and disintegration. Modularity is the capacity of analog components that allows them to communicate directly. A modular synthesizer is one made of many separate circuits that can be connected and combined in novel or useful ways. Analog devices are easy to connect to each other, but also easy to connect with natural phenomena: remember plugging wires into a potato? Saturation signifies the overdriving of a circuit that interferes with the fidelity of the signal it generates or mediates. Different from mere noise, saturation is the kind of distortion you get from the substrate’s limitations: transistors, diodes, tape, and tubes all have thresholds of signal efficiency and fidelity beyond which the substrate reacts unpredictably. Feedback means recursivity within a circuit, such that its output is added to its input. While feedback is a necessary technique for guiding thermodynamically sensitive systems (the steam engine is controlled by feedback), it also introduces the danger of uncontrollable runaway effects. Lastly, disintegration: the electrolytic material in capacitors literally falls apart, changing their ability to store charge. In short, entropy happens, but in the context of analog circuits, the disintegration of components, because of feedback and modularity, creates downstream effects that cannot be anticipated beforehand. These qualities, which are central to what follows, are aspects that accompany the most basic aspects of analog electronics, continuity.





What is continuity? It fascinates me that, with the advent of electronics, human kind has all around it the mechanical manifestation of something we all take for granted: everywhere invisible forces conspire to connect disparate matter in circuits of shared energy. Electricity is such a fundamental component of our experience of modernity that many argue it should be considered a human right. We take for granted that hearts can be restarted by electrical energy, or that radiation allows us to see through skin. Electrical fields are so permeating and so essential to our lives that, to modify Ursula Le Guin’s adage, it is easier to imagine the end of the world than the end of electricity. And for good reason: like the Copernican revolution, the discovery of electricity constitutes a paradigm shift. Our world no longer makes sense without electricity. But that doesn’t mean that we understand what it has done to life and culture since its installation

into our homes. The most fundamental quality of electrical circuits, the continuity of electrical energy within them and its resonance with / relevance to biological life, was shocking enough to inspire Mary Shelley to write *Frankenstein*. The latter is a novel above all else about galvanism, about the continuity between electricity and chemical life. But what is this connection, this continuity, and how else has culture adapted to it or manipulated it? This dissertation will not attempt to answer the question of how electricity has affected culture; rather, it asks how one form of electrical machine, the analog circuit, is imbricated with Western culture at a particular moment in time. The time period and the type of machine in question are certainly not arbitrary. On the contrary, the analog circuit is primitive and basic to the operations of more complex forms. And the 1960s is the decade wherein popular access to electronic machines was first established in the West, after the populace had been introduced to televisions and radios at their clunkiest, and welcomed the benefits of miniaturization that advanced manufacturing would offer. While many already had tube televisions and radios, the transistor opened the floodgates of manufacturing, making electronics smaller, cheaper, and much more abundant. But for all the ubiquity enjoyed by electronic gadgets throughout the sixties and seventies, they were still mostly analog, meaning they functioned by the continuous transformation of energy, as opposed to digital electronics, which operate by creating artificial discontinuities in the streams of otherwise smooth waves. Like *Frankenstein* with galvanism, culture in the moment of analog electronics also registers shock, not of the existence of invisible energy, but of its new forms.

In the same way that contemporary culture is inexplicable without considering digital technology, culture in the 1960s was everywhere impacted with the patterns of energy and connection that are possible only by analog means, most legibly in sonic art. Electromechanical instruments (like the Fender Rhoads and Telecaster), synthesizers, and tape recorders are circuits that are both deeply patterned and highly flexible, like language itself, and which exert their patterns on the face of reality. When record companies began capitalizing on the invention of the synthesizer by promoting records of popular music performed using the new technology, they used one phrase over and over: “Switched on.” There are many records that use this convention, like *Switched-On Nashville (Country Moog)* and *Switched On Santa*, but the most prominent of these is 1968’s *Switched-On Bach*, a virtuosic rendition of Bach’s most popular works played on the Moog synthesizer by an up and coming composer named Wendy Carlos. The story goes that Carlos’ record introduced the sound of the synthesizer to popular audiences, and made the

instrument desirable to non-experimental musicians (The Beatles used a Moog the very next year). For a long time the phrase “Switched On” seemed a bit silly to me. The words did not seem to convey the timbre or significance of the advent of a new, totally electronic instrument. But it occurred to me that my historical vantage point is the reason “Switched On” seems underwhelming: I have always lived in a world that is “on,” and most of it in a time when switching on and off happens millions of times per second all around me within digital devices. The names of the first Moog-heavy records reflect the novelty of a technology that remains active and whose internal continuities are exposed. The cover of *Switched-On Bach* depicts a man in a powdered wig and jabot before a Moog modular synthesizer system. The early Moogs took advantage of a key aspect of analog circuits—the ability to connect with nearly everything. Early synthesizers were (and some still are) merely racks full of disparate and unconnected modules, to be connected or “patched” by the composer or sound technician. Patching a modular synthesizer is akin to creating a new instrument every time you use it. But once it is patched—once all the cables have been arranged to achieve meaningful continuity, it becomes more than the sum of its parts: to be switched on is to be alive. Thus, the phrase “Switched on” conveys two things. First, it gets at the strange feeling of energetic organization that happens inside the machine once its continuity is achieved. But it also speaks, or fails to speak, to the complexity of the forms that occur within the machine once it is turned on. When the circuit is activated, it makes music within itself, subject to its own idiosyncrasies, prerogatives, and capacities. 1960s counterculture anticipates the sublime connotations of electrical continuity, even before the synthesizer. The father of psychedelic experimentation in the US, Timothy Leary, claims that he was given the slogan for psychedelic subversion, “Turn on, tune in, and drop out,” by none other than Marshal McLuhan. Funny if true, since McLuhan’s doctrine of media applies tremendously to this situation: the media of the circuit is the historical message it conveys—analogue connection is the logic of the midcentury. But what does the phenomena inside the circuit consist of, and how does this affect culture?

While pointing to a powerful aspect of analogical devices, the phrase “switched on” does not adequately convey what happens once the machine is activated. As a child I was obsessed with electricity, and I dismantled many of my parents’ electronic devices to understand how their circuits worked. I quickly learned that there are brute circuits, like fans and heaters, that turn electrical continuity into kinetic or thermal energy without much prompting. These circuits are

extremely rudimentary, and basically allow electricity to do what it was doing anyway, dissipating thermally or creating electromagnetic fields. The principle behind these is analogical as well (there is a direct correspondence between electrical field and work), but even in my most inquisitive moments my toaster has never been the subject of much inspiration. Then there are the subtle circuits: amplifiers and signal generators. In these, the work is accomplished by making electricity do something like math, but without any numbers. For instance, an amplifier is a (somewhat) carefully calibrated network of pumps that multiply the strength of a given signal. Oscillators, the basis for electronic signals, function by charging up and then quickly discharging in a cyclical pattern. In advanced synthesizers, oscillators traditionally come in four varieties of wave shape, sawtooth (), triangle (), square (), and sine (), and of these sawtooth is the most common because it is easy to implement and harmonically rich. There is a lot of math involved in the design and calibration of oscillators, but even more than math, there is compromise. “Mathematically perfect” waves, like the sine, are impossible to achieve using analog means. Square waves always have a slight angle in their horizontal lines, saws often have kinks in the descent portion (which would be perfectly linear in a perfect world), triangles evince rounding, and sines are inevitably lopsided. The analog domain introduces distortions. I learned this when I was first employed to calibrate analog VCAs (Voltage Controlled Amplifiers). Staring at an oscilloscope for hours, and turning the tiny calibration potentiometer as gently as I could, I could never quite make the input match the output—there was always a kink, a spike, a dead spot. Thankfully, my boss disabused me of my misguided goal. The point of calibration is not perfect correspondence to an abstract goal, but to achieve an approximation. The “switched on” phenomena, both in terms of technics and culture, consists of a thousand and one moments of adventurous calibration.

Approximation allows for experiment, and analog technology, whose fundamental mode is approximation, mediates and amplifies this relationship. The beauty of Wendy Carlos’ adaptations of Bach is not merely that the machine is “switched on,” but that it is subtly calibrated to produce timbres that are simultaneously approximations of the original instruments (harpsichord, strings, and horns) *and* new sounds that have their own qualities and textures. In her profile on Carlos, Roshanak Kheshti writes,

Analog synthesizers are almost impossible to keep in tune and are unpredictable in live performance settings, giving them a strange autonomy and making them

notoriously difficult to tame. Unlike the majority of other musical instruments, designed to function in sacred worship or ritual ceremony, the synthesizer was born as a result of happy accidents that arose in the development of war machines. They are instruments that can't be mastered, because there is no master religious or ritual narrative on which they are based. The analog synthesizer is a wild electric animal, the sci-fi creature no one saw coming. (2)

Taming analog equipment is one of the reasons that digital technology is so desirable. I have used digital synthesizers for live performance for a long time, just because they are reliable, predictable, and affordable. But I had a project come across my desk that demanded the sound of analog synthesis, so I went out and traded my trusty digital keyboard for a modern analog system. Lo and behold, even contemporary analog synthesizers get tired of being in tune, and I have to run a calibration algorithm every thirty minutes or so. This “strange autonomy” is part and parcel of the experience, however. Tuning “drift,” as it is commonly known, is such an essential part of analog synthesis that contemporary digital synthesizers often contain algorithms that replicate it. But in 1968 there were no handles on the technology's unpredictability. This in itself makes *Switched-on Bach* a masterclass in engineering: Carlos makes the early and primitive Moog system sound sophisticated, tuned, and polished in a way that has rarely been achieved before or since.⁶ But above and beyond the “endless tweaking, twirling, and futzing” (Kheshti's words) that Carlos employed to tame the Moog, there is also the very distinct presence of the instrument's “strange autonomy” that Carlos allows, entertains, and befriends. Carlos' rendition of the second movement of the Brandenburg Concerto No. 3 in G Major is a striking example of experimentation: while the rest of the album stays close to timbres that do justice to the baroque source material, the second movement is a sci-fi nightmare, bursting with alien tones, atonal wails, and noisy filter sweeps. Benjamin Folkman, who assisted in the album's production, writes, “Bach provided no second movement other than a ‘Phrygian’ Cadence: Obviously he expected the continuo player to improvise a cadenza leading up to it, thus giving the listener a rest from string tone. Our improvisation is a fantasia after Bach's most florid

⁶ The refinement of Carlos' engineering was one of the reasons that the album has been criticized as unimaginative mimesis of traditional instruments. But careful listening shows that the patches are all but replications: their resonances are carefully tuned, but to the “sweet spots” provided by the machine. As Rachel Elkind, who worked with Carlos on the *Switched-on Bach*, writes, “We were after a vocabulary of synthesizer sounds that might be analogous to the sounds that have become part of the standard orchestral language—but on the synthesizer's own terms” (Kheshti 36-7).

and chromatic style, and incorporates a number of virtuoso electronic effects not heard elsewhere on the album” (Back Matter). Bach’s instructions for the second movement are themselves highly subject to interpretation, and Carlos uses the opportunity to let the machine scream, or to scream together with the machine. Kheshti interprets the sonic landscape of the second movement thus:

A mighty electrical storm rustles a tinsel tree. Swooshhhhhh . . . thunder and lightning merge into one sound and erupt from the left channel of the stereo spread. The clouds part and electronic birds begin shyly chirping from the far right channel. The pitter-patter of other mystical creatures crawling out from their dampened shelters can gradually be heard. A sonic sunburst illuminates a tin branch that falls like a helicopter seedpod. Upon touching down it triggers an oscillator geyser that sprays sound toward the heavens just as the clouds burst open, hailing golf balls of voltage in return. The oscillations of a disapproving god yammer something no one can quite understand. The inhabitants of the land run about frantically, for they know not what god is synthesizing. (22)

Synthesis invites an “intra-active”⁷ imagination with regard to patching, and it evokes another layer of imagination upon listening. Which is to say that fiction is an essential part of synthesis. *Switched-on Bach*’s historical importance has been chronicled and interpreted at great length, by Kheshti as well as Trevor Pinch and, somewhat infamously, Amanda Sewell. I pause at Carlos’ masterwork not to provide another angle on the work, but to bring the critical perspective of it to bear upon fiction. *Switched-on Bach* is the culmination of analog philosophy, a proof of Kodwo Eshun’s adage: “Far from needing theory’s help, music today is already more conceptual than at any point this century, pregnant with thoughtprobes waiting to be activated, switched on, misused” (-003). We find that “switching on” stands for the threshold of a risky new perspective. To switch on is to be synthesized, reconceptualized, fictionalized, and reimagined by and with the machine. Carlos’ cyberneticism embraces a continuity that isn’t just inside the machine, it’s in you too.

So we are talking about the cybernetic capacities of analog technologies, their realization in electronic music, and their historical interactions with the imagination, but with a particular

⁷ To echo Kheshti’s use of Karen Barad’s concept of interpenetrating and reciprocal activity.

emphasis on the non-linear transformations between these porous surfaces. Kheshti leans on Donna Haraway's definition of the cyborg for her analysis of *Switched-on Bach*:

By the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs. The cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality, the two joined centers structuring any possibility of historical transformation. (66)

Haraway's definition of the historical interaction of human and machine is both diagnostic and aspirational. For Haraway, the capacities of the cyborg exceed the parameters of traditional science and politics, for which the "relation between organism and machines has been a border war" (66). Living with advanced technology has disintegrated this border, resulting in cyborg subjects, whose historical horizon exceeds and challenges the trajectories prescribed by "the tradition of racist, male-dominant capitalism; the tradition of progress; the tradition of the appropriation of nature as resources for the productions of culture; the tradition of reproduction of the self from the reflections of the other" (66). Haraway reads the incipient cyborg as necessarily separate from the Western traditions of subjectification that have pitted nature and culture against each other, but also as an exemplar of a utopian end of gender. Haraway's perspective has many virtues, particularly, as in Kheshti's application, with regard to "synthgendered" figures like Carlos. "Media determine our situation," writes Friedrich Kittler (*Gramophone* xxxix). Kittler's cyberneticism, like Haraway's, begins with the capacities created by a merging of nature, culture, and technology: if technological media situate us, they do so without regarding traditional paradigms of either politics or biology. But for Kittler, this determination is less an acceleration into a utopian future than a return to a basic primordial condition of being. Beside these two senses of cybernetics there is a third one, which is more general and fundamental: Second-order cybernetics, put forth by Margaret Mead and Gregory Bateson, and followed by Humberto Maturana and Francisco Varela, which posits that the first order of cybernetic phenomena, which consists of feedback between mediating interfaces resulting in homeostasis, are then also part of a second order of feedback, which consists of the observer's activity of conceptualizing, representing, and interacting with the first loop. Second-order cybernetics informs and augments Haraway's and Kittler's interpretations of human-machine interaction by introducing the indeterminacy of extreme contingency, but also the role

of observers in guiding complex systems. When we start thinking about literature and technology, it is of fundamental importance to acknowledge the likelihood of second-order phenomena, simply because the relationship between material conditions, politics, ideology, cognition, society, media, experience, etc.—all of that which bears upon the creation of art—is necessarily complex and non-linear.

Let us think about non-linearity, and what it means for interpretation. Ira Livingston describes non-linearity using the game of pool as an example:

It is true that you can become a mediocre pool player by mastering the geometry of the game, which accounts for a lot of what happens. But the effects of friction—the continuous feedback loop between the ball and its environment (table surface, rails, other balls)—are what push the game into the realm of physics and nonlinearity ... The further from the original stroke, the more nonlinearities are amplified: as anyone who has played pool knows, shots in which A hits B, B hits C, and C hits D are monstrously difficult because the margin for error gets smaller and smaller, rapidly exceeding human visual acuity, computational ability, and hand-eye coordination—and reaching the point where even perfect accuracy in these could not override the effects of tiny irregularities in the playing surface, cue tip, and more. (55-56)

The criticism of art that acknowledges technology (or science generally) has tended to resemble the mediocre pool player, whose conception of the world is fundamentally Newtonian, making guesses based on the geometricity of the given textual/cultural environment.⁸ Of course, it is the lack of non-Newtonian detail that gives critical concepts their (sometimes dubious) predictive and theoretical power: as I argue at the end of this dissertation, the Western tradition of employing and reifying highly discrete and exclusive concepts has fueled (for better or worse) modernity. But as much as systems of power have benefitted from Newtonian conceptualizations of the world (or the confirmation bias that accompanies them), the world is still stochastic and unpredictable. If calculating the effect of feedback and noise with just a few billiard balls is a task that exceeds “computational ability,” how much more so is the task of mapping the causal

⁸ For example, Joseph Carroll’s brand of literary Darwinism, which gets on by not accounting for the complexity of epigenetics; or media studies readings that celebrate the political potential of a given technology at exactly the moment it recedes into obsolescence, like the 1990s enthusiasm for virtual reality.

webs of cultural artifacts, particularly those that are materially linked to technologies that are highly subject to nonlinearities, like analog electronics? Add to this the second-order cybernetics insight that I myself am situated in an ever-moving stochastic field with regard to the subject of my attention. The same part of me that wanted to calibrate the VCA to death also wants to categorize and nullify the sources of non-linearity in literary history, and write a neat set of precise instructions on how to repeat it. But that's not where this is going. Part of Wendy Carlos' genius, one aspect among many that qualify her for that status, is that, far from banishing the noisy and non-linear phenomena inherent in analog synthesis, she befriends them. The electrons in analog circuits are in many ways like the billiard balls in Livinston's example. For a short time they behave predictably according to mathematical principles, but with every added component entropy increases: pitch drifts, noise seeps in, oscillations develop snags, tubes go microphonic, and capacitors leak. At some point you have to befriend non-linearity.

Switched-on Bach represents a high point for historically recognized analog electronic art, but it also represents the beginning of the social acceptability of electronic music, and a turning point for a history rife with chaos in its early stages. I start with Wendy Carlos to illustrate some ideas that are central to what follows: the relation between analog electronics and cybernetics, imagination, and non-linearity being foremost. *S-oB*, which “went Gold in 1969 and Platinum in 1986,” is the album that made the Moog synthesizer a household name, but it also led to socialization of the instrument itself (Keshti 55). “Carlos’s ability to *socialize* the Moog is what has enshrined her as the mother of synthesis,” writes Kheshti. “Much like mother’s role in the traditional nuclear family—as the nurturing translator of father’s rules—Carlos had a unique ability to translate the arcane and technical mechanics of the Moog 900 to sound colors that were legible to audiences” (56). This socialization consists not only of the carefully crafted timbres of *S-oB*, but also her relationship with Bob Moog himself, whom she advised. It is through Carlos’ influence that the Moog synthesizer went from the arcane patch bays and modules of the 900 Series (which Carlos used on *S-oB*) to the Minimoog, a keyboard instrument accessible to traditional players, which came pre-patched in a fixed architecture. The Minimoog is perhaps the most ubiquitous timbres in the history of synthesis. It certainly has the capacity to be experimental, but music historians mostly remember it as a pop fixture in songs by Bob Marley,

Stevie Wonder, Abba, The Bee Gees, Michael Jackson, Hall and Oates, and Dr Dre.⁹ As I argue in the conclusion, this corresponds to a pattern of culture and technology: through a process of institutionalization, the antisocial aspects of technological subjectivity are relegated to the margins of culture, while an institutionally acceptable version of the technology and its corresponding subjectivity, which reify the discreteness of the boundaries between human and non-human, are integrated into mainstream culture. Wendy Carlos is a fitting example of this process. While she is now recognized as an pivotal figure in synthesizer culture, her status was for decades bound up in controversies surrounding not music but gender, which for a time effaced Carlos' prominent role. The new technology was only acceptable if it actualized the old values.

Because Carlos primarily fashioned *S-ob*'s timbres on traditional orchestral instruments, Kheshti posits that analog synthesis exemplifies postmodernism as diagnosed by Jean Baudrillard. Kheshti writes, "Analog synthesizer music epitomizes the analogical condition of postmodernity, where the copy exceeds the so-called real in both symbolic and material value" (63). The problem with this diagnosis is that, by playing fast and loose with semiotics, it conflates signals with signifiers. Of the virtues that Kheshti assigns to the synthesizer—its non-linearity, its continuity (or intra-action) with human senses, the way it engages the imagination—all are aspects or consequences of analogical signaling, while Baudrillard's interpretation of the postmodern condition is tailored around symbols and signifiers. Baudrillard writes, "It is a question of substituting the signs of the real for the real, that is to say, of an operation of deterring every real process via its operational double, a programmatic, metastable, perfectly descriptive machine that offers all the signs of the real and short-circuits all its vicissitudes" (Natoli 343). To Kheshti's credit, this is an ambiguous matter, since synthesizers do provide an "operational double" to acoustic sounds, producing within themselves electrical doppelgangers of real processes. But the problem with this interpretation lies in the fact that analog signals are not signs in the same way that symbols are. Bran Nicol describes the Baudrillardian position thus: "Now there is only the endless and meaningless exchange of signs, which are even less 'real' and more ambiguous than commodities or currency (often they are images or words): everything can be exchanged for everything else, every sign is potentially interchangeable,

⁹ Many of these recordings have subversive social and technical histories, but they have become incorporated into a capitalist radioplay paradigm that has neutered these meanings within a marketplace of interchangeable content.

reversible” (5). In other words, to be precise as it concerns semiotic types, Baudrillard’s postmodernism is digital since it consists of a code whose referents are necessarily conventional. Analogical signals (which are rarely referred to in terms of “code”) are just what they are: patterns that cohere to a certain range of analogical vibrational capacities in the body and the auditory organs. It might seem odd to define analog signals in tautological terms, but I have reason, precedent, and elaboration. In an interview, Bob Moog himself shared his sense of the internal life of his synths:

When I think of this circuit, I have a feeling for what’s happening with the electricity as it goes through these paths. . . . What it has to do with all these little traces on the board here that connect it together and cause the current to change as it goes from one part to another. . . . I have a feeling, which is very similar to how I imagine a violin maker feels when he’s just getting the right amount of wood in one surface of the violin. There are a lot of people who begin to feel what the circuits do in a way that’s similar to how I feel them . . . and I know for a fact that musicians make contact with this board inside this instrument here [bangs knuckles against circuit board]. Uh, not physical contact—it’s not like they have it under their armpits—but [circles finger around his head and body] there’s something going on here that connects what’s going here [taps circuit board] with what’s going on inside here [points to head]. It’s not spiritual in the sense that it’s religious but spiritual in the sense that it uses some way of connecting the things that are in the universe by ways other than we can see with our senses. (Kheshti 48)

The “feeling” that Moog talks about is indeed a sense developed by many musicians and musician/engineers. It is a sense that is the subject of the next section, and which, I argue, is a consequence of creating unconscious cybernetic links both inward and outward. Moreover, it is a sense developed to correspond with the status of signals whose forms are retained as analogs through their transformations between interfaces. Unlike digital signs, whose very nature ensures that they have no essential relationship to physical conditions (their meaning comes from the code that guarantees their content throughout discourse), analog signals don’t lie. There are plenty of ways to be wrong about signals (noise levels can make signals hard to perceive, or some circuit in any layer of transformation can cause distortion) but all of these things are also

truths about the function of the system as a whole. The feeling for the machine, the sense of its spirit (to use Moog's terms), is far removed from Baudrillardian postmodernism because analog signals cannot be separated from the reality that directly undergirds them. So there appears to be a second postmodernism, whose rules are foreign and contrary to its Baudrillardian twin: the analog postmodern.

I want to tell the story of analog subjectivity from Carlos backwards, narrating not the process of how technology is integrated into hegemonic cultural practice, but how its unintegratable aspects live on in the cultural unconscious. *S-oB* was the beginning of the synthesizer as a socialized technology, but its prehistory consists of a landscape of unsocialized cybernetic encounters. Kheshti's willingness to interpret *S-oB* in terms of simulation is telling. It shows that Carlos' record-breaking album pushed the synthesizer into public consciousness in a way that made it discursive in new ways. But in the years immediately before *S-oB* we find a plethora of analog artifacts that never became as popular as Carlos' work, but which nonetheless evince the characteristic machine-human relationship of analog technics. While *S-oB* made the sounds and machines of electronic music more accessible to the masses, we must attend to the artifacts, both sonic and literary, that operated at the fringes of technoculture.

Sonically, a history of analog technoculture must acknowledge not only Carlos' popularization of the instrument but the experiments that came before. Morton Subotnick's *Silver Apples of the Moon* (1967) is an important counterpoint to *S-oB*: rather than justify the ways of synth to man,¹⁰ as Carlos does by socializing and domesticating the Moog, Subotnick lets the synthesizer run wild in an atonal soundscape of bleeps and bloops. It is an alien and alienating work, made using a different type of synthesis from the Moog paradigm. Subotnick recorded the album using the Buchla 100 system, which, instead of becoming more and more like traditional instruments, was intended to remain independent from traditional forms of control and timbre. Although Subotnick's album met with some success in classical music sales, Wendy Carlos panned the work, writing, "I'm sorry, but 'Silver Apples' is a bore" (Pinch 143). Carlos' review reflects the trajectory of electronic music culture: for most synth users and listeners, the sound of the Buchla became associated with inaccessible avant-gardism or, much

¹⁰ There is a messianic tone that runs through Carlos scholarship, that stems from her capacity to prevent the synth from lapsing into mere bleeps and bloops. Carlos' deserves credit for this, as taming early synths took considerable creative skill. I (mis-)use Milton's words to emphasize a dynamic that runs through utopian interpretations of technology, which reinscribes the values of revelation and power that cohere in a theological paradigm.

later, the conspicuous consumption of synth collectors. But *Silver Apples* also represents a recording of the synth *as* synth, rather than the synth as medium for pre-established cultural ideas (like Bach). Subotnick was joined in synth experimentalism by the likes of Daphne Oram and Delia Derbyshire in England, and Pauline Oliveros in the United States. Notably, Oram and Derbyshire were employed as studio technicians at the BBC, where they engineered the electronic sounds for the films *Doctor No* (1962) and *Doctor Who* (1963) respectively. Oliveros became a central figure of the San Francisco Tape center, co-founded by Subotnick, which was a haven for musical experimentation in the US in the early sixties. While Carlos is the avatar of the synthesizer's meteoric rise in popularity, these other figures created and maintained a culture of sonic experimentation that operated in the background of popular culture. Oram went uncredited for her sound design work on *Doctor No*, as if there were no words for describing her interactions with new technologies. Derbyshire was likewise unrecognized for her work on the *Doctor Who* theme. Synthesized and manipulated sounds did not enter the cultural scene with fanfare, but made secret incursions into the mainstream from attics, basements, and after-hours workshops. Subotnick, Oram, Derbyshire, and Oliveros represent the technological unconscious of the midcentury.

The technological unconscious bubbles up in literary art as well, possible even more acutely than in music. As composer and sound researcher David Toop, writes, "in a sense, Thomas Pynchon, J.G. Ballard and Phillip K. Dick predicted Brian Eno..." (13). Brian Eno, typically considered the father of ambient music, is an inheritor of the technoculture left behind by the first generation of electronic musicians like Carlos, Subotnick, Derbyshire, et al. He is best known for his album *Ambient 1: Music for Airports* (1978), but in the early-seventies he was a founding member of Roxy Music, participated in Cornelius Cardew's experimental "Scratch Orchestra," and collaborated with Robert Fripp on *No Pussyfooting*¹¹ (1973). Toop however connects Eno's experimentalism not with technoculture but with fiction. Toop continues, "Pynchon with his image of electronic sound as ambient entertainment; Ballard with his scenes of Vermillions Sands' cloud sculptors and sonic statue salesmen; Dick with his musical reverie technology. And, as with any science-fiction author, at the heart of his speculations are a collection of present-day realities" (13). Toop refers to these literary invocations of sonics as

¹¹ This is my personal favorite of Eno's. It displays his trademark patience with aleatorics, complemented by Fripp's sense of harmony and texture.

“pre-echoes” of electronic music and its culture, but also as manifestations of technological conditions. As I have mentioned above, electronic music was already getting going in the early sixties, so Toop’s examples didn’t exactly predict anything. (Pynchon would publish *The Crying of Lot 49* in 1966, Dick’s “We Can Remember It for You Wholesale” is from the same year, and Ballard’s *Vermillions Sands* hales from 1971.) But, perhaps more important than prediction, these stories register aspects of then “present-day realities” *through* and *with* sonic technology. In music technology, it is somewhat easy to connect the dots between general technological advancements and their implementations in instruments (the story of Leon Theremin’s activity as a Soviet spy turned instrument maker comes to mind). The components are, after all, just inside the machine, waiting to be appreciated and historicized.¹² But connecting technology to literature (and thus historicizing thought and subjectivity) is a bit trickier. There are very few novels that also contain the schematics for the technologies that subtend their meaning. But we find in Pynchon and Ballard (not to mention Dick) literary representations that hover near the machine. What we find when we examine the machines in fiction, like with their musical analogs, is a complex history of technological and experiential change, which provides context for how we became the technological subjects that we are now.

When the secret history of electronic music and the secret history of postmodern fiction intersect, they reveal a very clear picture of consciousness in the midcentury, particularly its rootedness in analogical technology and the joys of writing about it. The scene in *The Crying of Lot 49* to which Toop refers, where the protagonist finds her way to a bar that only plays electronic music, is itself probably a reference to the San Francisco Tape Center cohort. I cannot forensically substantiate this further, for the reason, familiar to all Pynchon scholars, that the author’s actual history is often shrouded in obscurity. But it stands to reason that Pynchon, as an Californian writing during the time in which the Tape Center cohort was active, being aware of trends in experimental electronic music at the time (evinced in his reference to Stockhausen), would reflect the activity of local composers like Buchla, Subotnick, and Oliveros. Moreover, Pynchon lists the gear used by these composers as the inventory in the bar. I will elaborate the relationship between Pynchon and technoculture later, but for now it is important simply to note

¹² There is a whole cottage industry among musician/engineers concerned with tracing the minute differences of electronic components from year to year and factory to factory. Not all TL072 Operational Amplifiers are created equal, and if you are intense about listening, the history of the factory that made the one you like the most, as well as its batch of semiconductive substrate and other conditions, becomes very important.

that the trajectories of literature and sonic technologies collide in such a way that reading one without the other leaves holes in the historical understanding of either. One of the main reasons why I became interested in the concept of the postmodern was precisely the ubiquity of technicity in writers that receive that name. From Calvino and Borges to Pynchon and Ballard, postmodern fiction is permeated with technical writing. The fact that Ballard and Pynchon were employed as technical writers (Ballard for a medical journal, Pynchon for an avionics manufacturer) is crucial. This detail has been subverted in literary criticism because of a long standing tradition of antipathy between the humanities and sciences, but when we attend to the way that sonic culture and literary culture collide in the period, each side's love for writing (with/through) technology is that which comes to the forefront of their aesthetics. Friedrich Kittler's essay on Pynchon's "electro-mysticism," offers a surprisingly comprehensive insight into Pynchon's output—particularly the relationship between filtering, amplification, and collapse between semiotic regimes of diagrammatic representation and reality (all concepts exemplified in sonics)—but its detailed engagement with electrical engineering will be opaque to non-experts (as far as I can tell, the essay has been cited very few times). Thus, Kittler's insights go unintegrated into the critical canon, the world keeps spinning and other critical modes, perhaps in conflict with valuable insights, persist. Certainly, there are valid reasons why Kittler's view has not become more popular. How many literature scholars do you know are also knowledgeable about physics or engineering? But the problem is that authors like Pynchon and Ballard are exactly this type of person. As Stockhausen himself said, "Working with electronic music, or realizing electronic music, means to synthesize all the [characteristics] of sound, and in order to do that you have to work like a physicist. There is no other way" (Stockhausen). Likewise, technical fictions of the midcentury, even if they are not written for an audience of engineers (though *Gravity's Rainbow* might have been), certainly speak the language of engineering because of the prominence of electronic techniques in that era. We can rewrite Stockhausen's statement for the likes of Pynchon and Ballard: "Working with electronic culture, or realizing electronic culture, means to synthesize all the characteristics of life, and in order to do that you have to work like a physicist. There is no other way." But this does not mean an evacuation of the human from criticism.

There is a stereotype about technical writing that sees it as an exercise devoid of joy or poetry. Few children long to become technical writers. But among musician/engineers, many of

whom, like me, had to become familiar with engineering out of necessity, technical writing is accompanied by a degree of *jouissance*. We, if I can be bold enough to count myself as a participant, are avid note-takers. Derbyshire, Subotnick, and Carlos are all known for their complex and idiosyncratic note-taking methods. This love of commentary made its way into manufacturing: the history of sonic technology is one of beautiful manuals. Like the illuminated manuscripts of the middle ages, synthesizer, effects, and amplifier manuals are objects of surprising aesthetic beauty. The manual for the Electric Dream Plant LTD Wasp synthesizer depicts a wasp-themed comic book character in the style of Jack Kirby, hands poised over the instrument's keyboard, his antennae arcing electricity between them, while space wasps soar past planets behind him, as if summoned by his interaction with the keys. This illustration is not merely part of marketing the synthesizer to young audiences, but a glimpse into the engineer's experience of the machine. Interestingly, this illustrated character appears more sinister than heroic. His dress, eyes, and cowl correspond more with the Flash Gordon's nemesis, Ming the Merciless, than to any hero. The Wasp doesn't make you a hero—it enmeshes you (very literally in the illustration) between the machine and the animal. This mode of representation obviously exceeds the traditional scientific prerogatives of objective representations. Printed circuit boards (PCBs), wherein text is usually reserved for assembly notes, have also fallen prey to the poetic and aesthetic sensibilities of engineers. Many manufacturers have etched “Easter Eggs” on PCBs—little hidden messages for initiates that speak to the spirit of the machine. The PCB of the Boomerang III reads, “May the music passing through this device somehow help to bring just a little more peace to this troubled world” (I'm not sure how to cite a circuit board), while Peter Blasser designed the circuits of his Ciat-Lombard devices to be mandala-like in themselves. Electronics culture evinces a history of representation that is simultaneously devoted to scientific detail and aesthetic exploration. In some sense, it shows that to be scientific is to be expressive of new forms, since to be in contact with ever-evolving truths of reality is to be renegotiating representation. Ballard and Pynchon reflect, often explicitly, this dynamic. That is to say that they remained technical writers. When Oedipa surveys San Narciso from above and is reminded of a circuit board, her reminiscence is not a reduction of the beauty or complexity of a city full of real human circumstance, it is a formal and aesthetic insight about technical organization of living creatures.

I find Ballard and Pynchon exemplary of an attention to technics and sound, but they are not alone. They are surrounded by a cohort of writers who similarly write technology as a medium for living signals. In researching this dissertation, I came upon many other contemporaneous writers who share the same conceptual techniques as Ballard and Pynchon. Ursula Le Guin (who started publishing after Pynchon, but who was several years older), Samuel Delany, Phillip José Farmer, Clifford Simak, Walker Percy, and John Crowley share a common way of depicting technology. Not as a fact of life to be taken for granted, nor as a medium for perfecting the future, but, even if the technology is mundane, as an experience that recalibrates experience indeterminately. This list also represents primarily authors associated with the movement known as science fiction's new wave, with which (no matter how you define the movement) Ballard was particularly involved. Octavia Butler, (even if her representations of technology are often more oblique than the others) also deserves mention among these writers. For Butler, technology often appears as an impediment to evolution, not an aid. Adrienne Maree Brown's *Emergent Strategies: Shaping Change, Changing Worlds* reflects this dynamic: Brown's book applies Butler's representations of interspecies symbiosis to political praxis. But upon deeper reflection we find that the choices that Butler's characters make are often about the use of technology, even when the device is not represented as futuristic.¹³ One of my main objectives is to show the parallels between Ballard in 1960 (while he is still very much writing from within the "genre ghetto") and Pynchon of 1966—in my opinion, Pynchon is very much a new wave writer. Moreover, I believe that anglophone postmodern writing of the midcentury, when considered together with the technology of its moment, is more a species of new wave SF than the other way around. Or, to be more specific, I want to deny the logic that has prevailed for many years that "the new wave is postmodernism applied to science fiction"¹⁴ and show that they are in fact the same literary phenomenon, separated merely by conventions of literary scholarship. The boundaries between what is postmodern (Pynchon) and what is SF (Ballard) blur when taken together and considered in connection with their mutual interest in and representations of analog technohistory. What sets these writers apart is their attentiveness to the subtleties of the machine, and how those subtleties reintroduce us to the subtleties of human life.

¹³ For instance, the role of the rifle in "Bloodchild."

¹⁴ I know not from where this piece of copy pasta (internet-ese for memed phrases) originated, but it floats around the internet in the guise of an adequate explanation for the new wave.

In chapter one, in which I establish the methodological framework, I argue that analogical processes set the limit for what can even be considered experience, in the form of circuits that balance the conscious and the subliminal. Art in the context of the analog paradigm explicated by Gregory Bateson and Charles Sanders Peirce consists of shifting the border between what is routinely conscious and that which is subliminal, and thus restoring the animal grace to human life by reminding us of the continuities of bodily substrata that furnish experience (Shklovsky thus emerges as exemplary of a style of analog reading). I show that technology is a crucial part of mediating the boundaries between knowledge and intuition, because it intervenes in human action prior to the codifications of symbolism and convention.

In chapter two, “The Unseen Powers,” I show that symbolically-focused criticism of J. G. Ballard’s “The Voice of Time,” a central text in the history of postmodern science fiction, has missed the analogical diagram within the text, and I argue that this diagram points us to a consideration of how technology mediates power, entropy, and human progress. I show how the moment of improvised radiological saturation in the story’s climax mirrors the discovery of sonic saturation that changed the course of music history, defining generic criteria for a generation of sonic practitioners. I read these two phenomena through each other to argue that the exacerbation of sensation that they both represent indicates a primordial capacity for living beings to grow into semiotically unintelligible conditions by relying on the basic sense of hearing analog icons.

In chapter three, “Filthy Machines,” I read Pynchon’s *Crying of Lot 49* as an analog of early delay machines to show how information that is caught in feedback loops can not only become life-like, it can become part of the indeterminate nature of life, hybridizing it. At the same time, the indeterminacy is filtered and formed by mechanisms that remember. I argue that, while there is no solution to the mysteries of the text, there is the possibility of being drawn into the same circuit as its mysterious entities, which is its own solution. I suggest that this is how the novel ends, with Oedipa ambiguously part of the system she investigates. Moreover, I show a potential historical source for Pynchon’s engagement with sonic technology, the San Francisco Tape Music Center, a connection that both substantiates the sonic reading of *Lot 49* and shows the relevance of the concepts of aleatoric sequencing and feedback within his work.

To conclude, I connect the consideration of analog techniques in literature and music to a wider social, cultural, and historical context that includes the competing semiotic paradigm of poststructuralism. I discuss how the dissertation project moved away from a critique of poststructuralism, but show that it is still necessary to place analog insights alongside and counter to the history of criticism that valorizes digitalist methods, including poststructuralism. I explain the historical benefits that digitalism represents for the advancement of Western modernity. Finally, I offer Robert Johnson and H. P. Lovecraft as examples of artists that deploy techniques that contradict the digitalist trend of modernity, and use Bruno Latour's theory of hybrids to show how the subsequent forms of science fiction and rock music produce and maintain postmodern subjectivity, setting the stage for authors like Ballard and Pynchon.

Chapter 2 The Peircian Piano

Thus we see that at the end of the story, the device is
liberated from the accidental motivation for its use.

—Victor Shklovsky, “Art as Device”

Musical instruments pose challenges to concepts of technics and semiosis because, even though they are “instruments,” they are not instrumental in the sense that they deterministically carry out plans. Building an instrument means making an object that retains analog correspondences to the hand, the mouth, the ear, the mind, and the body, while contributing something new. Music organologist Bart Hopkins writes, “Musical instruments are designed to produce sound, and to do so in a fashion that can be controlled by the player. Typically this means that the player decides which pitches should sound when, and for how long.” This description goes along with the common perception of what an instrument does, wherein the instrument (or player) merely executes the plans dictated by the music (an attitude that semioticians of music call “scorism”), but Hopkins continues: “How about a different concept of control, such that the player’s mastery over the instrument is replaced by one of creative interaction with the instrument?” (148). Hopkins argues that builders must be attentive to situations that instruments actually create, rather than being single-mindedly oriented toward an existing score: “Try to let the instrument and its sound suggest their own music” (148). In my experience as an instrument designer and user, but also in my judgment as a semiotic researcher, Hopkins’ insight is pivotal. The garbage heaps of history are full of machines that merely comply with instructions—hence the continuous and rapid obsolescence of computers.¹⁵ But machines that contribute their own prerogatives encourage creative interaction that is incalculable beforehand: thus, the instrument

¹⁵ A horizon created by what David Aurbach calls “The Stupidity of Computers.”

itself, inasmuch as it corresponds stochastically, unevenly, or inexactly to the will of the player (in other words, an analogical correspondence), is a site of freedom.

The connection between instrument and user, and the connections within each, create networks that we perceive as style, vibe, and genre, and these in turn are commentary and context for the material and social conditions that give rise to them. In popular styles of music, opposed to the European musical tradition that puts a high premium on the execution of instructions, creative interaction with instruments constitutes the aesthetic criteria for each genre. Consider the example of the electronic guitar amplifier, which was first developed so that jazz guitarists could be heard over brass bands. From a simple “instrumental” prerogative emerged a technology that is the enabling factor behind rock and roll and all of its subgenres. Even more to the point, changes to the design of instruments (sometimes minute and accidental changes) have birthed entire subgenres and subcultures. Sunn amplifiers, as an extreme example, are so loud that the doom genre was invented to accommodate the amount of noise and sensory violence they produce when they “suggest their own music.” On the one hand, the situation created by musical instruments recalls Marshall McLuhan’s dictum, “The medium is the message”—or, as Friedrich Kittler puts it, “the content of a medium is always [...] another medium”: the “message” of musical technology is the aggregate properties and histories of the instrument in question (156). In the case of some genres of “generative” synthesizer music, where the synthesizer plays itself, the medium—that is, the technology’s capacity for creating signals—is the aesthetic object, as well as a medium for the culture of synthesizer programming and its history. But on the other hand, because musical instruments are so entwined with “the Real of stochastic noises” (as Kittler puts it, evoking Lacan), their interactions with players and listeners also function as an index of complex conditions, including all the physical qualities of the instrument and its environment, not to mention those of the listener or player¹⁶ (155). Nor are these two aspects of the instrument contradictory. As Kittler points out, rock music stems from the “misuse of military technology,” and deeply reflects the prerogatives of wartime, but also resuscitates the ancient rituals of lyric poetry, wherein “Bodies became interfaces of a circuit linking them with their environment” (153). Music technology thus evokes and evades

¹⁶ Kittler, as he sometimes does, is playing fast and loose here, both evoking Lacan’s concept of the Real while also attaching the concept to a cybernetics/complexity theory dynamic of information ontology. “Stochastic noises” represent the entropic norm that furnishes the conditions for all patterned phenomena, such as signal or information.

historicism: rock and roll is a manifestation of the military industrial complex, but also the intensification of more fundamental modes of being. What this means is that an increase in power afforded by technical development is paralleled by the adaptation of the imagination to the secret capacities of instruments that evade their ideological instrumentality. In musical genres that do not rely on symbolic instructions¹⁷ (scores), i.e. popular music, the horizon of creation is constituted by hearing and adapting to the instrument's characteristics, and following/guiding those traits into new territory. The most stunning moments of early electronic music are those where the performer becomes entangled in the circuit of the instrument, rather than administering a text from without.

The science of sonic instruments is a deeply semiotic concern, since it signifies the social conflict between semiotic paradigms. The characteristic quality of normal (institutional) science is, after all, its computability: Karl Popper's principle of falsifiability, which putatively regulates what counts as science, is a mechanism that ensures that a premise evinces a logical quantity, either true or false (such that if it is impossible for the premise to be false, it cannot be of the logical type that could possibly true, and is therefore not science proper). If Popper's principle is indeed the border of what we call the scientific, then we might reasonably say that the culture of institutional science is concerned with digital semiosis, or with quantitative signifieds represented by symbols which allow for computation and storage. The technological use of digital semiosis as a means of computation has historically both advanced science and accelerated the need for better technologies of computation, resulting in our contemporary

¹⁷ I must admit my own illiteracy in this regard. I am of a certain type of musician who learned to sight read staff music as a child, but who allowed the muscle to atrophy into nonexistence. Non-reading musicians are so ubiquitous, we have become the subject of internet memification: in one such video a caricature of a non-reading musician yells at their bandmates, "I don't need to read it, just tell me the numbers!" The numbers in question are what are sometimes called "Nashville numbers," which correspond to scale degrees in a particular key (for instance the second degree of the key of C is D). This system is ubiquitous in most popular styles of music: jazz, rock, folk, pop, and rnb. While written scores may make an appearance in these contexts, the numbers offer the player context, but also allow for a high degree of interpretation within that context. For example, if I read a ii on a chart (improvising musicians use charts rather than scores), I have to decide how to articulate the notes of that chord according to context, choosing consonance, dissonance, high, low, loud, soft, fast, slow, wide, narrow, etc.. Of course, score-driven musicians must also articulate, interpret, and feel. But their task is bounded by the score—by faithfulness to a symbolic text. The player of popular music retains the capacity to disengage from all instruction. This, combined with the technological evolution of musical instruments, accounts for the great variety of popular styles: for every act of experimental interpretation of context (musical and technical), a new music is born. This is borne out in the history of the synthesizer. While some of the earliest synth records were of classical symphonies adapted for the new technology (Wendy Carlos' virtuosic 1968 record *Switch-On Bach* stands as a testament to how technology allows for interpretive articulation), other synth-centered records of the same moment became more suited to the capacities of the machine itself, like Morton Subotnick's experimental noise masterpiece *Silver Apples of the Moon* from 1967, which, by the composer's own estimation, was not music at all in the traditional sense. For Subotnick, the score was replaced by notebooks, not full of instructions, but instead full of notes about the machine: knob positions and patch diagrams.

situation, where digital technology is so ubiquitous that even very basic technical functions are administered by means of digital code (why does my toaster need software?). However, the science of sonic instruments retains an attitude of fugitivity with regard to the digital, stubbornly remaining analog. Deleuze writes,

In his great semiological theory, Peirce first defined icons by similitude, and symbols by a conventional rule. But he acknowledged that conventional symbols are composed of icons (by virtue of phenomena of isomorphism), and that pure icons range far beyond qualitative similitude, and consist of “diagrams.” But it is still difficult to explain what an analogical diagram is, as opposed to a digital or symbolic code. Today we can relate it to the sonorous example of synthesizers.

(116)

Here Deleuze passes over a great deal of Peircian theory all at once, and it deserves a closer look. Peirce’s semiotics is triadic, theorizing three main types of sign and the possible degrees of complex interactions between them. Nicole Everaert-Desmedt writes, “A representamen can refer to its object by virtue of firstness, secondness or thirdness, that is, through relationships of similarity, contextual contiguity or law. Following this trichotomy, the sign is called (1) an icon, (2) an index or (3) a symbol, respectively” (243). Warmth is iconic of the sun because the transformations between the object and the representamen retain some aspect of the object in the form of similarity. A sundial is an index of the time, given that its shadow has a relation to the context of the earth’s rotation. A digital clock is symbolic, since its digits refer to number concepts by conventional rule, even though, as Deleuze points out, these concepts may be made up of non-symbolic semiotic material, such as icons. The important thing here is that icons and indices are analog, for they are continuous with the objects to which they refer, while symbols sever continuity, submitting the representation to a system of functional rules. Alexander Galloway continues Deleuze’s line,

“Analogical synthesizers are ‘modular,’” Deleuze continued, contrasting them with digital synthesizers. “They establish an immediate connection between heterogenous elements.” So although digital synthesizers are integral, slicing up the world into masses of homogenous code atoms, analogical synthesizers work through modularity. What this means is that different elements, remaining relatively whole and heterogenous to one another, are nevertheless able to

interoperate immediately. They can touch each other directly, despite their differences. (One can begin to see why the fields of post-structuralism, deconstruction, hermeneutics, and semiotics¹⁸ are so inherently digital; as a rule they prohibit immediacy.) (103)

The prohibition of immediacy (the production of absolute difference) that the digital paradigm offers is its source of power, as we shall see in terms of the material processes that underlie digital technologies, as well as the sciences that produce them. But alongside that history, which is, as I argue later, is inextricable from modernity in itself, there persists the development of analog technologies, the science of sonic instruments, that is not and cannot be predicated upon difference, but instead synthesizes continuities between heterogeneous environments. As Deleuze points out, critical semiology (“post-structuralism, deconstruction, hermeneutics, and [Saussure’s semiology]”) are complicit in the digitality that they diagnose: because they are limited to the operations of symbolic systems, which by definition do not account for their own exterior, even the existence of non-symbolic systems becomes a suspect concept—for the digital, *there is no outside of the text*. The mere existence of analog anything, let alone technologies of analog synthesis, reveal that there is not only something outside the text, but that bustling interactions of the non-symbolic exert pressure upon the structure of the symbolic. Sound technologies contextualize history by reintroducing the analog valence to a modernity that relies on the digital.

In order to theorize the analog, Peirce turns to sonics, illustrating not only the continuity between environments facilitated by instruments, but how impressions of the invisible produced thereby contribute to an epistemology. Recognizing the trend of Western philosophy (and Western culture generally), which mobilizes arbitrary striations to gain computational power, Peirce anticipates the need for an alternative to digitalism: “The tendency to regard continuity [...] as an idea of prime importance in philosophy may conveniently be termed synechism” (Peirce cp. 6.103). Peirce considered synechism to be a revolutionary antithesis to the monads and dialectics of modern philosophy up to that point. In an essay that describes the implications of synechism concerning the idea of an afterlife, Peirce writes,

¹⁸ Deleuze here is referring to Peirce’s theory as “semiological” and Saussure’s as “semiotic,” while for Deely and the biosemiotics circle, the convention is the opposite. I use the latter convention.

A friend of mine, in consequence of a fever, totally lost his sense of hearing. He had been very fond of music before his calamity; and, strange to say, even afterwards would love to stand by the piano when a good performer played. So then, I said to him, after all you can hear a little. Absolutely not at all, he replied; but I can feel the music all over my body. Why, I exclaimed, how is it possible for a new sense to be developed in a few months! It is not a new sense, he answered. Now that my hearing is gone I can recognize that I always possessed this mode of consciousness, which I formerly, with other people, mistook for hearing. In the same manner, when the carnal consciousness passes away in death, we shall at once perceive that we have had all along a lively spiritual consciousness which we have been confusing with something different (Peirce CP. 7.577).

Peirce's spirituality is a topic for another essay, but the consciousness that Peirce hypothesizes here, which is raised to consciousness by the loss of conventionalized sensations and by the presence of sonic phenomena, falls squarely in the category of black science that I will discuss in the conclusion: a sacrifice of the rational and a use of analog instrumentation (directly or by proxy) that brings unimagined environments close to hand, augmenting the horizon of action. As in the case of Suzanne Ciani's experience of the Buchla 200 (below), the distinction between life and death becomes porous, not only because of the modularity afforded to analog processes, which connects disparate objects through immediate exchange, but because of the realization that this continuity extends beyond the audible spectrum. Life leaks into sensory domains where the concept of life has not yet been established as a symbol.

Death, considered symbolically/digitally, is the cessation of instrumentality. Ludwig Wittgenstein writes, "Death is not an event in life: we do not live to experience death"—an extension of his quasi-nominalist assertion that philosophical insight ends where language ends, a position comfortable within the history of computation (87). But in Peirce's synechistic perspective, which accommodates the continuous augmentations of consciousness' physical energies, life and death are states of more or less activity within a continuum, and thus the nominal paradox that is the experience of death becomes an unnecessary abstraction. That continuum, which includes death, is formed by susceptibility to "habits," as Peirce calls physical laws. Peirce leaves room for the possibility of expanding the habits that support the processes which result in life. Not through language (in the sense of whatever is communicable or

computable) but through sonic encounter. Symbolic language is for Peirce (anticipating and contradicting Wittgenstein) not the defining characteristic of this expanse (or philosophy), but merely a reification of reality's habits that admit of symbolic representation, a "mode of consciousness." Peirce's story about his friend does not merely show the ancillary function of language within the continuum of life processes, however, nor does it settle for a critique of language or consciousness on the basis of music. Peirce models a synechistic epistemology¹⁹ using this sonic encounter, and this model feeds back.

In the last two sentences of Peirce's anecdote about his friend's discovery of a new mode of consciousness, the grammatical orientation of the story reflects a breakdown of intersubjective striation that mirrors the breakdown between life and death. The story is narrated without quotation, so the shifts in narration are only indicated when Peirce explicitly denotes the subject, and the subject remains explicit until his friend's story ends. The next sentence, however, allows for ambiguity as to the identity of the speaking subject: "In the same manner, when the carnal consciousness passes away in death, we shall at once perceive that we have had all along a lively spiritual consciousness which we have been confusing with something different." It is unclear whether it is Peirce or his friend speaking here, but even if we infer that it is Peirce, the subject becomes "we," as though the undifferentiation that has occurred in the narrative (between hearing/feeling, life/death) has occurred between the subject, the writer, and the reader. The appearance of this hivemind voice ushers us into a sublime²⁰ idea: that death and difference are but habituated articulations of what we will probably discover is in fact just another environment, with its own unique features and possibilities. This is where we end up if we follow Peirce's narrative and his analogical interpretation thereof, which depends on the formal similarity between what we recognize as life using our reason as filter to our senses, and what we recognize as sound using our ears alone, stretched to accommodate that which we do not yet

¹⁹ If it can be called an epistemology. "Epistemology" connotes distinct objects of knowledge, of which, in this case, there are none of the traditional type. The more correct term is probably that which Peirce himself used: phaneroscopy. Peirce: "Phaneroscopy is the description of the phaneron; and by the phaneron I mean the collective total of all that is in any way or in any sense present to the mind, quite regardless of whether it corresponds to any real thing or not" (CP 1.284). In other words, phenomenology. But for Peirce, that which is present to the mind can only be so on account of an interpretant, such that the phaneron is (speaking synechistically) analogous to its source in non-trivial ways. But in this way we can actually speak of a synechistic epistemology, because the object of knowledge left behind is the suspicion that the paradigms of knowledge themselves admit of continuity, change, and augmentation.

²⁰ I don't mean "sublime" in any technical sense, even though I do think that my concept of what qualifies as sublime has been influenced by Kant. So what I mean is that the breakdown of individuated subjects in Peirce's story reveals an awe-inspiring expanse of connections that are not regulated by identities. I might also mean that this expanse of resonant quasi-entities also invokes a feeling of dreadful but survivable terror. But mostly just the first, more mundane, thing.

recognize but which in both cases can be said to have a veritable if not verifiable presence. This is a powerful analogy, which speaks to both the conceptual and sensory capacities of the analog, which allows for modularity in physical environments and also (of central importance for Peirce) connections of conceptual similarity. Analog technologies, in this sense, are physical analogies, and vice versa.

And yet, while Peirce uses this anecdote to show how synechism implies a concept of afterlife, it also reveals a reverse proposition, that we, in the presence of sonic phenomena, are already living a kind of afterlife that we do not yet recognize. Peirce's friend does not develop a new sense, but the piano, the sonic residue of hammers on strings, is registered undifferentiated sensations throughout the body. From Peirce's interpretation, we get the idea that the content of this undifferentiated sense is vague or "spiritual," but there is a detail in his friend's narration that returns us to the piano itself: Peirce's friend tuned in "when a good performer played." It is not merely the fact that he can hear the piano, but that he can hear it being used skillfully. Skill is an analog concept; it connotes, as Wheeler writes, "experiential knowledge [...] and the local and particular as opposed to the universal and abstract" (46). In this sense, Peirce's friend's real impulse to draw near to the piano is to be part of the feedback circuit of creative interaction with the instrument. Also of importance is the instrument itself: the piano (whose name originates from its ability to play soft [*piano*] or loud [*forte*]) allows for a wide range in dynamics, opposed to its predecessor, the harpsichord, essentially a single-volume instrument. The real afterlife here is that of Peirce's friend, whose sensory access to the world lives again through the dynamic continuum of the piano's wide-ranging sonic vibrations throughout his body, which reintroduce him to his own capacities. Like Robert Johnson, who I will discuss further in the conclusion, he is inducted into freedom via the blues—what begins as playful amelioration of suffering opens onto a new dimension of activity, even if only internal in the form of a defamiliarized sense. Thus, the sonic afterlife is entirely immanent (sharply different from conventional metaphysical models of transcendent being).

Peirce creates an unintentional recursion—whatever he says about synechistic afterlife can also be said of this sonic encounter. Heaven is listening to a piano with your body. I don't mean to make a religion of sonic experience here. But, by using sonics as exemplary of the synechistic interpretation of the afterlife, Peirce unwittingly shows how the sonic is constitutive of its own local, invisible, and enlightening afterlives. That is to say that the circuitry of

perception contains the possibility of encountering—becoming continuous with—other circuits that drastically alter our conventional schemas. Kafka, in the *The Zürau Aphorisms*, writes something to the effect that enlightenment is not a highwire but a tripwire. Here we find that it is not a tripwire but the wires connecting the diverse components of a circuit. This connection is clearly, by the standards of most revealed religion, blasphemous, as well as subversive in terms of the bifurcations that have proved central to capitalist economics and individualist socialization. There is a deep, non-trivial connection, such that philosophical consideration of this connection in its sonic form deteriorates the borders that organize the subject in language. The discovery that individuated senses are merely the habituated labels for deep undifferentiated senses that have yet to be cognized, leads to the inference that undifferentiated yet expansive senses exist, even in the realm of the social. May the circuit be unbroken.

Circuitry is a fundamental term here, whose function appears at first to be metaphorical, but which, in the semiosis of media, is literalized by practice. In fact, it is the literalness of the concept of circuitry that is at stake. Kittler is known, as John Durham Peters reminds us in *The Marvelous Clouds*, for provocative concepts, and the idea that rock music functions as a connection between self and environment, and between past and present, is indeed meant to provoke. But the technicity of rock evinces a literal circuitry that connects the player with their environment, in the form of electromechanical signals that run from instrument to amplifier to environment and back. Jimi Hendrix, according to an apocryphal story, is said to have gone through dozens of Fuzz Face distortion units until he found the one that felt right to him. The Fuzz Face circuit is extremely primitive, consisting of fewer than a dozen parts—and the parts that determine the sound of the unit (the transistors, resistors, and capacitors) differ by extremely small amounts of germanium, silicon, carbon, and electrolyte. But those small changes amount to “differences that make a difference,” to use Gregory Bateson’s minimal definition of meaning. It is Hendrix’s attentiveness to the seemingly trivial difference between units that is not only part of his legend, but an important function of his aesthetic work. Here, circuitry is not merely figurative, but denotes the real series of connections between body (already a circuit of circuits), instrument, electricity, metal, wood, paper, air, and body again.²¹ The “precise algorithms” of the

²¹ Much has been made of the why Hendrix chose the unit(s) he did, and much status has been attributed to particular materials for their special qualities—germanium transistors in particular have become the object of cultish reverence—but the point I am trying to make is not about the rightness of any particular choice.

heart, as Bateson calls them, interface, by means of a shared basis in (analogical) circuitry, more or less directly with the electromechanical world of sonic instruments (139). Bateson, who we must remember as a philosopher of the same moment as Hendrix, calls this propensity for connection “the fact of circuitry,” and deploys it as a primary critical tool for the analysis of art and science (146).

In an essay from 1967²² titled “Style, Grace, and Information in Primitive Art” Bateson proposes something seemingly unscientific sounding: “I argue that art is a part of man’s quest for grace” (128). Grace seems a bit out of bounds for anthropology, but when we follow his thinking, we find an evolutionary and cybernetic justification for its deployment. Bateson writes, “Man’s behavior is corrupted by deceit—even self-deceit—by purpose, and by self-consciousness. As Aldous [Huxley] saw the matter, man has lost the ‘grace’ which animals still have” (128). By today’s estimation, Bateson’s thesis may look like a bit of romantic boilerplate that would be at home with Wordsworth or Schiller. And indeed, the grace to which Bateson refers is an unselfconscious consonance with “nature” too. But as befits the transistor age, nature here is a complex of circuits: for Bateson, the concept of grace, a state of elegant sympathy with surroundings that humans have lost in our attempts to control our destiny, is a sign of something rudimentary—a synthesis between differing prerogatives within the same system. He writes, “For the attainment of grace, the reasons of the heart must be integrated with the reasons of the reason” (129). What so shocks and inspires me about this side of Bateson is how he himself integrates paradigms that seem to have so little common ground, such as engineering and anthropology, in order to paint a picture of the fundamental realm of human behavior. Integration is not only what he sees as the primary function of art, it is also the method of his own philosophy, which is rooted in a conviction that regimes of nature, logic, technology, and representation are compatible.

His argument goes beyond arguing that some artifacts or insights from the heart should arise to the reason in order to achieve grace, but that the very mechanism by which the heart and the reason connect is the subject of art and the criteria for grace. Art for Bateson is a matter of interface. Thus, Bateson translates Isadora Duncan’s famous quote—“If I could tell you what it meant, there would be no point in dancing it”—to “This is a message about the interface between

²² The same year as Hendrix’s *Are You Experienced?*

conscious and unconscious” (137, 138). Like in Peirce’s synechism, continuity between differing types of phenomena is a presupposition of Bateson’s argument. But Bateson builds on Peirce by elaborating a concept of interface derived from the electronic age, wherein analog connections became a fact of life. Where Peirce finds synechism within the invisible (and even inaudible) sonic world, Bateson derives his synechism, his rootedness in circuitry, from the machine.

Bateson finds the criteria for grace, aesthetic and otherwise, within the tube-driven world. Wordsworth and Coleridge had their lakes, but Bateson had, apparently, a broken television. “Consider the impossibility,” writes the Bateson, “of constructing a television set which would report upon its screen all the workings of its component parts, including especially those parts concerned in this reporting” (136n). Like his predecessors, Peirce, Whitehead, and James, Bateson’s assessment of the psyche is fundamentally pragmatic. Problems of psychopathology, aesthetics, and culture are ultimately problems of the capacities of materials in question and their historical economy. His image of the television that cannot watch itself neatly sidesteps the cascading abstractions that tend to fill theory of mind, emphasizing instead what is technically feasible and likely in the evolutionary development of a system. “No organism” he writes, “can afford to be conscious of matters with which it could deal at unconscious levels. [...] This is the economy achieved by habit formation” (143). It is hard to miss the influence of Peirce in these lines, a philosopher for whom habit is a primary concept that subtends consciousness, representation, and evolution. But to illustrate the limited, pragmatic, and contingent nature of consciousness, Bateson returns repeatedly to the example of the television. Indeed the thought experiment of the television that must watch itself is a potent parallel to the processes of consciousness: how can any machine be expected to both perform its function and also report on the process of performance?²³ While the evolution of consciousness does afford more layers of telemetric feedback between unconscious and conscious systems (discomfort to contentment), this intercommunication is contingent upon evolutionary habit, which cannot logically anticipate extreme circumstances. Hence trauma. Bateson returns to the television: “If the TV suffers from a blown tube, or the man from a stroke, effects of this pathology may be evident enough on the screen or to consciousness, but diagnosis must still be done by an expert” (143). Today it is hard to imagine consulting an expert to diagnose your television, since repair is often more expensive

²³ Bateson suggests that much of the history of western psychology is motivated by such a fantasy of total consciousness.

than simply replacing the unit, because of miniaturization and digitization of the component parts. But in the mid-sixties, televisions could be repaired almost indefinitely. Note Bateson's language: "If the TV *suffers* from a blown tube." Of course this analogy is intended to be relevant to its psychological parallels, but all the same, it's hard for me to imagine my current television suffering from anything other than what I force it to display. On the other hand, my tube guitar amplifier, an Ampeg SuperJet that came into my life with cigarette burns in the tolex, has what I always call a cough: in its thirty or so years of heavy use, some resistors or capacitors have become non-optimal, creating an occasional little splutter sound when the disequilibrium effects the bias of the amplifying circuit. It's not terminal, and the SuperJet seems to feel better with frequent loud operation and occasional fresh air. But when it is cold, it splutters more. The cough, that is to say, is habitual *sensu* Peirce: "Moreover, all things have a tendency to take habits. For atoms and their parts, molecules and groups of molecules, and in short every conceivable real object, there is a greater probability of acting as on a former like occasion than otherwise" (CP 1.409). A spike of current has found its way into a well-trodden path that it otherwise would not, creating a new (unwanted) noise. I personally find this cough charming.²⁴ More to the point, as a child I was obsessed with magnets (in the same way that I imagine that many children are fascinated by the invisible force of magnetism), and once, left to my own devices and armed with a strong hobby magnet, I got around to seeing what it did to the family (tube) television. I was elated by the change in pattern and color I could effect with the magnet up against the staticky screen. But I soon discovered that I could not undo the change, and no matter how I moved it around, there was always a purple spot on the screen now. My parents were not elated. But I learned a valuable lesson: Tube televisions respond to magnets by rerouting the trajectory of electrons within the tube, creating a new habitual relationship of colors. The television suffered a change in its optimal habitual arrangement. The television was unaware of this, as Bateson predicted. My experiment will not be repeated by contemporary children—LCD screens, now ubiquitous, are impervious to magnets. The philosophy of the analog world presupposes continuity, plasticity, and feedback, concepts that seem alien in a

²⁴ This has not always been the case. There was a period when I performed with a 1967 (yes, the same year as Bateson's "Style, Grace...") Sunn Concert Lead. I really liked this amp, even though nobody seemed to appreciate that it was uncontrollably loud (a hearty 100 watts). That amp developed a cough too, which was not so charming. It was tubercular, grating, and crunchy. I took the machine apart and changed many components in order to fix its strange noises. But there came a point where replacing parts would interfere with what sounded *right* about it. Looking back now, I know that the noises were integral to the machine.

digital world, but which nonetheless hold sway at micro and macro levels of complexity. Moreover, it is these concepts that allow us, as Bob Moog noted in the introduction, to develop a feel for the other. It is precisely the chaotic possibility of connectivity that allows for love, beauty, and wisdom.

For Bateson, the modularity of analog things carries with it an implication about the limits of consciousness and the role of art. He writes, "...life depends upon interlocking circuits of contingency, while consciousness can see only such short arcs of such circuits as human purpose may direct" (146). The two halves of this equation are equally important to what follows. First, life. For Bateson, the "fact of circuitry" is the basis not only for a aesthetic evaluation, but also for all scientific insight, since questions of art, psychology, or philosophy are fundamentally questions of the status of connections between self and other or self and environment, which are nontrivially linked to the evolution of such systems that mediate these connections. Likewise, when I talk about the transistor and the vacuum tube, I am thinking about how these technologies mediate and augment basic connections. Instructively, Bateson argues that simple biological or electromechanical systems communicate (relate via differences) through a basic type of semiosis. Without symbolic representation, which presupposes a system of conventionalized signs, plants, animals, and machines still communicate, but via analogic signs, which Bateson calls iconic, echoing the Peircian convention. The "circuits of contingency" that support our livelihoods are fundamentally analogical connections to non-human parts of the biological and mechanical world: from the tools we use to the food we eat, human life depends upon connections that occur at the level of physical correspondence—real analogy. Cellular receptors, ergonomic interactions, biomimicry, and sensory feeling all depend on a simple correspondence between self and other/environment. The simplicity and the implications of this insight cannot be stressed enough: on the one hand, the minimal definition of signs as differences that make a difference means that signals pass between all sorts of entities depending on their capacities to sense and signalize. Semiosis is thus extremely general, including even the way the moon's gravity makes differences in the earth's oceans, a difference that both undergirds and has

meaning for living organisms.²⁵ Semiosis is thus both general and complex, both ubiquitous and surprisingly novel.

Let us pause here at this threshold, for it is the point where meaning and complexity meet. In the complex of interlocking systems and subsystems that sustain life, every change in circumstance has effects at every level of connectivity. The classic example from complexity science (once called “chaos theory”) is of course the American butterfly whose flight creates a tsunami in Japan. Old news, I know. The moment for acknowledging complexity seems to have been somewhere around when the humanities discovered Ilya Prigogine and Isabelle Stengers’ *Order Out of Chaos* four decades ago, a work that contributed the vocabulary for phenomena like dissipative structures and self-organization in non-equilibrium systems. But the humanistic disciplines wavered in their attention to this development. The torch was however carried by biosemiotics, which traces its origins to Bateson and Peirce, and identifies semiosis as the redundancy that is available to low entropy systems, or within the decrease of chaos. Hence a collapse between the concepts of life and semiosis: the same types of organized matter that allow for life necessarily allow for redundancy of pattern, or information. The problem for the humanities is that redundancy is the norm in the realm of human affairs, not the exception. The human world is highly coded. “Sumer discovered writing;” write Prigogine and Stengers, “The Sumerian priests speculated that the future might be written in some hidden way in the events taking place around us in the present” (4). Humans, evolved to be attentive to the types of signs we deliver to one another, tend to see nature in terms of those same types of signs—writing, the vehicle of human modernity, in particular. The bias toward writing, which I will later diagnose as a phenomenon called digitalism, is an understandable prejudice considering the types of signs relevant to human experience. The Sumerians, prototypical of modern scientists, were correct to think that the universe is made up of meaningful redundancy, but wayward in their belief that the universe speaks the language of human modernity. If complexity has any implication for human arts and sciences, it is that the codes of human consciousness are an epiphenomenon of redundancies that are more basic. While “chaos theory” and the humanities seems to have burnt

²⁵ I have read, I can’t remember where, of a mechano-semiotics that addresses these types of relations, where purely mechanical effects become the basis for downstream meaning, but, in any case, there would be very little meaning on this planet without fundamental cycles of difference like the seasons and tides.

out on representing infinitudes,²⁶ the idea that most redundancies that arise from chaos are sub- or paralinguistic seems to have gotten lost in the noise. Schopenhauer was among the first Western philosophers to suspect the non-centrality of human signs in the universe, and it led him to formulate a metaphysical picture wherein consciousness is a naive speck in a vastness of uncaring and horrifying forces (a cosmic pessimism that shares the spirit of H. P. Lovecraft's fiction): for Schopenhauer, the non-human world speaks a language we cannot decipher, and we can rest assured that its discourse does not favor us. Schopenhauer's pessimism mirrors the attitude of Giambattista Vico, who writes in *The New Science*, it is a "marvel that the philosophers should have bent all their energies to the study of the world of nature, which, since God made it, he alone knows; and that they should have neglected the study of the world of nations, or civil world, which, since men had made it, men could come to know" (Prigogine 4). While Schopenhauer is exceptional in moving away from an anthropocentric paradigm, he ultimately reifies another classical anthropocentrism: the idea that nature is fundamentally opposed to human activity. But complexity science and semiotics confront this premise. "Present day research," write Prigogine and Stengers, "leads us farther and farther away from the opposition between man and the natural world" (4). This collapse is precipitated by the discovery that human knowledge is contingent upon (and reciprocal with) the non-human, that human language is contingent upon non-human paracommunication, that consciousness is contingent upon the unconscious.

As Bateson's equation posits, the "fact of circuitry" implies that "consciousness can see only such short arcs of such circuits as human purpose may direct," meaning that the majority of processes that subtend human life are necessarily unavailable to normal consciousness—a premise that conflicts with modern Western conceptions of history.²⁷ Historically, as Bateson argues, the Western attitude has been that consciousness is the norm, and that unconsciousness is symptomatic of some kind of failure in normal function. This attitude is expressed through a kind of fantasy of total consciousness: Even Freud was convinced that "where id was, there ego shall

²⁶ N Katherine Hayles' anthology *Chaos and Order* from 1991 represents the height of theoretical inquiry into the connection between complex dynamics and literature. It contains a wide variety of considerate approaches to the problems of complexity and literature, including Eric White's piece of *The Crying of Lot 49*, which I will discuss later. This style of criticism seems to have fizzled out as merely a niche approach, rather than becoming more basic to other approaches.

²⁷ Biopolitics is the social and institutional proof of this dynamic. The emphasis on consciousness here manifests as the epistemologies that permit institutional incursions into deeper and deeper levels of the processes of life. With the evolution of technologies that integrate the cognitive and the digital (such as the contemporary push toward brain/computer interfaces), the unconscious is in increasing danger of colonization.

be” (Bateson 136). But consciousness is always at a disadvantage: the very evolutionary circumstances that create the phenomena of self-awareness limit the extent of that phenomena. Bateson’s image of a television tasked with watching itself illustrates the aporias within the expectation that consciousness should be total, or that knowledge should be the criteria for beauty. While Schopenhauer and Miguel de Unamuno relied on a nascent Darwinism to understand the origin of consciousness, resulting in a pessimistic image of the human as a monkey afflicted with the illness of awareness, Bateson’s technical analogy lacks their sense of cosmic catastrophe: awareness, in this example, is not a cruel evolutionary dead end, but one of many regulatory gestures that function as an interface between self and other, or self and environment. But Bateson’s analogy also emphasizes the historicity of the process of consciousness itself. On the one hand, historical paradigms (Darwinian evolution for Schopenhauer and Unamuno; electronic circuitry for Bateson and the cybernetic generation) influence the human understanding of the process of consciousness itself; but on the other hand, these analogies direct awareness to aspects of consciousness that correspond to historical interfacing between consciousness and unconsciousness. The first of these is the historicist/structuralist insight, that our symbolic technologies construct historical consciousness; the second is the cybernetic insight, that the feedback between biology, technology, and culture are part of, or become, life’s regulatory process.

Notice the difference between these insights. Since the historicists (particularly of the Marxist tradition) have the advantage of representing constructs as purely ideological, political work can be extracted in the form of revolutionary imagination, or counter-ideology. But since the cybernetic outlook sees the imagination as necessarily relaying signals about the unconscious (or at least about functions for which there is an opacity of purpose), revolution can never take the form of pure negation, since even lies are coded on top of dynamics which have no negation²⁸—that is to say that the concepts of revolution and ideology, which have their basis in a dialectic that relies on negation, are difficult to place in the cybernetic paradigm. Prigogine and Stengers write,

...mechanicism remained a basic difficulty facing dialectical materialism. What are the relations between the general laws of dialectics and the equally universal

²⁸ Bateson reminds us that, when we tell someone we love “I love you,” they are unconsciously likely to check this message against our involuntary paralinguistic gestures.

laws of mechanical motion? Do the latter “cease” to apply after a certain stage has been reached, or are they simply false or incomplete? To come back to our previous question, how can the world of processes and the world of trajectories ever be linked together? (253)

Attempts have been made to show that natural laws are indeed fundamentally dialectical, which is to say that evolution is fundamentally revolutionary,²⁹ but these have reflected this “basic difficulty,” and in their worst moments represent physical phenomena that do not conform with dialectic as false or illusory. Dialectical materialism’s problem stems from the arbitrariness of the site of negation: the means of production and the symbols of false consciousness issuing there from. From the point of view of complexity studies and cybernetically inclined semiotics (as opposed to semiology), one might as well select frogs as the index of history, simply because processes and trajectories are bound together in ways that are themselves contingent. I don’t mean to be flippant here, but the (classic) historicists think that history can be understood if concepts are contextualized by means of the human systems of production (agricultural, industrial, cultural), while taking the non-human means of production, which are more or less unconscious, for granted. Dialectical materialism gains its critical power by tracing “short arcs of [...] circuits” that pertain to industrial, commercial, and technological power, which describe a great deal of human circumstance. But this type of historicism runs the risk of becoming anthropocentric in the extreme, assuming the closedness of human systems. Historicism has thus been insulated from the historicity of time itself, shielded from the radical contingency of the very processes that make life, evolution, and human affairs possible. Dialectical materialism, with its demarcated (or striated, to use Deleuze’s language) stages, provides the historicist with models of history that are always-already packaged as narrative. As Frederic Jameson confidently posits, narrative is an “all-informing process [and] the central function or instance of the human mind” (13). Jameson admits that he inherits this perspective from philosophical idealism, but leaves the reader to work out how this premise and his materialism should work together. Narrative implies a certain paradox that must be considered at the outset of criticism: the idea of “connected events,” which is central to the concept’s definition, is not illusory, since contingency is the law that sustains life, but this contingency also means that those connections

²⁹ I am thinking of Lewontin, R.C. and Levins, R., "Biology Under The Influence, Dialectical Essays on Ecology, Agriculture, and Health," New York: Monthly Review Press, 2007.

reach beyond the structures of culture and consciousness. The cybernetic picture of history (necessarily evolutionary) is less subject to schemes of political control or causal description by virtue of its entropic orientation. Semiosis is not a system of sealed pipes that deliver messages, but a momentary predominance of redundancy within a universe of roiling potential. Evolution, life, and consciousness, as emanations of this precarious redundancy, are special in their partial and imperfect sublimation of noise. As pathologist Michael Angelo has recently said, “Evolution is not like a scientist with a protractor measuring things out; it’s like a drunk guy with duct tape” (Inverse). Prigogine and Stengers put it similarly, concluding that evolution can be summed up in the phrase “Let’s hope it works” (313). This pragmatic hope achieves neither narrative or symbolic completeness, but only motion in a new direction, which integrates environment and body—it is a lurch in the direction of potential, if partial, homeostasis, facilitated by the body’s subliminal awareness of ever-changing circumstance. Thus, circuitry problematizes the modern idea of history as progressive, storied, or conscious, but gives us back history as continuous, accidental, and full of potential.

The problem then becomes one of describing the history of art in terms of this other, cybernetic and semiotic, materialism, which does not content itself at the threshold of human language, but incorporates an awareness of radical contingency and reciprocity. The materialism that I advocate, in light of complexity, contingency, and semiosis, is a kind of subliminal naturalism that is in conflict with the constructivist and structuralist leanings of historicism, but not to the point of essentialism—the fact of circuitry indicates a contingency upon physical conditions, but one that is actually rooted in constant change and spontaneous autonomy. I am not afraid of essentialism,³⁰ because if we can say anything about nature, it is that it is pluralistic, manifold, and unimpressed by stasis: it has no essence to return to, only the new essences it makes in its perpetual becoming.³¹ Complex contingencies can never be reduced to deterministic essences. In biology, the connection between many cells creates a network that has new capacities, but which is always in conversation with the underlying parts. In aesthetics, this “fact of circuitry” means that all expression includes the representation of underlying systems, some

³⁰ Essentialism has a bad reputation for very good reasons. The idea of originary essence is central to the function of every kind of social conservatism and fascism. But the fear of essentialism, which seems to be obligatory within Western academia, belies a strange paradox, since it seems to acknowledge that some essences are preferable to others, and that the future should be defined by an essence that the present currently lacks. “The end of history” itself is one of these future essences. But the problem remains that the universe seems to abhor the kind of stasis that could manifest pure essence, either in the past or in the future.

³¹ As Peirce puts it, “The universe ought to be presumed too vast to have any character” (CP 6.422).

(most) of which are inaccessible to consciousness, but which are nonetheless present in their physical substrates.

Thus we return to sound. But why? Again, Schopenhauer as educator: “The effect of music is so very much more powerful and penetrating than is that of the other arts, for these others speak only of the shadow, but music is the essence” (257). Let us leave for a moment the platonism of shadow and essence, and concentrate on the (perhaps inadvertent) materialism here: sound is, in a very real sense, a matter of power and of penetration. So is light, but the difference is that light occurs in frequencies that require special sensory organs (eyes), while sound, slow enough to move the atmosphere, penetrates the body. As illustrated in Steve Goodman’s *Sonic Warfare*, the ear hears frequencies from twenty to twenty thousand oscillations per second, but the mind and body are sensitive to a large margin below and above those limits (x). Let us consider the biblical interpretation of light: “The eye is the lamp of the body. If your eyes are healthy, your whole body will be full of light. But if your eyes are unhealthy, your whole body will be full of darkness. If then the light within you is darkness, how great is that darkness!” (Matthew 6:22-23). The eye is here a metaphor for perception generally, and relies on the singleness (the word “healthy” is translated as “single” in the King James Version) of light’s entry into the body. But sound isn’t single (and thus makes a bad metaphor for purity). It is multiple, continuous, vast, and unstoppable. Moreover, while bioluminescence is a fairly specialized adaptation on this planet, communication via sound is ubiquitous (except among sharks, who seem to have capitalized on silence). It is the ubiquity of sound generation and perception that creates the scene for reciprocation between these faculties: Michel Serres writes, “We can neither speak nor sing without the feedback loop which guarantees the audibility of our own voice. The ear guarantees and regulates the mouth, which emits noise in part for the speaker, in part for others, who in turn guarantee other feedback loops” (110). Hearing is singing, listening is harmonizing. This is, again, mostly unconscious: “mode locking” circuits in the brain detect redundant frequencies, and resonate in analogous patterns. We hear in Serres’ words the cybernetic paradigm that motivates Bateson and his cohort: feedback—the recycling, amplification, and reproduction of signals, gestures, or concepts—regulates and creates new stabilities. The machinery of sound creates islands of history through the inevitability of call and response, and through the commonality of harmony. You will notice that I have shrugged off somewhat the idea of “music” in favor of sound. Music gets us into trouble. Sussane Langer’s

Philosophy in a New Key provides a definitive overview of the difficulties in assigning meaning and value to music, in detail that I cannot hope to duplicate here. Music criticism is propelled toward considerations of form, convention, and symbol, which always beg the questions of literacy, sociality, and history. The consideration that I bring to bear upon the concept of the postmodern is much more humble: not music, but the production of sound. While sound production is most often employed for the purposes of creating music, the signal generators are an art of their own. In terms of the aesthetic meaning, we may, with reservations, agree with William James when he says that music is “a mere incidental peculiarity, with no teleological significance” (Langer 210). This is not the bad news that it sounds like. If music is, as it must be on some evolutionary level, an “incidental peculiarity” based on the contingencies of sensory and motor development, then an examination of the peculiar ways that sound, body, and environment interact tells us something about a specific historico-evolutionary moment.

To put it briefly, sonic media problematizes a historicism that leaves out the exigencies of nature, because there is no circumventing the physicality of signal-generating and listening circuits. In order to coax an instrument into being, one must be attentive to idiosyncrasies, qualities, and capacities of its materials. There is husbandry in this act. “Farming” Germanium, the material in early transistors, is time and labor intensive, and even once the materials are selected, processed, and integrated into transistors, the end product requires negotiation. While Jimi Hendrix allegedly preferred the stability of Silicon transistors in his Fuzz Face distortion circuit (this selection also an act of husbandry), many others have opted for the Germanium version, which differs more unit to unit and is also highly sensitive to external temperature. Imagine playing on an outdoor stage only to discover that your rig sounds different in the sun (more angry, spluttery, and sensitive). This is to say that the “natures”³² of Germanium and of Silicon are different, and these differences bear meaningful opportunities for the expression of the state of the system as a whole.

All these considerations of circuitry, contingency, meaning, evolution, and sound bring us to the main question of this essay: how does narrative participate in the feedback loops made by sound and its technologies? There is certainly a conflict between narrative and

³² What is the difference between nature and essence? Nature is a pattern that exists because of contingency, or to put it in Peircian terms, a habit. Germanium crystals have the pattern they have because of heat and chemical conditions in certain parts of the earth. Essence is imaginary: the abstract representation of germanium crystals without history, context, or physicality.

paracommunication, in that narrative's symbolic representation can be (and has been) treated as closed off from the non-symbolic representations. As in the case of dialectical materialism, the linguistic paradigms that have been brought to bear upon narrative art, particularly Ferdinand de Saussure's semiology and its derivatives, render a gulf between language and paracommunication, between human writing and non-human signals. But, from a semiotic perspective, the redundancies of narrative (patterning that allows us to create nonrandom guesses) and those of animal calls and music share a basis in material history, which guarantees meta-patterning that connects both phenomena. The meta-patterns often consist of exactly the type of information that is most likely to be taken for granted due to its familiarity—correspondences between pitch and meaning in verbal language; the meaningfulness of lullabies for prelingual children.

As Viktor Shklovsky noted in "Art as Device," it is precisely the familiarity of habitual perception that art interrupts. Of course "difference" and "interruption" can be taken as digital prerogatives, but this would be to create a striation of absolute difference, when in most paracommunication a (somewhat) different quality will suffice. The non-symbolic (analog) nature of paracommunication binds us historically to the nonhuman world via the unconscious. This is perhaps why Shklovsky differentiates story (*fabula*) from plot (*syuzhet*), story being "what happens in the text" and plot being "a construction which uses events, people and landscapes, which shrinks time, extends time or shifts time, and thus creates a phenomenon which is felt, experienced the way the author wants it" (24). The "construction" of plot, even in Shklovsky's description of it, is manipulated in a way that is more gestural than symbolic (although it can be both): used, shrunk, and shifted.³³ It is in the unfamiliar manipulation of plot that what is unconscious (or "automatic" in Shklovsky's terms) is restored to our sense of life. Thus we get to Shklovsky's most famous statement:

And so, what we call art exists in order to give back the sensation of life, in order to make us feel things, in order to make the stone stony. The goal of art is to create the sensation of seeing, and not merely recognizing, things; the device of art is the "*ostranenie*" of things and the complication of the form, which increases the duration and complexity of perception, as the process of perception is its own

³³ Bateson notes that text often is formally iconic. He uses the example of an essay on worms that begins with the head and works its way down the length of the animal, thus analogizing the shape of the creature itself (133).

end in art and must be prolonged. Art is the means to live through the making of a thing; what has been made does not matter in art. (80)

Shklovsky makes it explicit that the process of perception is the concern of art. Importantly, Shklovsky describes defamiliarization not in terms of stark differentiation, but in terms of “complication,” a word that conveys the idea that art as a device is the acknowledgement of the object’s unrepresented qualities that are still continuous with its reality. While it is clear that Peirce sees perception as rooted in continuity, Shklovsky’s interest in the analogical is a bit more oblique. Nonetheless, there is sufficient evidence that suggests that Shklovsky based his aesthetic considerations upon ideas consistent with Peirce’s. Take for example Shklovsky’s description of his infant son: “He doesn’t walk yet: he runs. His life is still continuous. It doesn’t consist of single drops. It’s experienced as a whole” (93). Underlying Shklovsky’s concept of defamiliarization is the recognition that habituation shapes conscious thought, but also that over and before consciousness the human birthright is to continuity of thought and experience. The synechistic dynamic extends Shklovsky’s aesthetics past thought and experience to the realms of other connections—from continuity to modularity. This dynamic comes into its own in the context of electronics.

It’s sometime in the mid-naughts, and I am in the control room of a recording studio, waiting for the engineer to tell me and the rest of the band what to do next. There is a lot of hurry-up-and-wait time in a recording studio. No matter how well you know your music or how prepared you are for the session, you still have to hang out while the everyday engineering tasks are performed, like placing the drum mics, calibrating the tape machine, or running cables from room to room. Prepared for these periods of required patience, our engineer leaves a stack of magazines in the corner of the control room, and one is smiling at me. It’s the May/June 2001 issue of *Tape Op* magazine—a special issue on budget electronics. Its cover features a large image of an anthropomorphized Playskool children’s tape player/recorder, with eyes screen-printed over the cassette reels, and a speaker grill the shape of a Cheshire cat grin. *Tape Op* is a magazine for recording studio nerds, for engineers and musicians who daydream about tape machines and vintage microphones. Being a broke musician who can barely afford studio time, I’m drawn to the idea of budget electronics, so I begin reading. The cover story, “Octant: On Hotrodding Playskool toys,” introduces a valuable heuristic concept: circuit-bending. As Matt Steinke, who performs as Octant, explains, circuit-bending is a way of finding unique musical

sounds within cheap mass-produced electronic toys by vivesecting them—using yourself and/or alligator leads (wires with spring loaded teeth at each end) to make new connections while the machine is on, in a trial and error jam session. “I went in and put my thumb on the ground and moved my finger around while I played it until I found warbly sounds, or until the sounds were broken-up,” Steinke explains, referring to a toy synthesizer he modified (Marble). You don’t have to know anything about electronics to circuit-bend. The only thing you really need to know is included as an editorial note in the interview: “don’t do this with high-voltage circuits, please!” (an instance of the “red stripe down rule” in modular synthesis, which protects user and machine from high-voltage mishap) (Marble).³⁴ You don’t even need extra wires; Steinke uses his thumb—his own skin—as a conductor. The point of circuit-bending is to discover a new noise—Steinke’s warbly or broken up sound qualities—within an inexpensive or generic circuit. The initial impetus for circuit-bending might have been economical—electronic toys could (back then) be found in piles in any local thrift store, often for a couple bucks a pop—but the practice outgrew economical utility when musicians discovered that circuit-bent toys contributed to music in ways that traditional instruments could not. They are idiosyncratic, responsive, and temperamental. (Circuit-bending eventually became a cottage industry for this reason, and consequently sound toys became rarer thrift store bargains.) Similarly, Suzanne Ciani, an early adopter of modular analog synthesis, tells of her experience encountering the Buchla 200, an intimidating design from the nineteen seventies:

Some people have a fear of technology, they look at this thing with all the knobs and holes and dials and things and go . . . “Oh, my God,” you know. Whereas for me, it was like, “Okay, I’m going to get to know this. This is a living, breathing entity. It has desires and abilities, limitations and possibilities.” And the process was getting to know the instrument. It was always in intimate and friendly rapport . . . And it was alive, you know, and you just have it on and you go and you interact and get to know it. You build up a relationship. (Pinch 163)

For both Steinke and Ciani, the instrument extends the environment of feelings and signals, but not in any determined way. Contrary to Western music orthodoxy, where the instrument is determined by the desideratum of fulfilling the musical potential of a given score, analog

³⁴ Serres writes, “Whoever listens to this din with his whole body calms it, provokes it, regulates or masters it—sometimes, not always, for it can crush you, dismember you” (111).

synthesizers and circuit-bent toys wake up singing, and are only generative of anything when befriended, and even then the product may not be considered music as such. There is no plan to follow.³⁵ Here continuity blends into its analog implication, modularity. Everything can (and probably does) connect to everything else. Synthesizers literalize this concept, and in so doing delinearize the subjective narrative. Notice that for Steinke and Ciani, both experienced musicians, the prerogative of their art shifts away from playing a piece of music to the exploration of the dynamics established by radical connection. Synthesists provide a playbook for electric reading.

³⁵ In the conclusion, I will discuss Robert Johnson as a precursor to electronic improvisation. Johnson's improvisational technique emphasizes the moment of execution, allowing for the unexpected expression of pathos in his guitar playing and vocal performance. What I often find shocking about Johnson is that he manages to condense the call and response dynamics of group improvisation (as in the blues and jazz traditions) into his articulations of guitar and voice. The surprising, adventurous meandering of Johnson's improvisation also compliments his social context: improvisation is a formal double to escaping the confines of the Jim Crow south.

Chapter 3 The Unseen Powers

We do not really think, we are barely conscious,
until something goes wrong.

—Charles Sanders Peirce

In this section, I argue that Ballard’s 1961 story “The Voices of Time” is paradigmatic of early analog electronic culture, whose technohistorical situation is marked by the transition from vacuum tubes to transistors in the 1960s, and which, as opposed to nascent digital paradigm that it parallels, is characterized by variability and heterogeneity of embodied consciousness and action. While critical analyses of Ballard have tended toward symbolic interpretations (such as Roland Wymer and David Pringle’s readings), my reading recovers the sonic history of Ballard’s early work—its connection to music, technology, and science—in order to reassess his literary legacy *vis a vis* postmodernism.

J. G. Ballard’s oeuvre uniquely registers the conceptual changes that accompanied the technological shift from thermionic valves to transistors, and the meanings that accrue to each within a small historical window. In his early work, between 1956 and 1961, Ballard does not use the term “transistor” at all, which is not at all surprising: the technology was only just patented within this range of time, and was still making its way into common language. These early stories, concerned as many of them are with technology, do however reference the components of early electronics. Words associated with tubes appear a dozen times in the same five year span, in the context of signal generation and amplification. Ballard begins referring to transistors in 1963, mostly using the word, as many post-war English writers do, as short-hand for transistor radios, and uses this convention for the rest of his career. But in the same year that “transistor” appears for the first time, Ballard uses the word once in a unique and revealing way. In the 1962 story “The Subliminal Man,” Ballard depicts one of his favorite archetypes: a paranoid mental patient doomed, like Cassandra, to always speak the truth but to only be

believed once it is too late. The paranoid character confesses, “Doctor, they're trying to transistorize our brains!” (327). This use of the word “transistor” has a different connotation than it does in conjunction with radios—to “transistorize” is to replace the tube elements of a circuit with transistors, but most often in the context of radios or computers. “Transistorizing” represents the rapid historical ubiquity achieved by transistor radios and the subsequent technologies they enabled, particularly radio controlled (RC) devices. But radio is not the only type of control that transistorization implies: because transistors are more durable, stable, and space-efficient than valves, the much-anticipated benefit would be for computer technologies, which in the 50s and 60s were slow, hot, and big when implemented with valves. In “The Subliminal Man,” where large blank signs over the highway turn out to be subliminally transmitting the words “BUY NOW,” “NEW CAR,” and “YES YES YES,” the paranoiac turns out to be right—the prevailing economic interests of the future really are trying to exert control over the masses (336). This can be considered both a type of radio control and also a digitization of society: people are being both steered from afar and programmed to become parts of an abstract economic system. Like the 1988 John Carpenter film *They Live* (its spiritual sequel), “The Subliminal Man” registers the twentieth century intuition that paranoia is justified by the all-but-transparent operations of social control that become possible through nascent mass media and computerized economics—a fear that transistorization mediates slavery. The subliminality of this story is that of false consciousness: pernicious prerogatives that are surreptitiously planted behind the boundaries of conscious decision.

Since 1962, the idea of technologically mediated false consciousness has become a bit cliché, especially after conservative groups have for decades used it to fuel reactionary politics. I am reminded of a book I found in my public library as a child, called *Saturday Morning Mind Control*, whose cover depicts a ninja turtle (the subject of my then favorite cartoon) emerging from a television set and shooting electricity, like Emperor Palpatine, from his fingers and into the faces of unsuspecting children. This image affected me greatly. The book, which fueled the satanic panic of the early 90s, argues that all of the cartoons beloved by children in the 80s and 90s are part of a vast conspiracy to enslave children to a cabal of knights in Satan’s service. It did not sour my enthusiasm for ninja turtles. But while Ballard’s “Subliminal Man,” joins a tradition of cautionary tales that courts conservative panic regarding how technology influences behavior, there is another type of subliminality that extends from his other early work. One of Ballard’s

greatest virtues, as evinced in his apocalypse quartet,³⁶ is that he redeploys scenarios using different materials, and with different effects. While “The Subliminal Man” shows a sense of transistorization that is accompanied by a fear of technologically mediated slavery, other stories from the same period show a more subtle relationship between the electromechanical, the subliminal, and the social.

Ballard’s short story “The Sound Sweep” (1960) depicts the life of a public servant who has an unnaturally powerful sense of hearing, making him sensitive to layers of invisible sound condensations left behind by the everyday world. His work consists of using a specialized vacuum (powered by valves) to remove sounds from offices and auditoriums, cleaning them of residual secrets or annoying resonances. He lives in a world five minutes in the future, where the average form of entertainment is music (amplified by valves) tuned just above the range of human hearing, whose effect is noticeable but indistinct. The lonely sound sweep’s only friend is a retired opera singer for whom he feels pity. Leveraging the small amount of influence he has among industry contacts, he arranges for the defunct *bella donna* to perform again over broadcast, but with her voice muted to spare her the shame of the truth, that in her years of self-pitying convalescence her voice has deteriorated into a parody of operatic splendor. But she betrays him, and the sound sweep avenges himself upon her by simply allowing her to be heard: instead of muting her, he amplifies her performance over the now all but unused range of audible sound. In this story, the paranoid fervor of “The Subliminal Man” has died down into a mundane state of daily affairs: the subliminal is so ubiquitous that it becomes a legitimate form of art and entertainment. Rather than reveal the secret message of the subliminal, the sound sweep’s great gesture is to reveal that which is hidden in plain hearing: that a once-great singer has lost her one legitimate claim to fame. Here we can see that Ballard’s interest in the technological mediation of subliminal signals is not limited to pessimism, but also accommodates a kind of return of the repressed, where the sensitivity of a mutant and the power of amplification create a circuit that expresses the truth. Moreover, “The Sound Sweep” shows us that sound and sonic technologies are primary terms for Ballard. His attentiveness to the medium of amplification and recording in the story shows that Ballard is engaged with sonics and technique not as a backdrop to science-fictional exploits but as a structuring concept.

³⁶ Consisting of *The Wind From Nowhere*, *The Drowned World*, *The Drought*, and *The Crystal World*, the apocalypse quartet depicts the deterioration of the known world by various unseen causes, and the biological and psychological changes that follow.

Ballard's meditation on sound, technology, and the subliminal reaches its peak in "The Voices of Time" (1960). Notably, this story appears between "The Sound Sweep" and "The Subliminal Man," between technical regimes of valves and that of transistors. It serves as the connective tissue between Ballard the science fiction writer and Ballard the postmodernist, registering the fabular clarity of the early tales as well as a keen awareness of modernist culture, intertextual representation, and historical relativity. "The Voices of Time" takes the theme of the subliminal out of the social context in order to explore the effect of the dimly perceived signals that connect humans with their evolutionary past and future. By Ballard's own admission, "The Voices of Time" sets the trajectory for his later work:

If I were asked to pick one piece of fiction to represent my entire output of 7 novels and 92 short stories it would be 'The Voices of Time', not because it is the best (I leave that for the reader to judge), but because it contains almost all the themes of my writing—the sense of isolation within the infinite time and space of the universe, the biological fantasies and the attempt to read the complex codes represented by drained swimming pools and abandoned airfields, and above all the determination to break out of a deepening psychological entropy and make some kind of private peace with the unseen powers of the universe. (Wymer 19)

Even though critics have emphasized the symbolism of the empty swimming pool and the airfields, I argue for a critical return to biology, entropy, and "the unseen [but perhaps heard] powers of the universe" as a window not only into Ballard's career, but into the meaning of the sonic and literary cultures it touches. While "The Voices of Time" appears a decade before *Crash*, and two decades before *Empire of the Sun* (the two most critically recognized texts in Ballard's oeuvre, and two that have enjoyed successful adaptation to the big screen), its representation of subliminal adaptation provides a schema for the marginal subjectivities of those later novels.

The story begins ten minutes in the future (five minutes after "The Sound Sweep"). Robert Powers is a newly retired neurosurgeon who, like a growing segment of the world's population, is slowly succumbing to an unstoppable narcolepsy. Counting down his days of decreasing consciousness, Powers attends to the animals of an experimental zoo, which were left behind by his mentor, the biologist Whitby. The animals in the zoo and the population of terminally narcoleptic patients have in common a genetic abnormality: a gene known as "the

silent pair,” whose function is mysterious, but which Whitby, before his death, speculates is life’s last ditch effort to adapt to an increasingly radiated environment. Whitby, (prior to the events of the story) experimenting with this evolutionary hypothesis in mind, subjects his menagerie to blasts of tuned radiation in order to activate the silent pair. The result is a collection of flora and fauna with hideous advancements in their forms: a spider whose web is made of neuronics material, the anemone that hears the ultraviolet spectrum, a chimpanzee that has taken a serious interest in interior decorating, and a frog with an iron shell. Powers, in the final days of his access to waking life, constructs a giant mandala on a bombing test site, and then subjects himself to a high dose of radiation from a GE maxitron x-ray projector. In his very final moments, standing in the middle of the circle he has constructed, he stares into the depths of space and experiences a transformation in his powers of perception. Like the sea cucumber and the spider, he begins reaching out into a new sensorium: his body becomes a listening device attuned to cosmic radiation—to the voices of time itself.

Compared to “The Subliminal Man” and “The Sound Sweep,” “The Voices of Time” is more ambitious, technical, and experimental. It combines the paranoia of the former with the latter’s interest in mutation, but with characterizations that are elliptical, poetic, and saturated with history. The paranoid character returns, but now as Kaldren, an insomniac collector of “terminal documents.” Rather than being a simple Cassandra archetype, who forever tells the truth but is never believed, Kaldren tells a version of the truth, but not the whole story. Like the paranoid in “The Subliminal Man,” Kaldren surprises the protagonist at his car, bearing bad tidings. (This is an interesting theme in Ballard’s work—that the bearer of bad news always seems to be waiting at your car.) But the bad tidings Kaldren brings come in the form of encrypted messages. Powers notices that “someone had traced with a finger across the dust caked over the windshield: 96,688,365,498,721” (139). We find later that these numbers are counting down—they are messages from an alien source that foretell the heat death of the universe, billions of years hence. Notice the shift in the paranoid’s position in the narrative, from unrecognized prophet to collector of somewhat useless information. The bad news has shifted from ideological to existential, and the bearer’s semiotic mode has shifted from describing the subliminal to decoding the Freudian subconscious. It’s a subtle but important change. Kaldren is, because of an experimental operation, unable to sleep, and is thus barred from dreaming. His access to the unconscious/subliminal is indirect: he collects the papers of Freud and interprets

codes from the stars. He indeed has come into contact with some form of truth, but at a great remove—he is trapped in codes of consciousness, which are represented by his home, a multi-level maze of avant garde architecture. Importantly, while “The Subliminal Man” depicts a small triangulation of relationships that consists of the paranoiac, the doctor, and the duped every-person, “The Voices of Time” (“TVoT” from here on) has a more complex collection of characters. Kaldren is accompanied by Coma,³⁷ a young woman who is an enthusiastic student of Powers’ and Whitby’s research. Then there is Whitby, who is only represented in the narrative through faded tape recordings. Each of these characters exert influence over the narrative, and especially over Powers.

This text, as central as it is to Ballard’s oeuvre, and to the literary scene around it, has been the subject of very little criticism, but the literary scholarship about it mainly comes down to the centrality of Jung and Freud as symbolic frameworks. Roland Wymer’s “Ballard’s Story of O: ‘The Voices of Time’ and the Quest for (Non)Identity” is the leading critical text on the story. Wymer perpetuates the assumption, made explicit by Patrick Parrinder, that “the main ‘scientific’ background for these [early] stories is not biology, as it was for Wells, but Jungian psychology [...] Ballard’s fiction is a progressive subjugation of every feature of external reality to the demands of the ‘collective unconscious’” (Wymer 26). Wymer acknowledges Roger Luckhurst’s assertion that Ballard scholars unjustly flatten both Ballard’s and psychological theory by forcing them together in “an unrigorous mish-mash of mystical religiosity, which is then—and this is the major concern—offered as the interpretation which would unlock the entire chain of Ballard’s oeuvre,” but then goes on to repeat this cycle, tossing in some Freud for good measure (Wymer 26). The objects in the “TVoT” are, for Wymer, only symbols of individuation:

...on the floor of Ballard’s drained pool are ‘strange grooves’ cut by the biologist Whitby before his suicide which interlock ‘to form an elaborate ideogram like a Chinese character’, constituting ‘an enigma now past any solution’ (9). This ‘enigma’ is not quite as enigmatic as it appears, since its shape is explicitly described for us a few pages later: ‘It covered almost the entire floor of the pool

³⁷ Charles Bukowski once said that Ballard’s women were all poorly written. This is not a unique problem among science fiction writers. But I will say that Coma, compared to the other female characters in Ballard’s work, is an interesting case. Ballard represents her rather elliptically, but the image we get is hardly flat. She seems to have her own research program and investments, apart from Kaldren and Powers, and Ballard, as I shall point out later, leaves her as the inheritor of the story’s mysteries. While not a huge step away from the female characters endemic to SF of the time, Coma sets the stage for the more explicit explorations of gender that the new wave eventually provides.

and at first glance appeared to represent a huge solar disc, with four radiating diamond-shaped arms, a crude Jungian mandala' (13). In a story which comes close to overwhelming its readers with an informational overload, forcing them to scabble for meaning among 'a heap of broken images', Ballard has helpfully, perhaps teasingly, provided a key which promises to explain everything. (26)

It is undeniable that Jung, Freud, and existential psychologist R. D. Laing exerted influence over Ballard's psychological concepts, but this style of interpretation leaves much to be desired. Just because Ballard refers to a shape as a "crude Jungian mandala" does not mean that its function corresponds to the psychologist's theories. What surprises me most about this interpretation, and the interpretive style it represents, is the degree to which it attaches significance to the shapes of the story only in terms of their symbolic meaning. Wymer continues from the mandala imagery to an exploration of Jung and his interest in mandalas, leaving Ballard's story behind completely in favor of a "key which promises to explain everything."

I argue that the mandala is indeed at the center of the story, but not as a symbol. Wymer's allegiance to symbols makes sense, considering the history of English criticism: the high modernism of T. S. Eliot and Ezra Pound infected academic semiotics with a mania for symbols. The joys of modernism can be said to be in part the joys of symbolic reference, of hunting down the clues that provide the paradigm for understanding the text in question. For Wymer, Ballard's novella is "a piece of modernist SF," that appeals to readers "with a certain amount of literary experience," who would have "recognized and appreciated the story's direct and indirect allusions to writers like Conrad, Kafka, Blake [...] and T. S. Eliot [...] and its modernist recourse to different type faces, page layouts, and linguistic registers to create a sense of fragmentation but also a sense of a potential new ordering through some hidden principle of montage" (20-21). Like his interpretation of the mandala, Wymer's approach to periodization is fundamentally a matter of finding paradigmatic predecessors from within a group that is already integrated into academic discourse.³⁸ This discursive history, however, is at odds with both the material history of "TVoT" and also the concepts within the story itself. Let's think about this mandala, which

³⁸ Again, this all makes perfect sense considering institutional history. But this style of reading smacks of what we might call "the law of the Father" in Lacanian terms. But look at me, *hypocrite lecteur*, guilty of invoking Lacan willy-nilly! All I mean to say is that academic interpretation has run on a certain prestige accorded to certain figures, particularly father figures like Freud, Jung, Marx, Adorno, etc.—and the act of interpretation *vis a vis* theorists is also an act of grouping, or genre creation. Here, Wymer is able to link Ballard together with Jung and Eliot, and in doing so makes the argument that Ballard's work *belongs* to their theoretical paradigm.

has accrued so much importance. Leaving aside all the Jungian significance that it might have as a symbol, “TVoT” provides alternate ways of reading it.

First, we encounter the “ideogram” at the beginning of the narrative: Whitby, before his death, has carved a circle in the bottom of an empty swimming pool at the hospital. Ballard writes, “Damp leaves and bits of paper obscured it, but the outlines were just distinguishable. It covered almost the entire floor of the pool and at first glance appeared to represent a huge solar disc, with four radiating diamond-shaped arms, a crude Jungian mandala” (140). It’s a shape we can imagine without much difficulty: a circle, with four shapes pointing to the center. It is a child’s drawing of a sun, or a target. Ballard acknowledges both readings, calling it a “solar disc” and, later, a “target bull” (149). The question, which is neither asked nor answered in the symbolic interpretation of this shape as mandala, is what does this shape *do*. A solar disc, not a symbol but an icon, is an analogous representation of radiation. A target is not a symbol but a diagram, a gauge and guide for controlling a projectile’s (or projection’s) trajectory. Powers recreates the shape at the end of the narrative, building a giant version of it on the site of an abandoned bombing range, and when Coma and Kaldren discover his dead body in its center, the latter calls the shape a “clock” (157). A clock is an index, not a symbol. The shape of the mandala bursts with non-symbolic forms of meaning. These, analogical, modes of signifying might seem too rudimentary to even mention, but they lead us to aspects of the story that are much more baffling and productive than its link to Jung.

There is a third mandala in the text as well, one which is implicit, but which binds together the non-symbolic referents of radiation, time, and guidance. Whitby’s laboratory is also a circle subdivided in four, just like the ideogram in the pool and the structure that Powers builds in the bomb range:

Sliding partitions divided the dome into four chambers. Two of them were storerooms, filled with spare tanks, apparatus, cartons of animal food and test rigs. They crossed the third section, almost filled by a powerful X-ray projector, a giant 250 amp G.E. Maxitron, angled on to a revolving table, concrete shielding blocks lying around ready for use like huge building bricks. [...] The fourth chamber contained Powers’ zoo... (142)

Critics have missed this third mandala, since it wasn’t neatly labeled. But this time the shape is easy to miss because it has contents: the dome’s subdivision is functional rather than symbolic.

But its contents are themselves telling: one half for “apparatus,” one quarter for a radiation projector, one quarter for the vivarium. The other two mandala shapes also have content. Powers finds in the first one a mutated frog, and he himself is the living content of the final shape. Thus we find that the form of the mandala in “TVoT” is inextricably linked to its function as a container, not only for living creatures (important in itself), but also for radiation.

So far I have simply drawn attention to the way that analogical forms are central to the meaning of this narrative, but the form in question (what we can call a mandala) points us in the direction of the (animal) unconscious and its technological media. It points, literally. The circle is bisected by diamonds, a shape that points both inward and outward. “TVoT” is a story about trespass, in two directions. In the beginning, the mutant frog is found navigating the circle: “Reaching the edge of the disc, it stopped and hesitated, then slowly backed away into the centre again, apparently unwilling or unable to cross the narrow groove” (140). The creature is bounded by this shape, not to mention the swimming pool’s walls. There is a semiotic irony at work here, that even if the creature were to succeed in crossing the boundary of the disc, it is still trapped by structures out of its control. But this situation sets up a paradigm that is later complicated. Consciousness reaches outward while signals reach in. (In this case only noise reaches in, in the form of leaves and pages, which in the context of a pool call to mind schoolbook illustrations of entropy, Brownian motion, and Maxwell’s demon.) You’ll notice that I have referred to this as unconscious as well, but I avoid the term subconscious, and its Freudian connotations of symbolic contents. Although the Jungian mandala calls to mind the content of the collective unconscious, and, for Wymer, also the content of the psychosexual subconscious, I am reluctant to engage in psychoanalysis here. Instead the definition of the unconscious I employ is that of Bateson, which I have outlined earlier. For Bateson, the unconscious contains merely that which there is no longer a reason to hold in consciousness, and an economy managed by the physical capacities of the awareness and cognition. Bateson’s contribution to discourse about the unconscious is notable in its lack of spectacle. The unconscious is not so much a dark world of secrets as much as it is a partially closed closet—an area that is forgotten out of habit (like half of Whitby’s dome). But as Peirce puts it in the epigraph to this section, this closet is opened in times of emergency. In “TVoT,” the catastrophe is one of radiation—of life’s attempt to adapt using the right tools.

Let's pause for a moment to consider the genre of this story. For as much as Wymer emphasizes the modernist elements in "TVoT," he admits that "despite its avant-garde form, [the story] had a distinguished and recognizable ancestry in conventional SF" (22). Andy Sawyer points out that critical readers of Ballard's later fiction tend to consider his SF stories as marginal or accidental, ignoring "the fact that it was science fiction rather than any other form of literature that Ballard wanted to reform and invigorate" (Wymer 20). But what is it about "TVoT" that makes it science fiction? Darko Suvin's classic critical approach to SF designates that "analogical historicity is the epistemological key logically necessary for interpreting or allotting meaning to any SF tale" (38). In other words, the aspects that are different but formally similar to our own time, which Suvin calls the *novum*, are the criteria for science fiction. Trace Reddell explains, "As it holds up a distorted-mirror version of familiar situations, the novum provides the yardstick by which Suvin not only deems a respective SF text successful but also determines whether the work is in fact science fiction" (9). But what is the novum of "TVoT"? When we look at the story's technology we find the GE Maxitron x-ray projector and the tape machine, devices that were already old at the time of publication. "A correspondent recently pointed out to me," writes Ballard, "that the poetry-writing computers in Vermilion Sands are powered by valves. And why don't all those sleek people living in the future have PCs and pagers? [...] I could only reply that Vermilion Sands isn't set in the future at all, but in a kind of visionary present—a description that fits the stories in this book and almost everything else I have written. But oh for a steam-powered computer and a wind-driven television set" (4). As I have noted earlier, it is precisely this characteristic of Ballard's work that makes him such a fruitful subject of historical inquiry, since his work indexes technoculture in real time. But can a story be about a visionary present and also be science fiction? Reddell argues that, in SF film, science fictional sounds also break the logic of the novum, since they are necessarily sounds made in the present to accompany imaginary events. But this does not make SF sounds any less profound, since their mode of creation is often as fantastic as the representations they accompany. For instance, Delia Derbyshire's work for the BBC Radiophonic Workshop was almost more outlandish than the *Doctor Who* scenarios it was made for: the process of recording the theme required the slowing and reversal of a tape loop containing piano string noise, and circuit-bending a series of test oscillators—a method Ann Shenton has called "DIY brain surgery" (*The Delian Mode*). The novum, as Suvin initially defined it, is a matter of cognitive estrangement, which is to say that it

is an object that is so unfamiliar that, in becoming accustomed to it, the reader decouples from their historical paradigm, or at least is given a paradigm from which to cognize it. Suvin reverses the Brechtian formulation of estrangement, which aimed to make the familiar unfamiliar, but, as a critic of Suvin wrote, “the final effect is the same; by Brechtian distancing or by the unfamiliarity of science fictional worlds, we are estranged from our assumptions about reality and forced to question them” (Nodelman 24). (Suvin and Jameson have both put a great deal of pressure on theories of genre to account for the strangeness of SF, and they’ve both in turn put pressure on SF to instrumentalize its strangeness for political ends.) Without going down a “what is science fiction?” hole from which we will never return, I think that the genre problem evinces the same dynamics as the consciousness problem—SF, like the unconscious, is not a matter of a type of difference, but a degree of difference. Indeed, what Ballard’s work seems to show is that SF is a matter of degrees of consciousness. The two problems are, in fact, the same problem. Thus, what makes “TVoT” science fiction at all is its representation of speculative—i.e., foreign—modes of consciousness. And it exemplifies strange modes of thinking through sound.

Let’s return to our three mandalas, which, in the spirit of this inquiry, we can refer to as a conceptual circuit. As I have already demonstrated, the standard reading of the mandala is symbolic. David Pringle writes, “It is my belief that Ballard's use of symbolism has, on the whole, been more conscious, more intelligent, and more innovative than that of any other contemporary SF or fantasy writer (which is not to say that Ballard has ‘placed’ every symbol, with a devious cunning, so that the whole can be unravelled [sic] like an explicit code; there may be deep meanings in Ballard's fiction, but there are no Hidden Messages)” (17). Unlike Wymer and others, who do seem intent on finding a master code for Ballard’s work, Pringle is cognizant of Ballard’s sense of semiotic play, which is artistic, but not necessarily [evocative] of a system. And even the middle mandala, the one formed by Whitby’s laboratory is not “hidden”—it is in plain sight, only surrounded by clutter. But the cleverness of Ballard’s use of analogical shapes lies in the fact that this middle mandala goes without the symbolic marker, hiding it while it performs a semiotic function. Pringle argues, following Northrop Frye, that symbols³⁹ come in

³⁹ Pringle notes that his “symbol” is probably closer to the concept of icon, since Frye’s use of symbol is perhaps over-accommodating: “In his *Anatomy of Criticism*, Northrop Frye defines the word “symbol” as ‘any unit of any literary structure that can be isolated for critical attention. A word, a phrase, or an image...’ That definition is perhaps too loose to be of much use here: suffice it to say that for the purpose of this discussion I shall regard all the aforementioned objects and landscapes as symbols. They are, of course, primarily visual in their appeal, and Ballard's affinity with painters (particularly the Surrealists and

groups of four (16). But the secret third mandala instead calls to mind the triadic nature of Peirce's semiotics rather than any numerology. For Peirce, semiosis "brings three terms into relation: the sign or representamen, the object and the interpretant" (Everaert-Desmedt 241). The interpretant can be any trigger that connects a representamen and an object, either cognitive or material. The three circles of "TVoT" bring three "terms" together in a circuit, a relationship of disparate but compatible parts. Again, the circles have contents. The first contains the frog, the last contains Powers himself, the middle contains the vivarium and the Maxitron. I think it would be fascinating enough to compare the shapes and grammars of the first and last circles, drawing a circuitous analogy between only Powers and the frog. But in between them is the laboratory, a space that is intended for experimentation and discovery—a space that embodies the concept of the interpretant in a physical space. And within its environs occurs perhaps the most poetically stunning moment of the entire narrative:

The anemone stirred. Basking in the warm subliminal sea of radiation rising around it, prompted by countless pelagic memories, it reached tentatively across the tank, groping blindly towards the dim uterine sun. Its tendrils flexed, the thousands of dormant neural cells in their tips regrouping and multiplying, each harnessing the unlocked energies of its nucleus. Chains forged themselves, lattices tiered upwards into multi-faceted lenses, focused slowly on the vivid spectral outlines of the sounds dancing like phosphorescent waves around the darkened chamber of the dome. (155)

This scene, which foregrounds Powers' own transformation, represents the experience of the anemone as the effects of the "resonance transfer procedure," and thus the activation of the silent gene pair, take hold. It is an odd moment in the story, since it interrupts the narrative style, shifting it suddenly from third person with limited omniscience, which barely describes the protagonist's thoughts, to a detailed and intimate omniscience of an anemone's inner life. It is a scene of evolution-in-progress, and we behold the creature developing a new sense: "Now it's almost as if they can hear primary colours," says Powers, "...it's re-adapting itself for⁴⁰ a non-

Pop Artists) brings to mind the term 'iconography.' Icon would, perhaps, be just as apt a term as symbol, although the latter word seems slightly less pretentious" (16).

⁴⁰ If there were any single word in this story that encapsulates the problems of analogy, resonance, and technicity and their relationships to historical concepts like modernism and postmodernism, it might be this "for": while the moderns were (as I shall elaborate further in the development of digital media) enamored of ultimate purposes, and the postmoderns (by most definitions, particularly Lyotard's) cynical about them, we find in this representation of rudimentary life a vision of purposiveness that is

aquatic existence in a static world of violent colour contrasts” (143). First, we must ask ourselves why it is important that the sea anemone develops hearing. As I noted in the previous section concerning Peirce’s friend, hearing can stand in for the awareness of resonance from many parts of the body. As in that example, the idea of hearing where there should be no hearing estranges the very evolutionary path that has led to our familiarity with the division of the senses. This defamiliarizing idea reunites us with the continuity of sense experience and consciousness. Importantly, sea anemones have highly rudimentary nervous systems, wherein discrete senses are impossible. Sense and motor functions are highly continuous with one another, and both are tuned to sustenance. [come back here]

What does this color-hearing critter do in the circuit of mandalas? If we arrange the three areas according to their order of appearance, we get this kind of sequence: frog (mutated), sea anemone (mutated), and Powers. Of course Powers is also, when he occupies the bullseye, mutating. I argue that this circuit of analogous diagrams asks the reader to read one through the other, to collapse them into the same paradigm. This insight is consistent with the type of fabular construction used by fantastic and mythological literature for thousands of years: consider biblical stories, fairy tales, or even jokes that establish paradigmatic redundancy by placing three characters within the same semiotic frame.⁴¹ But what is most important is the qualities they all share. We know from the end of the narrative that Powers too develops the ability to hear radiation. Ballard writes, “Above him he could hear the stars, a million cosmic voices that crowded the sky from one horizon to the next, a true canopy of time. Like jostling radio beacons, their long aisles interlocking at countless angles, they plunged into the sky from the narrowest recesses of space” (156). But the anemone episode reveals something that is missing from Powers’ last moments. Jonathan Sterne writes, “...sonic imaginations are guided by an orienting curiosity, a figural practice that reaches into fields of sonic knowledge and practice, and blends them with other questions, problems, fields, spaces and histories” (6). Powers’ experience of the voices of time is figured as overpowering—an onslaught of sensory information. But for the sea anemone, one is able to distinguish a more fundamental dynamic. In Peircian terms the sea anemone’s hearing gives it access to qualisigns, color is perceived as a “quality that functions

neither. Final causes return, but here as an experimental attitude that attenuates patterns of feedback between subject and environment. See Mihaly Szegedy-Maszak’s “Teleology in Postmodern Fiction” and, more recently, Arran Gare’s “The Grand Narrative of the Age Of Re-Embodiments: Beyond Modernism and Postmodernism.”

⁴¹ A priest, a rabbi, and a literature critic walk into a bar.

like a sign” (Everaert-Desmedt 243). For the anemone, the fact that it experiences an inchoate resonance that is merely iconic, inspires a reaction of curiosity. Notice its experimental response to its new sense: “reach,” “grope,” and “focus.” These verbs are missing from Powers’ final moment, but his connection to the sea anemone via the circuit of mandalas draws our attention to the way that Powers is also involved in an unconscious reaching prompted by a secret sense.

The space between secret sense, of registering distant quality, and of employing it as a part of one’s environment, is mediated by technology. In the approach to the story’s denouement, the narration shifts to segments of Powers’ journal. “Some contractor keeps calling me up,” he writes, “about payment for 50 bags of cement he claims I collected ten days ago. Says he helped me load them on to a truck himself” (150). Thus we find that, although his sleep is black and dreamless, there is nonetheless an unconscious force at work, which leads him to build the final mandala. Like the sea anemone, he reaches for an icon. Up to now I have said very little about the difference between sight and sound. As Sterne Notes, many studies of sound have over-articulated this difference: “Despite the realities being somewhat different, seeing and hearing are still often associated with a set of presumed and somewhat clichéd attributes, a configuration I call the *audiovisual litany*...” (9). He goes on to describe binaries like the following: “hearing is concerned with interiors, vision is concerned with surfaces,” “hearing involves physical contact with the outside world, vision requires distance from it,” and “hearing is a primarily temporal sense, vision is a primarily spatial sense” (9). If I’m being honest, this essay reifies some of these presuppositions. Sterne continues, “The problem with the litany is that it elevates a set of cultural prenotions about the senses (prejudices, really) to the level of theory. To figure sound in these terms is to misattribute causes and effects” (9). I think that Sterne hedges on the side of safety, and that there are indeed intuitive phenomenological truths to how the differences between sight and sound are represented. For instance, the idea that hearing involves contact is well founded, since sound presupposes a continuity of physical pressure between subject and object. One binary that is notably not in Sterne’s litany, is that sound happens at lower frequencies than light, within a range of speed that concerns all animal function. As Steve Goodman has provocatively demonstrated in *Sonic Warfare*, the sonic continuum is also the continuum of physical effects from “respiratory inhibition” to “neural entrainment” (Front material). Goodman’s work is a fascinating glimpse into the problems that sonic analysis presents. Like Sterne, Goodman is reluctant to fall into traps of ontological descriptions of the

relationship between sound, subjectivity, history, and technology. His analysis jumps from period to period, paradigm to paradigm, concluding that “Where aesthetic and technological innovation, collective, affective, and economic mobilization, and social desegmentation coincide, the appropriate term for such cultures [...] may be sonic war machines” (194). His writing is an often-insightful adventure, but the lack of particularity it provides to the coincidence of history, sonics, and technology is iffy. My analysis of Ballard, which drew me to semiotic theories that emphasize an evolutionary and pragmatic approach to both technics and sonics, attends to the capacities both of the physical substrates that allow for perception and their analogous continuities with technology. Notably, “TVoT” does this as well: the mandala formed by Whitby’s lab, which is paradigmatic of Powers’ transformation, puts technology and biology side by side. Powers’ unconscious reaching for the icon is impossible without technological intervention, particularly via the GE Maxitron.

Powers’ transformation is mediated by a real historical machine rather than a speculative technology, and thus uniquely indexes the material effect of contemporaneous analog technology on Western culture, particularly literary culture. Ballard’s implementation of the GE Maxitron x-ray projector (a radiology device used primarily for oncology research) as a central narrative component shows the synchronic function of technology at the mid-century, but also the diachronic trajectory of that function. Importantly, radio technology evinces a different logic than the computational technologies popularized by hard science fiction and cybernetic culture alike. By “radio technology” I am not referring to radio communication (radios and their particular texts), but instead technologies that radiate. Unlike radios that use waves as a vehicle for communication, the technologies in question generate radio waves for their own sake, sometimes in conjunction with communication technology, like the amplifier section of a radio. The early 1960s saw a boom in technologies of this type (enabled by the development of the transistor in the late 50s), which create, amplify, or modify electromagnetic waves, including x-ray projectors like the Maxitron, as well as consumer music technologies like the guitar amplifier and the synthesizer. What these devices share is a reliance on the analogical implementation of transistors (or valves), rather than their digital use as switches. Even though analog and digital technologies grew up together (in the technological sense, they are two logically different ways to use a transistor), their mechanical functions and cultural functions are categorically different.

Ballard's use of analogical technology couples with the iconism that knits together disparate paradigms of the story (the contents of the mandalas) to create an image of amplified semiosis.

Ballard's representation of the Maxitron also complies with his critique of science fiction's representation of technology, in which he subordinates flights of technological future fancy to synchronic experience. Ballard, in a 1964 editorial in *New Worlds Magazine*, writes that "the great merit of science fiction has been its ability to assimilate rapidly the materials of the immediate present and future" (122). Ballard argues that conceptualizing the contemporary is a historical feature of SF as such, a critical departure from earlier SF thinkers who emphasized forecasting technological realities rather than assessing current ones. For Ballard, the promise held forth by SF is fulfilled by William S. Burroughs, who offers the "first definite portrait of the inner landscape of our mid-century, its own language and manipulative techniques, its own fantasies and nightmares..." (121). In the same issue of *New Worlds* magazine, Michael Moorcock calls for a "new literature of the Space Age" (3), paraphrasing Burroughs: "If writers are to describe the advanced techniques of the Space Age, they must invent writing techniques equally advanced in order to properly deal with them" (2). Paradoxically, this new approach to representing the Space Age must be, for Ballard, an approach that forsakes space travel. He posits that SF "is now failing in precisely those areas where the future has already become the past" (122), his contention being that SF conventions, particularly "interplanetary voyages" and the fictive technologies that enable them, belong not to the history of the future (or even the present) but to the bygone era of pulp fantasy. While fantasies of space exploration have historically been linked with the concept of progress, Ballard's eschewing of the continued use of Buck Rogers tropes, as well as his celebration of Burroughs, indicates that space travel, by the time it had become a reality, had already become an object of nostalgia—not an extrapolation of specific technology at all, but only stylized backdrop for adventure stories. "Once it gets 'off the ground' into space all science fiction is fantasy," writes Ballard, "and the more serious it tries to be, the more naturalistic, the greater its failure, as it completely lacks the moral authority and conviction of a literature won from experience" (126-7). But even more telling, in terms of how it represents the "advanced techniques" of the mid-century and their relation to human experience and history, is the GE Maxitron. "The Voices of Time" figures the Maxitron being used not for oncology, but to accelerate latent evolutionary change in a future where life is succumbing to entropic enervation.

As much as critics like Wymer have discouraged serious interpretation of the scientific rhetoric within “TVoT,” it must be noted that its “symbolism”—or, really, the iconic functions of the story—is intimately paired with the story’s science, which is fundamentally about radio waves and their effect on living things. The walls of Whitby’s laboratory, which themselves are partially built of radiation shielding, form part of the narrative’s invisible mandala. The laboratory is a monument to “Resonance Transfer.” Powers explains to Coma,

“...What was happening was that the protein lattices in the genes were building up energy in the way that any vibrating membrane accumulates energy when it resonates—you remember the analogy of the bridge collapsing under the soldiers marching in step—and it occurred to him that if he could first identify the critical resonance frequency of the lattices in any particular silent gene he could then *radiate the entire living organism*, and not simply its germ cells, with a low field that would act selectively on the silent gene and cause no damage to the remainder of the chromosomes, whose lattices would resonate critically only at other specific frequencies.” [...] Powers gestured around the laboratory with his cigarette. “You see some of the fruits of this ‘resonance transfer’ technique around you.” (144-5, emphasis added)

What Whitby does to the flora and fauna in the vivarium, and what Powers eventually does to himself, is neither science proper nor pointless violence but a form of biological circuitbending, performed by using radio technology to saturate living tissue with specific resonances, and allowing it to grow into new forms in this alien environment. This quasi-scientific drive has a precedent that is contemporaneous with Ballard’s story, and which shines light on their shared technological context.

In 1961, Marty Robbins was recording a new single called “Don’t Worry.” The song would feature a six string electric bass solo by Nashville session guitarist Grady Martin, but when it came time for recording the part, the performers and recording engineers discovered that the studio’s new mixing desk contained many mis-calibrated transformers (Paz). This improper calibration caused distortion in the guitar’s timbre. Prior to this instance, distortion had been an accidental byproduct of the use of vacuum tubes in guitar amplifiers. When reaching the edge of their amplifying efficiency (not in the time domain, but in amplitude), the tubes would “break up,” producing a harsh, saturated tone. While even early adopters of the tube amp were aware of

(sometimes excited about) this new timbre, using it was impractical because making a tube distort requires running the amp at its loudest volumes, at which point there is no control over the “saturation” effect. When Grady Martin’s mixing console malfunctioned, causing such an extreme change to his guitar’s feeling, a small arms race began: I refer to the effort to duplicate that sound change by using the then new technology of the transistor. You might wonder, what is so attractive about distortion, about a loss of clarity? Like reverb and delay, saturation is linked to the experience of space: there is space within a tube or transistor for efficient amplification (this is called headroom), but the beauty is that when you run out of space, there is still more. Distortion is rock and roll synecism: a demonstration that beyond every threshold there is simply more environment.

“Saturation,” as distortion is often called in its controlled form, is literal—the input overfilling the amplifying medium. Consider transporting water from one bucket to another using a sponge. If you dip the sponge to its half-way point into the first bucket, it has plenty of space to accommodate the water as you transfer it to the second bucket. But if you drench it, fully submerge it, then we can say that its headroom has been exceeded, and things get messy during transfer. This is an imperfect metaphor, but it’ll do. When you overpower a transistor, tube, or even a speaker, something has to give. The overflow creates a sonic ripping sound right at the limits of headroom. The ripping is often called “clipping,” since the extremes of the wave are “clipped off” past headroom capacity. But at the clipping point, the nonlinearities of the amplifying substrate are revealed: tubes clip one way, transistors another, and diodes and speakers evince yet more clipping styles.

Once, on Christmas vacation in Illinois, my relatives asked me what I was doing for work. They are not musicians, so I was having a hard time describing my job as a manufacturer of audio signal processors. Trying to keep it simple, I said, “I build distortion pedals... You know, for rock guitar.” To which my grandmother asked me a very good question: “Why would anyone want to sound distorted?” Oddly enough, while distortion has been a daily concern for me for over two decades, this question still stumps me. And I’m not the only one. Only very recently have academic studies acknowledged and explored the role of distortion in music history, theory, and reception.⁴² And even so, the consensus seems to be that it’s very important

⁴² Most of this work has been done by just one person, Jan-Peter Herbst, who has put together a tremendous amount of sociological research about distortion.

to many people. But I would like to try to answer my grandmother's question with as few statistics as possible.

I argue that distortion is a defamiliarizing effect. My amplifier, the same SuperJet with the cough, does this wonderful thing when the volume knob is right around one and a half (it's fifty watts, so even a little past one on the volume knob is uncomfortably loud). Lower than this level, it reproduces the signal from my guitar with beautiful clarity and precision (what is called a "clean" tone). But after 1.5 I feel more myself. What happens in this small space on the volume knob? 1.5 is the spot where the tubes run out of efficient headroom, and my signal runs into the edge of that space. When I play softly, I can avoid the edge of the tubes' headroom, like playing a game of Operation. But when I play loudly or expressively, my signal careens violently into the edge of the amplifier's capacity, creating an electrical sizzle.

I don't remember exactly the first time I heard distorted guitar. Growing up in the late eighties/early 1990s the sound was already everywhere. But I do remember the sound of every distortion device I have ever used. Each one, when you hit the edge of its efficiency, acts a little differently. The SuperJet is untamed but a little hifi sounding, its lows are like ripe fruit, the midrange is a polaroid memory that rips and explodes with uncontrollable color, the highs are pleasantly burnt. I have played hundreds of different distorting machines, each of them a poem. And like a good poem, the good distortions remind you of where you are, who you are, giving you experience in return. The relationship with saturation is dynamic: I am suddenly aware of how loud I am playing, of all the parameters of my instrument, because the life of the machine is entangled with my actions. It is both excruciating and life-affirming. I must remember to be alive when entangled with this device of sonic warfare.

While I saturate the amplifier, it saturates me back. Many years ago, a drummer asked me to please point my amplifier away from him, adding, "My skin hurts." While this was certainly an unwanted consequence of playing too loudly, feeling sound within the body is often as important as hearing it. Indeed, when I was a young boy, my closest friend's older brother had a car stereo system that could be heard throughout the neighborhood; he, like Peirce's friend, was totally deaf. Part of the attraction to amplified music, especially as it concerns musical cultures that centralize amplification like metal and hip hop, is the degree to which resonance can be transferred into the body. The socializing effects of amplification can be seen in contemporary dance music, where the constant pulse of four-on-the-floor bass drum organizes the activity of

club-goers, in a clockwork of 120bpm bodies. But even in that case, which is superficially more homogeneous than others, the dancers must find a way to *live* in this new, harsh environment. It might be hard to imagine human evolution taking the direction of acclimating to conditions of increased sonic radiation, but our sonic cultures show that this has already happened. As “tonal creatures,” as Alain de Botton has referred to humans, we now live in a time of ubiquitous sonic incursions that form our unconscious experience of our environment. Analogical sonic technologies, were (and still are) the mode available for piloting to the edges of that terrain.

Of the highest importance here is that Ballard writes “TVoT” at precisely the moment when the military industrial complex has spilled forth into both music and medical science, in the form of radio amplification. The story is a setup for Powers to exceed the efficiency range of the human body, to trade places as it were with the tube or transistor, and thus to be made conscious of his position in the environment. Whitby foreshadows this triangulation: “My total failure, my absolute lack of any moral or biological right to existence, is implicit in every cell of my body...” (147). For Whitby, the knowledge that the success of the human species is but a temporary state in a constant flux of stochastic processes sets off a cynicism about life itself. It is easy to see why Wymer would interpret this story, and the entropic leanings of the new wave generally, as essentially about decline. Wymer writes, “Ballard, in a way which runs counter to so much genre SF of the 1940s and 1950s, reverts to the standard pre-Enlightenment perspective of Spenser, Shakespeare, Donne (and most early theologians) that, since the Fall, ‘all this world is woxen daily worse’, and that as far as humanity is concerned ‘the peak has already been reached, and the pathway now leads downwards to the common biological grave’” (21). Tellingly, Wymer quotes Whitby, not Powers. Thus, while Wymer’s interpretation is understandable, it is not particularly sensitive to the context that the story provides, nor to the scientific context the story builds upon. The Maxitron (a man-made amplifier) models and accelerates the natural increase of radiation in the environment, allowing Powers to sense the edge of efficiency of the human biological plan, but also the *potential* for life to adapt to these new conditions, as evinced so poetically in the example of the anemone. As Kittler notes about the status of rock and roll in the mid-century, analogical radio technology brings back a primordial situation of sensation and survival.

As I have already mentioned, the sea anemone, radiated and mutating, is a foil for Powers’ transformation—but this parallelism also gestures toward a kind of cybernetic

epigenesis that conflicts with symbolic interpretations of evolution. Power's explains the process of resonance transfer to Coma, "It's rather like the perforated sheet music of a player-piano, [...] or a computer punch tape. Knock out one link with an X-ray beam, lose a characteristic, change the score" (144). Initially, this description seems to correspond to the Dawkins/Hitchens interpretation of evolution, that prioritizes the gene—the carrier of digital genetic information—as the primary motor of evolutionary change. It also seems to agree with Wymer's assessment that "TVoT" is fundamentally about decline, since the radiation only "knocks out" characteristics rather than produce new ones. On the one hand, as Hoffmeyer points out, it is not the gene that evolves, but the *population* that experiences the world of "physical extension and continuity": "The chain of events that separates life from nonlife—i.e., the unending chain of responses to selected differences—thus needs at least two codes: one *code for action* (behavior) and one *code for memory*. The first of these codes necessarily must be analog, and the second very probably must be digital" (83). What Ballard describes as the situation with carriers of the "silent pair," both in and out of the laboratory, is not simply individuals subject to genetic changes, but populations *and* individuals choosing within the context of environmental options. On the other hand, Ballard offers an explanation of the "resonance transfer" process that also accentuates the analog dynamics of gene evolution: as I have already quoted, Whitby's method involves using radiation to resonate gene lattices at specific frequencies, and thus destroy only specific segments of DNA. This is of course an explanation adapted from oncology, where cancer cells are "targeted" by tuning radiation to their scale, avoiding the cells around them. The vibrating bridge analogy is helpful—if one stands in between the nodes of a bridge that is resonating in a standing wave pattern, they will appear, comparatively, to be standing still. But we also know that this is not how oncology really happens. Radiation affects the entire organism. Rather than emphasizing the genetic dogma about evolution, Ballard evinces genes that indeed carry genetic information, but are embattled and modified by both micro and macro conditions. But surprisingly, although these circumstances ultimately end in death (of individuals), increased noise also invites surprising growth. In the spirit of this dissertation, whose research has revolved around exploring machines, I am tempted to subject a player piano to the ravages of artificial entropy, actualizing Powers' simile, to see what really does happen. The problem is that, even though contemporary genetic modification is performed by literal modifications to genetic code (I've seen the CRISPR

system referred to as a word processor for genes), modifying genes with radiation is rather like editing the score of a player piano using a chainsaw.

Clearly, Ballard is historically at a disadvantage concerning progress in gene editing, but, as he says in the introduction to his collected fictions, there is a purposeful belatedness in his approach—a fidelity to antiquated technological paradigms—that exceeds mere ignorance. Although “TVoT” is supposed to take place in the future, sometime after World War III, the nuclear testing at the Enewetak Atoll (which stretched from 1948 to 1958) haunts the text. Whitby is said to have been inspired by the “radiobiological damage” of that event, and Powers’ repeatedly reflects on the phrase “Goodbye, Eniwetok” in his journal (141/144). As in Ballard’s Apocalypse Quartet, and especially in *The Drowned World*, there is a foreboding sense of the oncoming uninhabitability of the world, of the limitedness of the conditions for which humans are adapted. But alongside this unenchanted acknowledgement of cosmic and evolutionary caprice, there is an acute interest in the edge of survivability and its subjectivity. *The Drowned World*, which also features a world becoming hotter and more radioactive, depicts a protagonist who, in the end, wanders out into the flooded and atavistic landscape of tropical London, knowing that his mind will soon adapt, and that he will lose his humanity. These are disaster stories, yes. But they are also adaptation stories, which eschew the idea of genetic perfectibility in favor of new unthought and seemingly unthinkable paradigms. Death (or lack of representation in *The Drowned World*) is thus not the moral of the story, but merely a representational limit. The future is unconscious, and thus will not be televised. But there remains in Ballard’s representation of the sea anemone a renewed enchantment that, while refraining from the excesses of symbolic representation (in that it relates experience to no code or law), depicts an expansion of listening to the point of saturation. The anemone experiences a “subliminal sea of radiation,” a context that has no objects, and, being subliminal, has no representation to consciousness as such. But nonetheless, the creature responds with tentative reaching. There is something akin to Freud’s death drive here, but implemented analogically. Rather than an impulse toward the ultimate stasis of geological crystallization, “TVoT” represents a desire for the primacy of the sea over the symbol, of listening over decoding. This desire is romantic, in that it figures a “return” to the simpler cognitive paradigm of other biological modes, but it is also rooted in the semiotic and evolutionary likelihood that, while

digital coding provides a haven from environmental change, survival is a matter of the behavior of living beings in changing environments—a matter that can be navigated by feel.

The same risky listening, to return us to the historical coincidence of the invention of distortion, rises out of rock music's technohistory. I have mentioned doom as a genre of rock that arose out of an adaptation to the Sunn amplifier's uniquely violent capacities. Doom metal has its roots in English rock groups, especially Black Sabbath, who were the first adopters of amplifiers like the Laney Supergroup, 100 watt amplifiers that contributed saturation to guitar signals. Doom is a historical plateau between blues music and modern metal: Black Sabbath, which started as several electric blues bands, used the pentatonic vocabulary of traditional Black American music, but, because of the way that distortion blurred the notes of chords together, the guitar featured a reduced harmonic complexity, resulting in the "heavy" sound of what are called "power chords" or duophonic chords. While "heavy" music eventually became more complex (both in terms of rhythm and harmony), especially when it became hybridized with European classical techniques, the doom tradition persisted in albums like *Dopesmoker* by the band Sleep, which retained the primitive structure of early Black Sabbath. The same desire for a sonic drowning of the world that exists in Ballard persists in doom records. Doom music is slow, plodding, repetitive, loud, distorted, and simple. Its complexity lies in the pathos of each gesture and the texture of overall distortion, which serves as the overriding timbre. The atavism of the doom genre is clear in both its form and its content. The album cover of *Dopesmoker* depicts a caravan of cloaked figures, faces obscured by scifi gas masks, crossing the dunes of an orange desert. Doom is about survival and adaptation. Importantly, the social context for doom music is rooted in the realities of Western class striation. Andrew Cope writes, "one cannot dismiss simply as coincidence that the dark, angry and serious forms of music evident in the early work of Black Sabbath seem to correlate to the darkness, depression, boring school and dead end, working-class factory life of the industrial Midlands" (27). While some have sought to dismiss the connection between the aesthetics of heavy metal and its social context, the industrial environment of Birmingham birthed Led Zeppelin, Judas Priest, and Sabbath and anecdotes from many of the musicians involved in Birmingham's rock scene link the characteristic aggression of these groups to the city's alienation of young people in the midcentury. But more importantly, Birmingham was also a scene of invention: the Laney amplifier company was founded there, and

developed in concert with local musicians, contributing the characteristic timbre of metal guitar to an environment that was socially ready for an evolutionary mutation.

What I am pointing to here is the Ballard's and Black Sabbath's parallel embrace of doom, of an end to (biological and social) modernity, and the use of primitive sonics as a means of navigating this atavism. Using distortion to acceleration the non-linear features of the environment reverts the subjects of both "TVoT" and doom metal to a primordial state of experimentation, a attitude toward the world that does not take survivability for granted, but instead uses primitive aesthetic structures as scaffolds. This scaffolding is literal in "TVoT," where the mutated spider spins webs out of its own neuronal material. Powers says of this creature, "World War IV should really bring him into his element" (144). Redundancies in this devolving paradigm do not become more abstract or internalized, but instead bind consciousness and environment. The outside becomes the inside. This doom epistemology is a response to modernity's failed technocratic promises, to the actual environment of desolation that industry, war, and progress has left behind. But it also represents an evolutionary hope, the hope that, through recalibrating and continuing, that signal and noise will reach a state of balance.

There is, in Ballard's editorializing about "TVoT," a probably inadvertent but telling piece of wordplay: the author says that the story is his attempt to represent "the determination to break out of a deepening psychological entropy and make some kind of private peace with the unseen powers of the universe." The unseen Powers is what indeed we get: we find Robert Powers' invisible (but not inaudible) and unconscious energies called to respond to an environment both natural and mechanical. When Powers, succumbing to mutation and radiation poisoning, listens to the universe's voice, it is not death that he finds, but continuity: "he felt his body gradually dissolving, its physical dimensions melting into the vast continuum of the current, which bore him out into the centre of the great channel, sweeping him onward, beyond hope but at last at rest, down the broadening reaches of the river of eternity" (157). The lesson here is not that Powers has succumbed to an exhaustion of hope, but that hope is somewhat misleading as a historical paradigm, because it defends the habitual while attempting to recuperate its superficially beneficial qualities. Evolution does not work by hope for a particular end, but merely by risking a new paradigmatic position—it proceeds by listening, and by risking the sense of that which exceeds the parameters of knowledge.

Let us consider the meaning of hope, which bears upon the historical meaning of “TVoT” as well as the analogical culture it represents. Prigogine and Stengers remind us that evolution proceeds by the sentiment, “I hope this works,” Powers finds himself “beyond hope but at last at rest,” and finally Deleuze writes, “There is no need to fear or hope, but only to look for new weapons” (4). Deleuze’s statement is in reference to “societies of control” and their implements—those tools, like “prison, hospital, factory, school, [and] family,” which necessarily have a disciplinary effect on subjects. The tools are ubiquitous, so fear or hope are less useful stances than an awareness of what new tools become in play. This awareness is defensive, but also regulatory. Deleuze writes, “For example, in the crisis of the hospital as environment of enclosure, neighborhood clinics, hospices, and day care could at first express new freedom, but they could participate as well in mechanisms of control that are equal to the harshest of confinements” (4). What decides the difference between freedom and confinement is precisely the subject’s consciousness of the mechanisms in play. This, like the other quotes in question, highlights the cybernetics interpretation of hope. Consciousness is bound in a feedback loop that adjusts behavior towards homeostasis, a state of rest. For Deleuze, hope and fear represent a fixation on ends that distracts from the pragmatic work of making choices about the mechanisms that are already guiding the shape of the (social) system. Hope and fear in this sense amount to about the same thing: a wish that the mechanisms were different. In the case of Powers, we find that the lack of hope is paired with homeostasis—he is “at last at rest.” Of course, we must acknowledge the common sense conflict between death and homeostasis, “rest” as ultimate stasis or as a sustainable state. Let us remember Freud’s idea of death drive. For Freud, all life reaches toward death, toward a point of stasis. He equates this to movement toward a geological state of crystalline patterning, where energy no longer changes the shape of the molecular matrix. In this interpretation, death is a form of purity. Wymer reads Ballard according to the Freudian paradigm of death. But what we find in “TVoT” is that death isn’t pure at all. Rather than crystalizing into forms of unmoving stasis, death provides more feedback into consciousness that steers living systems. When Prigogine and Stengers refer to the “hope” that “this works,” it is important to note that, unlike the hope or fear that Deleuze discourages, which are linked to the teleological content of a particular future, the former refer to improvised movement, which reveals new potential. The emphasis is not on “hope” but on “works.” Improvisation is an act of putting oneself in a position of experience that changes the statistical properties of the system.

How does Powers' synecdochic death change the statistical properties of the system? Powers is survived by two characters, Kaldren and Coma. Kaldren, a modernist to the last, performs a solipsistic retreat into his maze-like home after learning of Powers' death, refusing to answer the door. For Kaldren, who represents a Freudian perspective within the story, life is but the collection of symbols of the ever-encroaching purity of death, and his last words in the story ("Don't let them break the clock," referring to the mandala platform Powers erects [157]) show that he interprets Powers' death as merely another symbol to be saved and tabulated. But Coma, who discovers Powers' body, is the real inheritor of Powers' legacy, because she is represented as understanding the meaning of Powers' final moments as evolutionary rather than suicidal. Earlier in the story, Powers tell Coma,

'As far as Whitby could tell,' Powers said, 'the silent genes represent a last desperate effort of the biological kingdom to keep its head above the rising waters. Its total life period is determined by the amount of radiation emitted by the sun, and once this reaches a certain point the sure-death line has been passed and extinction is inevitable. To compensate for this, alarms have been built in which alter the form of the organism and adapt it to living in a hotter radiological climate. Softskinned organisms develop hard shells, these contain heavy metals as radiation screens. New organs of perception are developed too. According to Whitby, though, it's all wasted effort in the long run—but sometimes I wonder.'

(147)

While Kaldren counts down each of the billions of remaining years before the heat death of the universe (leaving behind a paper trail of recorded numbers), Coma is given the knowledge that life has already prepared for the eventuality of change. Notably, this message, that the silent pair signifies a recalibration of life's forms, is transferred to Coma, whose name implies a link to the unconscious, and not Kaldren, who is effectively banished from dreaming. And, again, while Whitby doubts the ultimate efficacy of the evolutionary turn represented by the silent pair, Powers retains not hope but wonder, an attitude seemingly shared by Coma: "It's fantastic" she remarks to Powers, reviewing the mutant flora and fauna in Whitby's lab, "Are these the creatures of the future, doctor?" (145). At the story's end, much like in Ballard's philosophy of technology, which expands upon the potentials of the present, the glimpse of the future collapses into the existential limitations of the "now," such that the present is transformed. Powers,

Whitby, and the animals are dead, Kaldren is locked away, but Coma, the “girl from mars,” who is in league with the dream, remains—unindexed by the containing or focalizing call of the mandala, not subject to the silent pair, but conscious of the probability of inevitable change. Coma is the new wave subject.

Alongside the “resonance transfer” that is at the heart of “TVoT,” and which mimics the historical advent of sonic amplification technology, there is an epistemological transfer within the text, mediated by analog recording technology. If the resonance transfer axis corresponds to the mandala shapes that analogize Powers with the sea anemone, the epistemological transfer happens along an axis that leads from Whitby to Powers and ultimately to Coma. The contents of this epistemology are, as we have seen, the inevitability and continuity of evolutionary change, but its mediation is the important thing. Ballard writes,

Then he climbed off the desk and reached behind it, picked up a tape-recorder. [...] Switching it on, he zeroed the tape and adjusted the speaker volume. 'Whitby and I often talked this over. Towards the end I took it all down. He was a great biologist, so let's hear it in his own words. It's absolutely the heart of the matter.' [...] He flipped the tape on, adding: 'I've played it over to myself a thousand times, so I'm afraid the quality is poor.' [...] An older man's voice, sharp and slightly irritable, sounded out above a low buzz of distortion, but Coma could hear it clearly. (146)

In terms of literary history, this passage reflects the contemporaneous work of William S. Burroughs, whom Ballard explicitly emulated.⁴³ In a 1964 issue of *New Worlds* magazine, Ballard refers to Burroughs as a model of thinking about and representing the techniques of the space age in literature. As I have pointed out, Ballard rejects outer space, noting that by the mid-century “the whole of science fiction’s imaginary universe has long been absorbed into the general consciousness,” and positing his doubt that the genre “is any longer the most important source of new ideas” (127). Instead, he celebrates Burroughs for his attention to the science-fictional aspects of the present: the realities of drug addiction that create microcosms of human

⁴³ McLuhan was also quite enamored of Burroughs, writing in 1964, “Today men’s nerves surround us; they have gone outside as electrical environment. The human nervous system itself can be reprogrammed biologically as readily as any radio network can alter its fare. Burroughs has dedicated *Naked Lunch* to the first proposition, and *Nova Express* [...] to the second” (86). One could say that, in the aesthetic history which is fed by the experience of electronic life, the theory of cybernetics, and the class divisions that maintain modernity, Burroughs is the first of the transistor generation to represent the medium as its own message.

experience, the technological surveillance of homogenizing culture, and the relativism in language that reflects and complements relativism in spacetime. But in Burroughs' fiction we find another way in which he attends to the present moment. Burroughs begins *The Ticket that Exploded* (1962) with this acknowledgement: "Mr Ian Summerville of London pointed out the use and significance of spliced tape and all other tape recorder experiments suggested in this book" (Front Matter). Burroughs' novel comes out after "TVoT," so I cannot claim causality between texts, but their shared interest in tape can be said to be an expression of the technical capacities of the moment, and both authors' attention to those capacities. Indeed, *The Ticket that Exploded* is full of tape—it is dominated by tape. The end of the novel meditates on what tape does to experience: Burroughs writes, "a tape recorder is an externalized section of the human nervous system ⁴⁴ you can find out more about the nervous system and gain more control over your reactions by using the tape recorder than you could find out sitting twenty years in the lotus posture or wasting your time on the analytic couch" (213). For Burroughs, tape is an embodied model of habituation—of the tapes we play and are made to play repeatedly—wherein freedom can be attained through the appropriation of the act of recording, looping, and editing. But in Ballard there is a parallel interest in tape that coincides with his representation of the non-linear properties of saturation.

Magnetic tape, as is clear in Ballard's text, degrades over time and after steady use. It is a plastic medium that not only allows for the reproduction of sonic signals, but also makes itself conspicuous on account of its unique distortions. When a tape is played many times, the ferromagnetic powder that lines the tape, which is organized like the grooves of a record to represent sonic phenomena analogically, falls off the surface, resulting in distortion, dropouts, and noise. In 2001, avant garde composer William Basinski used this quality of tape to create *The Disintegration Loops*, a suite of recordings consisting of found sounds played on tape machines until the ferrite fell off. As Jakko Kemper writes, "[Basinski's] use of tapes is embedded in a rich musical tradition of exploring a medium's material properties with an eye for points of rupture, elevating technological malfunction to the role of creative wellspring" (¶16). Indeed, tape recording has a tradition whose nascent moments are documented in *The Ticket that Exploded*, where musique concrète techniques and tape manipulation are central to both the

⁴⁴ This section has no punctuation.

experience and social knowledge. Tape, in this paradigm, re-embodies and amplifies the paralinguistic aspects of language, communicating both the words and the spirit. But Basinski's work and Ballard's representation of tape, which both emphasize the entropic malfunction, go a step further than *musique concrète* by representing the inadvertent way that tape functions as an index of time. Scientifically, noise itself is the true voice of time, and it appropriates the tape recording with every new play-through, introducing "a low buzz of distortion." Coma is the ultimate recipient of Whitby's knowledge about life's sensitivity to radiation, but she must become a recipient by hearing both signal and noise. She hears both "clearly," and it is this quality that makes her a unique subject of the story's ending. Unlike Whitby, who interprets evolution as a failed experiment; and unlike Powers, who is faced with the tragicomic circumstance of becoming an evolutionary dead-end (even as he experiences the universe's subliminal signaling); and unlike Kaldren, who is barred from the subliminal altogether, leaving only an obsessive modernist paranoia; Coma inherits both the world of subliminal noise and the conscious world that must always cling to symbols.

As Kemper notes, noise is a fount of possibility. As I argue in more detail in the next section, it is noise and its inevitable cascading through cognitive, mechanical, and cultural systems that provides the possibility for new entities, for better or worse. But in Ballard's work we find that the historical period of analog electronics helped create a subjectivity of sensitivity to the vicissitudes of noise, not, as others have argued, as a destructive force, but as a new trajectory, not yet calculated into the reified habits of culture. Yes, some of these paths lead to death, as indeed all paths do. But the analogical and technical subtexts in "The Voices of Time" show that the continuum of death contains its own logics, some of which are central to the continuation of life. Even though science fiction's new wave has long been considered to be rooted in thermodynamics, this interpretation has also coupled entropy with death. Here, we see that entropy is a ubiquitous aspect of cybernetic and semiotic transformation, the noise in every signal, and that it is precisely the persistence of entropy, and its amplification in analogical techniques, that leads to new and unexpected possibilities in experience and in cultural understanding.

Chapter 4 Filthy Machines

...it is essential that in this perspective we no longer see the internal feeling of irreversibility as a subjective impression that alienates us from the outside world, but as marking our participation in a world dominated by an evolutionary paradigm.

—Ilya Prigogine and Isabelle Stenger, *Order Out of Chaos*

What can one say about Thomas Pynchon's most loved novel that hasn't already been said? After all, *The Crying of Lot 49* has been read as spiritual allegory, thermodynamic legend, and the key to America itself. In the spirit of the rest of this dissertation, I return to these critical themes, once more with sonic feeling. I argue that *The Crying of Lot 49* illustrates the problem of self-generating patterns, a concept from complexity theory, applied to the domain of culture, and it does so through sonic technique. I analyze the behavior of shadows and shadow organizations within the novel, compared to the topology of audio delay machines and their techniques to show how noisy feedback creates unpredictable but structured patterns. I show Pynchon's interest in and awareness of sonic culture plays an important role in the novel's structure, such that even some of the visual themes in the novel are actually epiphenomena of sonic phenomena. I argue that Pynchon's novel demonstrates an unpredictability in the development of culture that nonetheless coheres to form, based on the media by which it is transmitted.

While critical consensus might find that Pynchon's novel has something to do with cybernetics and information, its link to technology has been far less analyzed. Aside from Friedrich Kittler's essay on Pynchon's oeuvre, which I will address later, historical technological development and its connection to form have been much overlooked. It is clear that Pynchon's texts meditate on the theory of information (from references to theoretical schema's like Maxwell's demon), but I want to here emphasize the way he represents technology as a microcosm of the issues of teleology, self-organization, and semiotics. In this essay, I read *The*

Crying of Lot 49 alongside the contemporaneous logics of analog delay machines to elucidate the novel's material history. I argue that the concept of sonic feedback reveals within Pynchon's novel a commentary on the politics of Western technocracy. Overlaying the history and theory of electromechanical echoes allows for an interpretation of *The Crying of Lot 49* that emphasizes the way that analog signals are interpreted, modified, and amplified through social, institutional, and technological circuitry, ultimately constituting unexpected new forms. In some sense, it is uncontroversial to point out the complexity dynamics within art, since all human actions evince these dynamics by definition. But complexity has often been misunderstood in these contexts to represent only a drift toward chaos rather than the inklings of self-organization.

It has become seemingly commonplace to associate Pynchon with technology and informatics. When Malcolm Bradbury and Richard Ruland refer to Pynchon's fiction, they group the latter together with William Gaddis in a genre they call "cybernetic" (344). While it is unclear what they mean by this denomination, other critics, such as Victoria Alexander and Anne Mangel, have offered multiple links, many empirical and some speculative, between *Lot 49* and the history of cybernetics, and to its founder Norbert Wiener. For Alexander, Pynchon's explicit acknowledgement of Wiener (in *Slow Learner*) and intertextual traces of C. S. Peirce's theory of complexity in *Lot 49* are enough to read the novel as a meditation on one cybernetic question: "What is responsible for organization that emerges out of an essentially chaotic world, a world without a centralized source of direction?" (23). (I call this question cybernetic because of its concern with the source of control, but it is also, as we shall see, a semiotic question.) I cannot do justice to the complexity of Alexander's elegant interpretation, but I can make a sketch of its pertinent details. The story goes like this: one of the central concerns of *Lot 49* is entropy, which, as the second law of thermodynamics states, is the principle that "disorder is more likely than order" in any given system (25). But the fact remains that organization happens, entropy notwithstanding, in the form of telic systems (purposeful, resistant to change, and subject to laws that "govern the functional relations among parts and wholes" [24]). This is extremely problematic, especially if one (incorrectly) assumes that telos is a property only of linear—that is to say non-entropic—systems, since teleology would seem to imply a prime mover, a *steersman* (*kubernetes* in Greek, the source for cybernetics), or a demon. As the etymology of cybernetics implies, the problem of teleology was a thorn in Wiener's side—the latter, associating *telos* with linear systems, denied the possibility of self-organizing and purposeful systems (and notably

claimed that belief in such occurrences was delusional), preferring instead to assume that a human agent was necessary to govern the recursive entropy of the mechanistic universe. Peirce, on the other hand, understood the second law of thermodynamics to imply, through the statistical amplification of local fluctuations, a universe capable of telic self-organization.

While Alexander points to this controversy of self-organization to argue that *Oedipa* solves (and represents) the riddle of the universe, my interest in the controversy is slightly less lofty: the difference between Wiener's view and Peirce's has to do not only with whether or not *telos* is a property of self-organizing systems, it also concerns the signs by which *telos* becomes intelligible, and is thus a question of semiotics. It is worth noting that, even though Alexander's driving question has more to do with physics than language, she still finds it necessary to link *Lot 49* with Peirce through a small labyrinth of intertextual speculations. Although this inclusion of Peirce is ostensibly important because of his prescient configuration of *telos* within non-linear systems,⁴⁵ his formulation of the latter is also central to his semiotics. Thus, if Alexander's analysis is correct and *Oedipa* occupies the "complex position between the forces of *telos* and entropy" (as all living things do), then the mystery of *Lot 49*—the mystery of *Trystero*—is one of telling (reading) the difference between chaos and order, all the while knowing that one transforms into the other.

Aside from Alexander and Mangel, Eric White⁴⁶ has also pursued the thermodynamic interpretation of *Lot 49* in his essay "Negentropy, Noise, and Emancipatory Thought," attending specifically to the problem of self-organization within the novel. White turns to Michel Serres' concept of the parasite, which is both the stochastic variation in the signal that allows for new information *and* the desire to master the new path that noise creates. Serres, similar to Nietzsche, differentiates between two historical and cosmological regimes, Mars and Venus, who, like the Apollonian and Dionisian dichotomy that Nietzsche develops, represent tendencies of order and disorder:

...where Venus proposes a 'science of caresses' valorizing stochastic processes, Mars insists on a 'science of death' according to which reality can be reduced to

⁴⁵ By linear systems, I mean those systems that are deterministic with regard to causality, or reversible. Algorithms and simple machines represent systems of this type, whose movements at any point can be predicted using a simple set of rules.

⁴⁶ I am truly indebted to the late Eric White for his influence on my thinking. He introduced me to the works of Serres, and I will always remember him as a generous and wise interlocutor. Of all the work conducted in the confluence of science and literature, Dr. White's, which always had a remarkable quality of prescience, is among the most clear and erudite.

deterministic trajectories. Again, Venus would promote multiple perspectives on a world in flux, multiple tales of cosmic evolution, while Mars demands representational closure, a definitive image of reality, a single master narrative commanding the entire sweep of natural history. (White 266)

The martial approach of Mars, not only technocratic but “thanatocratic,” controls by circumventing the possibility for new phenomena, while Venus represents the irrepressible chaos that always introduces new and lively parameters into a system. In terms of *Lot 49*, White shows that the thermodynamic drama of the novel consists of the eventuality that Martian regimes are overcome by Venusian regimes, which become Martian regimes—the Tristero, Trystero, W.A.S.T.E., and even Yoyodyne are all apparently manifestations of the same initial conditions, even though some of these entities are evil and some good. For White, this poses a problem for interpreting the novel in terms of the emancipatory potential of chaos: yes, chaos creates the potential for new conditions and the destruction of old regimes, but it is equally a guarantor of the new regime’s moral and political indeterminacy. White’s analysis of the implications of complexity addresses one of the novel’s most important themes, graciously admitting the limitations of critical endeavors: “There is no Edenic language; every form of discourse, even the most apocalyptically paralogical, will in the end seek to ‘consolidate control by extending the image of human consciousness to all creation’” (271). While I agree that the enthusiasm for the political efficacy of the chaotic must be tempered by the acknowledgement that new systems all have the potential for totalitarianism, I argue that it must also be acknowledged that Mars and Venus are not equally capable.

The figures of Mars and Venus, which correlate to the semiotic modes of digital and analog representation respectively, have an imbalanced relationship *vis à vis* power. Yes, the martial power of Mars murders to dissect, cutting and appropriating wherever possible in order to make a system more efficient. But this algorithm of death is costly. This is perhaps easiest to see in the case of computer electronics, where millions of digital operations come at the expense of the high amount of power it requires to fuel and cool transistors. Analog circuits require power, but also produce and transform power with less work than in digital circuits. There are many reasons for this disproportionate relation to power, from practical to theoretical, but one reason speaks chillingly to the limitations of Martian modes of being. Stuart Kauffman writes about how Georg Cantor discovered that irrational numbers (quantities that are not constrained

by abstract rational description—i.e., those that “are not expressible as the ratio of two whole numbers”—which cannot fully be calculated using computational technologies) necessarily belong to a different class of infinitude than rational numbers (38). Real numbers are made up of a mixture of rational and irrational numbers. The upshot of this is that real continuous phenomena are highly unpredictable in terms of symbolic representation. Martial control, which thrives on and necessitates description as a medium for influencing future states, is always out-gunned by the sheer quantity of reality’s continuous detail. As Kauffman writes, “the physicist cannot simulate the evolution of this specific actual biosphere,” even by eliding tertiary factors that complicate the algorithm (39).

The overwhelming second order infinitude of chaos provides for an overload of telic possibility, but patterns emerge nonetheless, restrained and amplified by resonating channels. Here is where I’d like to add to White’s assessment of *Lot 49*: while I agree with his argument concerning the ultimate uncertainty of social and political futures due to the Martian/Venusian dialectic, he substantiates the argument by avoiding the specificity of the initial conditions that mediate the future. Part of White’s style involves collapsing segments from disparate areas in the novel into a unified concept, a method that reveals the text’s complexity themes, but overlooks the specific media in question. I argue that second order infinitude implies something special about meaning: because, as Cantor proved, there are infinitely more real quantities than there are rational numbers, the existence of any redundant phenomena requires physical channeling that evinces semi-stable qualities. That is, chaos is tamed by the inhibitory qualities of its particular passage of becoming. White writes,

In America, ‘with the chance once so good for diversity,’ Oedipa discovers an all-encompassing system dedicated to optimum performance that pursues this end by reducing every member of society to the status of ‘generic,’ interchangeable bits in the great social cybernetic network. She therefore seeks to bring about a ‘miracle’—‘another world’s intrusion into this one’—which would renew her society, transforming the ‘printed circuit’ of San Narciso into Pentecostal glossolalia. (269)

Here he associates “generic” qualities and the printed circuit board with the thanatocratic control schemes of the Martian regime. To the contrary, I argue that the generic and the circuit-oriented

aspects of *Lot 49* are precisely the signs not of the inevitability of stasis, but of the embodied nature of change.

Oedipa, seeing San Narciso from above, recalls the time when she looked inside a transistor radio, finding a printed circuit board. Far from being an example of total control, the analog circuit is noisy and prone to interference. Technology cannot be interpreted, particularly in Pynchon's work, as merely metaphorical for regimes of control. Sometimes a cigar is just a cigar, and sometimes a radio is indeed a radio, in all its technical fidelity. Kittler himself turned his reading of Pynchon's work toward the electromechanical. In "Pynchon and Electro-Mysticism" Kittler writes,

...I will assume that, rather than enlightening the darkness of classic modernism, subjects such as the disappearance of the hero or even the death of the author merely prolong and obscure the problematic, twisting it even into incomprehensibility. In contrast I will begin with a question which may sound trivial at first sight. How did music adjust to the twentieth century? (108)

He begins this inquiry by comparing a passage from Sartre with one from Pynchon's *V.*, pointing out that Sartre, even though he attempts to "switch from existence to technique and thus provide their readers with the true feeling of modern life," falls flat when describing historical technology (109). "To cut a long story short, Sartre could certainly have got away with studying less Heidegger, but he definitely should have examined more circuit diagrams before allowing his hero to confound the highly complex process of record pressing with this intoxicated record-induced bliss" (110). He goes as far as to call Sartre's mistake, which is that he mis-describes post-war sonic technology as mechanical rather than electromechanical, a piece of "outstanding stupidity" (110). Kittler, provocateur as usual, is setting up Sartre as a foil for Pynchon. Kittler finds that, contrary to Sartre's rather bumbling and incompetent approach to appropriating technology as a poetic backdrop, Pynchon's representation of sonic technology is "not simply postmodern, but both technically and historically up to date" (110). It could be said that Kittler is being unfair by assessing literature in terms of its attention to rather specific historical details about the evolution of amplifier design, but there is something more at work here: within Kittler's (funny to me at least) critique is a historico-aesthetic argument. We can infer from his dunking on Sartre that a defining aspect of modernist writing is precisely its inattention to the specifics of materiality, while the question of how music adapted to the twentieth century can

reasonably be addressed to Pynchon's work because the subjectivity of that time is inextricably linked to technological awareness. For Kittler, the technological awareness that Pynchon evinces is not particularly a product of "postmodern" aesthetics, but more definitive of the aesthetics that are called postmodern. Kittler does not explicate these ideas, devoted as he is to being the LeBron James of media criticism (i.e., a disproportionate dunker), but the implications are fascinating and telling. If the defining feature of postmodern literature is its technological subjectivity, then the machines of its era have critical detail to contribute to the interpretation of the era and its art. Indeed, Kittler sees in Pynchon something that he calls an "electro-mysticism" that unites subjectivity, history, and technology. It's an apt phrase—it emphasizes parity of the phenomena of life and the invisible operations of electricity, which I too find to be central to Pynchon's project in *Lot 49*.

It is worth commenting on why Kittler's approach to Pynchon specifically and postmodernism generally has not caught on. Kittler's essay, "Pynchon and Electro-Mysticism" is full of obscure diagrams, formulas, and concepts, some of which are not even accessible to a scientific audience. His sensitivity to the poetry of engineering and engineering of poetry is admirable, evocative, and productive, but outside of the ken of most humanities scholars. But why? I argue that this thread of criticism has been left behind because of a historical epistemological trajectory. Science and the humanities are, because of the "two cultures" problem described by C. P. Snow, seemingly always repelled by each other. Furthermore, we must admit that in an age of digital ubiquity, there is no longer the need for even basic literacy concerning technological theory.⁴⁷ I myself, whose only experience with engineering is what I have had to pick up in recording studios, assembly rooms, and workshops, had to look up the finer points of Bernoulli's catenary formula, because I certainly don't have it memorized. Thus, as Kittler points out, English scholars are quick to use theoretical tools that evade technical and scientific description. And for good reason: critics like Evelyn Fox Keller and other feminist critics of science have argued persuasively that scientific tradition is, above and beyond its theoretical findings, inextricably linked with the cultural projects of misogyny, racism, and

⁴⁷ This might seem paradoxical or counter-intuitive, since we are now far more surrounded by advanced technologies than we ever were in previous decades. But consider television and radio antennae: there was once a time when everyone in a household knew how to manipulate their TV's bunny ears to get a better signal, or coax a radio dial into just the right spot. This is a skill now virtually lost to most westerners, since tuning has either become quantized by digital circuits or done away with altogether in favor of digital streaming.

colonialism. But while scientists like Keller argue for a “disunification” of the sciences (one that importantly leaves room for more humanistic tools like metaphor and modeling), humanities scholars have, as the story goes, tended to reject science altogether, in favor of “theory.” This has been a prevailing understanding of the discipline, and one that I myself have held. However, Jonathan Kramnick writes, “Recent years have seen a vibrantly eclectic curiosity in quantitative, empirical, and otherwise novel approaches to literary study, from the digital humanities to the cognitive sciences to affect theory and beyond. To say that the business is theory-besotted and averse to things scientific is, to borrow an expression from Joseph Carroll, ‘boxing at shadows,’ at a caricature of the profession that never was accurate and is now certainly behind us...” (433). There is reason to believe that “theory” is not merely the navel-gazing that we as literary scholars are afraid it might be, but that it has become more legitimate, humble, generous, and productive. But, on the other hand, we must consider Thomas Docherty’s injunction to “follow the money”:

Theory is domesticated as a university discipline or field of study, extending the principle of equivalence that governs modern life and capital. It is the rise of theory, especially within the university, that has contributed to the advance of a neo-liberal ideology. Marx famously argued that we should always start from the real conditions of everyday life; and theory as we now know it is precisely what stops us from doing so. (McHale 170)

While on the surface the combination of science and literary criticism evinces epistemological difficulties (which are by no means totally false), there is perhaps a greater issue at hand, which is that both science and the humanities are beholden to a cultural economy invested in alienation. So the greater problem isn’t that Kittler’s math is too hard, it is that academic culture is not primarily interested in the intuitive science accrued from experience. When we remember that Kittler’s criticism of Sartre is simply that he had not paid attention to his own environment, it becomes clear that what is lacking is not theory but, or even scientific knowledge, but a pragmatic sense of how things work. Science and theory are indeed subordinated to this primary concern. Kittler quotes the poet-engineer from Pynchon’s *V.*,

Poetry had to be as hasty and as rough as eating, sleep or sex. Jury-rigged and not as graceful as it might have been. But it did the job; put the truth on record. [...] “Truth” I mean, in the sense of attainable accuracy. No metaphysics. Poetry is not

communication with angels or with the “subconscious.” It is communication with guts, genitals and the five portals of the senses. Nothing more. (318)

Kittler continues in his own words, “It is up to us, who speak and write of poems, to amplify this message instead of filtering it, however eruditely.” (119). Whatever tool will get us to the truth of the senses is the right tool, regardless of its cultural cache. Ironically, Kittler knows that, in the history of electromechanical techniques, amplification always includes some degree of filtering.⁴⁸ But the truth of the senses is not the truth of facts, algorithms, or syllogisms. The truth(s) of the senses is/are the totality of the sensorial circuit, which includes filtering, feedback, and the transformations implicit in the analogical world.

In the late nineteen sixties, building upon dynamic random access memory technology that was developed during World War II, engineers in the Dutch wing of the Philips Research Labs developed a new way of storing analogue signals: the Bucket Brigade Device. The *Newnes Television and Video Engineer's Pocket Book* reads, “Unlike a digital shift register [sic] the type used in a solid-state image sensor can deal with an analogue signal which in effect consists of ‘packets’ of electrons. It is known as a bucket-brigade device (BBD) and finds applications elsewhere in consumer electronics, primarily for analogue delay lines” (Trundle 123). As the source suggests, the chip was used in image sensors, but it was out-performed in the use-case by its successor, the Charge Coupled Device, which is a similar but more sophisticated means of passing voltages from one capacitor to another. In electronic camera sensors, BBDs and CCDs are responsible for capturing, line by line, the photons at the back of the lens, and delivering them either to a digital storage medium, which converts each packet of electrons into bits, or along an analog path, storable on tape. In the context of optical applications, the BBD is just one step in the evolution of digital capture and storage technology—simply a means of converting analog to digital—but its sonic applications remain primitive. And, tellingly, they are still called Bucket Brigade devices in the audio world.

Imagine you are an old-timey fire fighter. There is no fire engine with its elaborate pump system, and no fire hydrants. You and your team must retrieve water (quickly!) from a well. So you and your team arrange yourselves in a line between the well and the fire, each with a bucket.

⁴⁸ Criteria such as signal to noise ratio and frequency response attest to the everyday engineering reality that there is no amplification with total fidelity.

The person at the well (*A*) pours their water into *B*'s bucket, who pours that water into *C*'s bucket, until the water reaches the fire. This is fundamentally how BBDs function, except the buckets are capacitors, and the water is electrical charge. (In digital video applications, the well is the serialized photons collected from the lens, and the destination (fire) is a system that records the exact amount of energy in each bucket.) You may find yourself wondering, is the bucket brigade an analog or digital operation? It appears digital, since it striates the water from the well into discrete units. Furthermore, this striation is indispensable to the process of digitizing image data. But we run into a problem when we think about the bucket brigade's stages. *A* doesn't know the quantity of water they have passed on to *B*, who similarly is unaware of how much they pass to *C*. This epistemological blindspot (i.e., the fact that the charge in each capacitor is not represented as a value) creates interesting possibilities. A bucket brigade, in order to successfully transfer water to the fire, must work at a consistent rate. Consider what happens when they are not in sync: *B* is extremely anxious to put the fire out, and so they prematurely attempt to pour their share into *C*'s bucket, missing the target, and leaving water either in their own bucket, or on the ground. By being out of sync, *B* ends up making a sloppy mess, which has cumulative effects. Because there is no accounting for the quantity of water that *should* be in any one bucket, the input of the bucket brigade is no longer consistent with its output—or, in other words, the operation has introduced nonlinearity. This isn't just an abstract scenario either: BBDs are “clocked” by a timing mechanism that ensures that each capacitor empties into the next in a synchronized manner. But electronic clocks are imperfect things, and introduce exactly the sort of slop that *B*'s impatience produces, an effect that engineers call “jitter.” So we find that, although BBDs are integral to the capture of certain kinds of quantitative or symbolic data, they themselves are analog, and as such are vulnerable to nonlinearities. Their analog qualities, and the implications of this technology, can be clearly apprehended in their sonic applications.

In music, BBDs are used to create echoes. As the *Newnes* guide says, the BBD can be used as a “delay line,” meaning that the pail-bearing fire-fighters (numbered in the hundreds or thousands) effectively hold on to the signal, delaying its passage from input to output. By splitting the input signal in two, running one side into the delay line, and then merging the output of the delay line with the unaffected half, one creates a “slap-back” echo: one hears the original sound, followed closely by the version of the sound carried by the bucket brigade. This effect,

which, prior to the advent of BBDs was achieved using tape machines,⁴⁹ was, in the hands of players like Les Paul, used to simulate a second guitar—a doubling effect. But echo was quickly appropriated for its own unique properties. Artists like Pink Floyd and Led Zeppelin, harbingers of rock and roll experimentalism, used echo machines not for subtle doubling but for longer reverberating echoes. These echoes differ from Les Paul’s use of the technology by incorporating a new element: feedback. At about a minute and forty seconds Pink Floyd’s recording of “Astronomy Domine” there is a break in the rhythm that is gradually filled with an echo-laden guitar on one channel, as well as a swooshing sound in another. Both of these sounds were achieved by allowing a delay machine’s output flow back into the input, effectively recycling the content of the remembering substrate (in this case, the wire drum of the Binson). Feeding the output back into the input became a normal feature as delay machines evolved, but it opened a new sonic possibility: hearing the delay play itself. The swooshing sound in the middle of “Astronomy Domine” is exactly this: a delay machine pushed into what is known as “self-oscillation,” a phenomenon that happens when the amount of feedback exceeds the strength of the initial signal.

Let’s return to our bucket brigade: imagine that every time the water reaches the end of the brigade, it is sent back to the beginning and added to the water from the well. (This is where the bucket brigade analogy begins to fall apart, but it’ll work for now.) Clearly, the buckets will run out of room eventually, and every bucket will become full after a couple rotations. But what happens in delay machines that are put in this predicament is that patterns emerge. You can hear it happen in the middle section of “Astronomy Domine”: The guitar strikes a note, that is repeated by the Echorec, but instead of dying out slowly, as echoes naturally do, the echo

⁴⁹ Creating artificial echoes has a long (indeed ancient) history. In terms of creating echoes using post-war electronic technology, the BBD was the final step in achieving the effect in analog, preceded by using modified reel-to-reel tape machines to rapidly record and then reproduce the input signal. This method can be seen in action in a video recording of Les Paul and Mary Ford performing “How High the Moon” in 1951. One can hear a fast (probably only 40 or 50 milliseconds) repeat of his guitar, and then the camera zooms out to reveal several large tape machines—one for producing the echo sound, and one (supposedly) for recording the entire performance. This method was eventually miniaturized (not by much) by the Maestro Echoplex (1959), and then the Roland RE-201 Space Echo (1974). These machines are still highly coveted for their unique sound, but they are finicky and fragile, making them suboptimal for live use. Another echo machine, the Binson Echorec (1962), is a striking example of how music tech repurposed military tech: it functions using the same principle as military wire recorders, but the wire is mounted to a rotating drum. The Echorec too is highly vulnerable to accident. Part of its characteristic charm is the way that the recording drum, being mechanical in nature, tends to wobble, creating a noticeable sea-sick pitch differential in the echo. The BBD, even though it is analog, is not mechanical. It represents a stabilizing and democratization of analog echo technology that until that point had been prohibitively fragile, expensive, and unwieldy.

becomes louder and louder, emphasizing new timbres based on the nonlinearities of the wire, the magnetic heads, the motor speed, and amplifying circuit.

Self-oscillation is a sonic concept that comments on the non-linear nature of embodied memory. I have used BBDs as the main example, but they are merely one of many means of remembering sonic phenomena. As I have already mentioned, tape, wire, recording, and vinyl lathes preceded the BBD, and resulted in technologies that all had their own unique capabilities. But these technologies share the ability to recycle their contents in such a way that changes and grows. It is worth comparing these analog delay systems to digital delays. In digital delay devices, if the output of the line is “read” back into the input, a static loop results: the loop, because it can be described symbolically, can be reconstructed with complete linear fidelity. This is why we put so much faith in digital memory to store our most valuable memories, from our family photos to our currency. But every time an analog memory is revived, it will be different, even when there is a system in place (i.e. feedback) to retain its signal. In computer science, this degradation is described as a decline in the signal to noise ratio inherent in certain technologies. But as I have pointed out in the semiotics of circuitry, noise is its own signal: it is the sound of complexity working through the universe and through life, and as such speaks importantly to culture. In our own age, accustomed as we are to the virtues of digital memory, it is hard to imagine how the noisy caprice of analog memory could be beneficial. But I argue that analog memory provides a way of becoming lost, against the overly instrumental and surveilling force of digital encoding, which is itself a central component in the acceleration of western modernity. Musician and film-maker Jim Jarmusch comments on his favorite analog delay, “I use the Deluxe Memory Man as a way to get high, [...] You can get lost in it for hours. I have a lot of interesting pedals, but this one is maybe my favorite, for finding spacy, ambient things. A whole day can get away from me. It’s like a drug” (Paz). Jarmusch’s testament points to the analog delay machine as an extension and reflection of consciousness, and as a mode of defamiliarization.⁵⁰ I can attest to the drug-like effect of delay machines. The Deluxe Memory

⁵⁰ It is impossible to write about this period of literature without acknowledging the role of drugs. Whether you take Williams S. Burroughs or Jorge Luis Borges as instigators of postmodern subjectivity, they both represent a fidelity to altered consciousness, the former due to decades of heroin addiction and the latter from fever dreams experienced during acute brain trauma and its medication. The connection between drugs and form requires its own dedicated inquiry. But I can wager here that drugs and technology are both favored objects in postmodern literature because of their capacity to reorganize consciousness at a level of mechanical process. While previous regimes of literary subjectivity—i.e., realism and modernism—represented experience as either uniformly cognizable or as uniformly alienating, postmodern fiction, under the influence of both democratized inebriants and technologies, represents subjectivity as corresponding to only local and contingent laws.

Man, as well as my own favorite echo machine, the DOD Rubberneck (both BBD-based circuits) record your playing, and speak it back as an oily, dream-like excrescence. If you get the feedback level just right, it obsesses over one passage and transforms it into a new signal, an ever-transforming meditation on mutability. I have performed many experiments where I find this balance within the machine, leave my studio, and come back hours later to discover that my 3 seconds of input have transformed into words in the language of the machine. Kittler writes, “Pink Floyd sticks in one’s head, simply because people no longer need to be reminded, simply because machines themselves are the mind. And with that, it also becomes possible to store—beyond words and melodies—the colorations of instruments [*Instrumentalfarben*], sonic spaces [*Klangräume*], and indeed, even abyssal stochastic noise [*die abgründige Stochastik des Rauschens*]” (*Truth* 55). As laconic as Kittler often is in his economy of explanations, he here groups together that which is possible in the mind of the machine due to its analogical contingency: sensitivity to timbre (sometimes called “color”), the modeling of environment, and amplification of noise. These are all really different names for the same thing, but expressed in different domains: timbre itself is an expression of “abyssal stochastic noise” channeled through a particular vibrating medium; the sense of sonic environment is a product of the entropic diffusion of signals returning to noise in formally regulated ways; and, of course, the injection of abyssal noise into recording is itself a channeling and acceleration of entropic flows. These are all issues of the flow of time, of thermodynamics and history, and their manifestation in aesthetic technology. But they are not general considerations of complexity theory, but considerations of the history as it is “stored” in particular mechanical and living substrates. Self-oscillation in a delay line exemplifies this dynamic: it holds on to a moment, but continually reinterprets it by pulling it into the present.

I posit that the technopoetics of self-oscillation functions as a corollary of traditional poetics. Consider Walt Whitman’s perspective concerning the role of the poet *vis a vis* history: “Past and present and future are not disjoined but joined. The greatest poet forms the consistency of what is to be from what has been and is” (13). This definition is a diagram of homeostatic feedback: to add input (present) to output (past), regulating them (forming consistency) as the former becomes the later in perpetuity. For Whitman, the poetic subject is one who channels and synthesizes history and present into a form that, when recognized, makes one “Encouraged or terrified afterward for many years” (13). Poetry, and the poet are thus a strange sort of machine

that stores history analogically, shifting it through a circuit of registers that distort it by exposing it to the nonlinearities of the present. Being exposed to this machine—reading or making poetry—is not conducive of moral discipline (Whitman makes this point clear), but instead leaves one shocked or pacified. Courage and terror, which Whitman seems to describe as equally proper effects of good poetry, are, I think, consequences of a confrontation with the history not as text but as becoming—as an unstoppable process whose redundancies are not “editable” but can be communed with.

Mostly, I use my delay machine to create a feeling of space around musical passages; sometimes I use it like Pink Floyd did in “Astronomy Domine,” to create a noise swash rich in the machine’s overtones; but sometimes I just speak with it. I play some notes into it with the feedback at a setting that allows it to continually hold them in recollection (at a threshold that straddles positive and negative feedback), and I listen as the notes change. Sometimes I can intuit how the BBDs will garble or pervert my input, but never exactly. When it starts flowing away from a balanced state, I add some new notes that interrupt and harmonize with the little circulating ghost in the machine. Harmony and dissonance are very important in this practice: consonance affects the feedback path differently than dissonance. The machine listens, and responds, and what it tells you is humbling because it doesn’t seem to care about your ideas, but it listens all the same. It encourages you to speak, and it terrifies you with its nonhuman words. It is a tiny model of complexity, since it displays the “edge of chaos” dynamics that define things like life: its behavior is between high and low entropy, allowing its signals to coalesce into structures. Moreover, it also models the criteria of evolution, since its behavior changes non-deterministically according to feedback.

But what do we learn from the echo machine as a ship in the bottle, a miniature performance of the principles that subtend life? We find that the bottle is open: the delay machine is not a closed system, since it is part of a circuit that includes and influences me. We also find that this feedback (of the second-order variety described by Margaret Mead and Gregory Bateson) illustrates and reifies the intuitions of writers like Whitman, who imagined aesthetic action as a synthesis of past and present, and that this poetic subjectivity has a basis in complexity. Lastly, we can see that the technological progress that makes the delay machine accessible as an aesthetic tool creates some kind of subliminal awareness of the scientific and existential conditions that the instrument implies. Prior to the public availability of microscopes,

we might have recognized the existence of germs, or the manifold qualities of cells, but growing up in an environment where microscopes are everyday objects must constitute a change in subjectivity. The delay machine is like a microscope for sonic phenomena—a petri dish for examining the evolution of sounds and their relationship to human and non-human elements. The content of the machine, the electrical signal that manifests from feeding past into the present, is an analog shadow of its input, which is simultaneously a true reflection of history, and an icon of the mechanical distortions that house it. Its mediation is its signal.

[The shift from cybernetics to semiotics narrows our attention to the ontology of semiotic encounters within the text, and how they bear on Oedipa's interpretation of Trystero. Human language, including fiction and whatever else it may do, is subject to, and a product of, telic self-organization]. This is not a panacea for problems of interpretation generally, since it does not describe the relationship between what we consider meaning (philosophical, aesthetic, affective, or scientific) and information. As J. Kerry Grant notes, "The word 'information' in this context [of thermodynamics and Lot 49] cannot be thought of in its usual sense as being equivalent to some specific meaning encoded in language or numbers or symbols of some other kind. In the words of one of the early theorists in the field: 'This word "information" in communication theory relates not so much to what you do say, as to what you could say'" (103). Information in this respect is not a specific message but the form of telic coherence itself, such that we can adopt/adapt Marshall McLuhan's phrase about media to fit information: the form of coherence is the information. To return to the Peircian semiotics, translating Claude Shannon's mathematical informatics paradigm to something a little less reductive, we can consider "information" to include forms of proto-meaning, such as analog signals. These signals exhibit coherence (or redundancy, in Bateson's terms) that prepare the channel for meaning, but they are themselves not necessarily telic—i.e., intentional, or indicative of a sender. Consider a child's reaction to the shadows of trees that penetrate their windows at night. These reflections move as though motivated—a coincidence that has scared many a child. But what if the shadows were indeed an index of life, motivation, or purpose? Of course this is the predicament for which the animal mind is always primed—a product of evolutionary training. Consider cats and cucumbers: cats are evolutionarily sensitive to snake-like shapes, such that a unexpected cucumber is nearly always met with mortal shock. Early humans became sensitive to minute changes in the rustling

of leaves for the same reason. But how does the human mind cope with the inchoate rustling within culture and technology?

Pynchon seems to have [something of this sort in mind] when Pierce Inverarity calls Oedipa for the last time:

[...] last year at three or so one morning there had come this long-distance call, from where she would never know (unless now he'd left a diary) by a voice beginning in heavy Slavic tones as second secretary at the Transylvanian Consulate, looking for an escaped bat; modulated to comic-Negro, then on into hostile Pachuco dialect, full of chingas and maricones; then a Gestapo officer asking her in shrieks did she have relatives in Germany and finally his Lamont Cranston voice, the one he'd talked in all the way down to Mazatlán. (2-3)

The “meaning” of this communique is nothing other than the kinds of voices that Inverarity can impersonate, which are all either characterological or stereotyped. It is not a message that can be decoded, and is not represented as such: none of Inverarity’s discourse is described explicitly, and much of it is conveyed via its typology.⁵¹ Even though there is no message as such encoded in the phone call, it is not a random occurrence. It has redundancy—information—in the form of generic types. When Inverarity facetiously tells Oedipa, in the voice of another “type” (the Shadow himself, or his alter-ego Lamont Cranston, the archetype for the masked hero), that the Maas household awaits a “little visit from The Shadow,” the narrator converts the type into a metaphor: “The shadow waited a year before visiting. But now there was Metzger’s letter” (3). (The letter here being the one announcing Inverarity’s death.) As Grant points out, much has been made of this reference to *The Shadow*—it has been seen as both the Holy Spirit and the protean spirit of the novel—but inasmuch as the reference functions as iconographic information (not meaning), there are a couple of points to add.

[collapse] First, even though Inverarity’s call is full of types, including the Shadow, by the time the letter announcing the former’s death arrives, the type has hypostatized into a

⁵¹ It is possible that Inverarity’s phone call counts as what J. L. Austin would refer to as a “performative utterance,” but I think that even this designation overestimates the amount of “meaning” conveyed here. Austin’s schema presupposes a sender and receiver that have a conventional understanding of what the performative utterance signifies and what it demands. Thus, in making a promise for instance, I mean that I shall make the linguistic situation felicitous by fulfilling the promise. But here, the condition that would make Inverarity’s phone call felicitous is totally opaque, not only to the reader, but also, apparently, to Oedipa, who only calculates the meaning of the call after receiving the letter announcing Inverarity’s death.

metaphor (evinced in the transition from “Shadow” to “shadow.” That is to say that the object in question, which is still equivocal, has moved from being a something with a certain quality to being a something evincing enough singularity to be metaphorized, even if the metaphor only emphasizes its inchoate quality.

This transition parallels, in my view, the Peircian semiotics of recognition. According to Umberto Eco’s interpretation of Peirce,

The iconic moment establishes that everything starts from an evidence, albeit imprecise, which we have to take account of; and this evidence is the pure Quality that in some way emanates from the object. But the fact that the Quality emanates from the object does not provide any guarantee of its "truth." Insofar as it is an icon, it is neither true nor false: the "torch of truth" must still pass through many hands. It is the condition whereby we set off on our way to saying something.
(112)

In Peirce’s tripartite conceptualization of semiosis, the icon belongs to the lowest threshold of distinguishment, Firstness. As I have already mentioned, Peirce’s semiotics are consistent with his conception of self-organization. The realm of firstness is literally one organized system’s (the perceiver) way of detecting other telic systems by sensing the organization of parts to wholes. Peirce remarks, “The existence of things consists in their regular behavior” (CP 1.411). The lower threshold of semiosis is the zone wherein, long before “the torch of truth” arrives, the ontology of interpretation is initiated through the arrival of an emanation of quality, the aftershock and presence (or shadow) of telic “things.” Tellingly, Eco puts the predicament of Firstness in terms of casts and impressions, a structure equally accommodating to shadows: “Natural primary iconism would be the quality proper to impressions that still have not found (necessarily) their impresser but that are ready to ‘recognize it.’” (110). Here Eco separates the impression from both an abstract “cognition” as well as from its impressor, in much the same way that the Shadow acts as a disembodied icon capable of having no determinate position (the visual effects of the 1994 film version of *The Shadow* try hard to drive this point home by making the vigilante into a variety of impressions: from cartoonish shadow to effluvial smoke-creature).⁵² Pynchon’s deployment of the Shadow serves the purpose of providing an impression

⁵² Christopher Nolan’s *Batman Begins* (2005), *The Dark Knight* (2008), and *The Dark Knight Rises* (2012) show Batman’s indebtedness to The Shadow’s archetype by revisiting (with more realism) the question of the agency of

of telic organization without any signification as such, and it also represents the chaotic “afterlife” of informational things.⁵³

Also at issue in Inverarity’s call is that his mimicry of multiple types (a way of remaining iconic, or, at most, indexical) complicates the process of interpretation because it distorts the relationships of parts and wholes that Firstness initiates. A type is neither a part nor a whole but a kind of thing. Invarity’s performance of type implicates him in a handful of discourses, but not necessarily real ones—discourses as they are already presented in their most abstract forms. If, as Peirce writes, “A sign is something by knowing which we know something more,” then Inverarity’s phone call is a vacuum for meaning, since it not only contains no sign as such, it seems to absorb and distort the more stable signs around it. “But Margo,” he addresses Oedipa (this is not the only time she is mis-addressed). As Grant notes, Margot Lane is “the only person who knows to whom the voice of the invisible Shadow belongs,” but also that Pynchon misspells her name (17). When brought into the purview of an ontology of interpretation, this intertextual address becomes telling: even though it would seem that by calling Oedipa “Margo,” Inverarity (metaphorically aligning himself with the Shadow) is interpellating her (to use Althusser’s phrase) as the person who will recognize the “true” version of himself. And yet, by disguising himself in the half-light of iconicity, and by dying, he leaves an impression (shadow) that can only be turned into a sign by meeting the “real” impressor that the stereotypes represent. And, thus, because of this, the “thing” that Oedipa is primed to recognize is the circuitry that contains mediates the shadow (or the telic system that can be called by that name): “She had dedicated herself, weeks ago, to making sense of what Inverarity had left behind, never suspecting that the legacy was America” (147). I would like to resist the idea that Oedipa discovers some truth about America⁵⁴ that exceeds the form that is defined by the ontology of interpretation. America in this case must be understood as a circuit that houses the shadows of historical reality—this is

pure icon. The trilogy’s main tension revolves around maintaining the impressionistic nature of the icon (the guise of Batman) while also producing clearly telic effects (justice).

⁵³ As I will treat in more detail later with regard to self-oscillation, Eco’s (and Peirce’s) separation of the impression from either impressor or impressed rests on the logic of self-organization: once information has left its source, it is itself subject to the same potential for self-organization as its source or destination. In information theory this could be referred to as noise, since the laws of self-organization as applied to communication certainly modify the “message,” but this description does not take into account, since the schematic is limited to the relations of just two agent (sender and receiver), how information, once “transmitted” is freed up to mingle its energies with other systems or with recursion.

⁵⁴ While Inverarity’s phone call looks like (vague likeness being the hallmark of Firstness) a shadow index for the real people who Oedipa could potentially meet, the types he presents are over-abstracted—cartoonish.

America not as culture or state but as delay machine—as analog memory: Oedipa’s quest consists of following the transformations of signals as they live on inside circuitry.

The shadow persists throughout the novel, changing forms for every technology from which it emanates. When Oedipa, by accident, alights on Mr Thoth’s knowledge of Trystero, the latter’s narrative is interwoven with the hyper-abstraction of cartoon iconicity: “‘It was all mixed in with a Porky Pig cartoon.’ He waved at the tube. ‘It comes into your dreams, you know. Filthy machine. Did you ever see the one about Porky Pig and the anarchist?’” (73). As Mr Thoth’s dreams are penetrated by the imagery of 1930s cartoons (the anarchist of the Porky Pig cartoon “The Blow Out” is represented as a human shadow as well), so Oedipa’s dreams are interrupted by Inverarity’s performance of pulp radio. For both, a shadowy icon serves as a something around the edges of which reality seems to congeal. “Can you imagine a 91-year-old man so brutal?” says Thoth, collapsing the typological perception of his grandfather *as* a grandfather with the exploits of his grandfather as a much younger man, pushing the impression back against the impressor. This is, to be sure, a Freudian problem: here iconic vagueness serves as a “screen memory” (or perhaps, in this case, a smoke-screen memory) around which the mind, in the process of detecting the purposes of other minds, writes an abundance of non-pertinent but vivid details. But the shadow icon—though it intrudes into the mind at its most oneiric point—is not even a memory, so it screens very little: the filthy machine is none other than the mind itself, that combines the intrusive icon with the history of its own violence, but even more so, the reality of complexity (caricatured as multiplicity).⁵⁵ In the old pulps, the Shadow has the “hypnotic power to cloud men’s minds so they cannot see him” (Grant 16). The shadow, its icon more generally, seems to have the effect of producing the feeling that there is something waiting to be recognized. It comes out of the multiple, so it could be (in) anyone (even an old man watching cartoons). It generates, by necessity, suspicion.

The problem I have been describing so far, the problem of ambiguous icons, is a problem of signal to noise ratios: the icon, being the emanation—the shadow cast by the something—is generally low in signal and high in noise. The optimal response to the icon is alertness to the subsequent pattern of the impressor’s organization (maybe even suspicion). This is a shift from the mechanisms of impressions to the mechanisms of the impressed, and more specifically the

⁵⁵ I will, as they say, eat my own hat if no one has noticed the tropological links between *Lot 49*, “The Blow Out,” and Conrad’s *The Secret Agent*.

processing of impressions. If the semiotic process works by reading the behavior of things, the problem with processing the ghostly Tristero is that its behavior is either unclear or so manifold that it implies no distinct function. As Grant writes, “The Tristero is revealed to Oedipa in tantalizing fragments, none of them sufficient to constitute definitive evidence of even the existence of a whole, let alone its shape” (53). Oedipa’s encounter with “tantalizing fragments” triggers her suspicion by implying a remainder that coordinates or explains the relationship between parts and wholes. Grant goes on to note that, in the abundance of interpretations of the Tristero’s significance, most critics have identified the organization as having either a positive or negative impact on either Oedipa or the world generally. The positive and negative valences of the hidden organization can be inferred from the intertexts that come to symbolize it: while the reference to *The Shadow* would connect the Tristero to vigilante justice, the cartoon anarchist suggests a more nefarious purpose. Both of these inchoate abstracts share a necessary secrecy, but to different ends: one heroic and one malicious. As White posits, this seems to emphasize the indeterminacy of complex systems. The juxtaposition of these potential teleologies draws our attention not only to the problem of processing, but also to the problems of determination and sorting. While the theme of sorting, especially as it concerns Maxwell’s demon and John Nefastis’s machine, has been well pretty well trod, I would like to point out two other moments of processing in the text, both of which sit at the threshold of the Tristero’s indeterminate shadow, the first being the tragicomic near-suicide of the Yoyodyne executive.

When Oedipa traces the sign of the muted horn to the nameless representative of “Inamorati Anonymous,” he tells her the story of how the organization began in the aftermath of a Yoyodyne executive’s replacement by an IBM 7094. When his suicide is interrupted, and he discovers the sign of the Tristero on stamps mailed by correspondents advising him on the pros and cons of self-murder, he interprets the icon, but according to a linear logic: “Idly, he peeled off a stamp and saw suddenly the image of the muted post horn, the skin of his hand showing clearly through the watermark. ‘A sign,’ he whispered, ‘is what it is.’ If he’d been a religious man he would have fallen to his knees” (93). I say that his response is linear because, although he recognizes the sign of the Tristero *as* a sign, he takes it to signify not the organization itself (or its mysterious manifestations) but a discrete answer to his own problem. The nameless Yoyodyne executive is waiting for a sign, but only one that amounts to a “yes” or “no.” This is one of the things that constitutes the tragic comedy of the episode: even though he is replaced by

a computer that can make decisions more efficiently than he can, he and the machine process information in the same way already, by performing binary, digital calculations. The “yes” or “no” that he seeks is the literal equivalent of “on” or “off,” which is the capacity in which he has been instructed to function as a bureaucrat:

“...trained to do absolutely nothing but sign his name to specialized memoranda he could not begin to understand and to take blame for the running-amok of specialized programs that failed for specialized reasons he had to have explained to him, the executive's first thoughts were naturally of suicide. But previous training got the better of him: he could not make the decision without first hearing the ideas of a committee.” (91-92)

In the on/off economy of binary processing, the executive’s previous value (his function as a switch for processes that he knows nothing about) reverts to off.

Moreover, even in the absence of the institution for whom the binary function was necessary, he reverts to binary as a way of processing new information. Here, the IBM 7094 serves not as his mechanical antagonist, but as the fruition of the mechanical style of thinking that he already embodies. The 7094 was one of the first computing systems to utilize transistors, which were more efficient than their antecedent, the vacuum tube. What made the transistor better than its predecessor was its ability to perform simple logic operations, translating the status of its inputs into positive or negative voltages (on or off), without using massive amounts of slow and inaccurate heat energy.⁵⁶ When the executive reaches out for a committee, he recreates the schematic connections of the binary processor, reattaching inputs to feed him information. His binary style of processing is satirically exposed when he expects his advising “inputs” to exclude the middle between “suicide” and “living”: “His shrewd assumption being that no suicides would reply, leaving him automatically with only valid inputs. The assumption was false” (92). To the dismay of the executive, who had been trained only in the binaristic method of sorting information into two boxes, the world consists mostly of non-excluded middles. “He found it impossible,” Pynchon writes, “in the absence of some trigger, to come to

⁵⁶ The vacuum tube is also problematic in the context of computation because of its predilection for burning out. Tubes can be held at stable current for long periods of time, but if one wants to process information with them, you must turn them on and off regularly, which degrades the filaments. Vacuum tube computers would “burn through” tubes at the rate of one or more in an hour. Compare this with the case of the executive: as part of a human computing system, his options are to be upgraded or to burn up (literally) through inefficient processing.

any clear decision” (92). The use of the word “trigger” here is decisive—in the terminology of computation, a trigger (similar to a gate) is a small blast of positivity—a high energy burst of absolute “yes” from the void. Thus, when he sees the “sign” of the Tristero, he reads it as a trigger, without regarding the depth of its semiotic potential. The sign triggers in him merely a change of state, but not from ambivalence to suicide, but instead from seeing love as positive to regarding it as negative.

In terms of an ontology of interpretation, the sign here goes more or less unexamined—it merely “trips” the logical threshold of state change—but even though the ex-executive neglects to interrogate the Tristero in its complexity as a system, his lapse into the logic of theology indicates that it is precisely the recognition of the Tristero as agential (and thus teleological) that is taken for granted in order for the sign (literally, the muted post horn) to trigger a change. In this conditional, “If he'd been a religious man he would have fallen to his knees,” Pynchon indicates that, even though the founder of IA does not necessarily believe in a god, the effect of having come into contact with an ineffable agent nonetheless remains. It is this remainder that the executive processes as a trigger. Daniel Dennett writes,

“We are born with an ‘agent detection device,’ and it is on a hair trigger. When it misfires, as it often does in stressful circumstances, we tend to see ghosts, goblins, imps, leprechauns, fairies, gnomes, demons, and the like where all that is really there are waving branches, toppling stone walls, or creaking doors. From an early age we effortlessly and involuntarily see others as agents, and not just happy or angry or baffled or afraid, but as *in on the secret* or *wondering which way to turn* or even *unwilling to accept the deal offered.*” (XX, italics in original)

Dennett uses the reductive metaphors of triggers and misfires too, which implies a digital dynamic: in digital (binary) processing, the surface of the phenomenal universe has zero depth, only admitting information in the form of radical difference, a trigger. But Dennett also acknowledges that this binary phenomenology is a function of an increased sensitivity due to “stressful circumstances”—so the “triggering” of the “device” operates here as metaphor for a much more nuanced process in more normal behavior. Again, there are two sides to this equation: there is the state of the interpreter and the *telos* of the thing perceived. As we have already seen in Peirce’s conception of Firstness and the shadows that haunt *Lot 49*, the perceived thing emanates unevenly, its agential status and aim initially ambiguous. The ambiguity of the

shadow is thus a hyper-analog process: it consists not of determinate bits of information, but vacillating nonlinear flows whose consistent behavior implies some purposeful direction (this behavior itself being the inducement toward interpretation). But on the side of the observer, the (reasoned) determination of either entity or aim does not, and cannot, come for free.⁵⁷ As Koteks tell's Oedipa, the problem with, as well the appeal of, Maxwell's demon is that it seems to violate the second law of thermodynamics by "getting something for nothing" (68). But what does seem to come for (nearly) free, especially in times of increased stress, like in the case of the Yoyodyne executive, is the intimation of a preternatural agent—whether gnomes, demons, or gods—capable of arranging chaos into purposes. Indeed, for IA's founder, the appearance of the muted post horn at just the right time is enough to qualify as not only the trigger he was waiting for, but also as a sign that the kind of query he was asking was the wrong one. The trigger is so powerful, that is, that it causes him to descend from one line of processing into a totally different but anterior one—from processing the efficacy of killing himself, to assessing the *cause* of his problem: love.

While we might say that the executive simply misreads the posthorn, I argue that what is happening here is consistent with a pattern (in language) of quasi-interpretation, wherein the semiotic process "automatically" accommodates for preternatural agents when the behavior of the object is consistent (and thus teleological) and yet information about the agential cause of the behavior, the relationship between parts and wholes, is ostensibly inaccessible. As Dennett notes, this potentiality may assume the form of a kind of "agent detection device," but its effect on language, both in social and narrative fictions, is the manifestation of placeholder agents, endowed with the responsibility for the behavior of telic systems. The case of the Yoyodyne executive illustrates how, in spite of an attempt to process information efficiently, and actually as a result of macro processes intended to maximize efficiency, abstract entities become incorporated into the ontological framework of human reality. In light of the human capacity to outsource processing to other entities, real or imagined or both, the executive's problem is not that he lacks efficiency, but that he is *too* efficient already; he is so efficient that he accommodates the presence of a secret entity as an indication for how he should behave. The executive is, in effect, kept alive by fiction—not unlike Shahrazad, but dissimilar to this

⁵⁷ One is reminded of the economics of the Heisenberg uncertainty principle, wherein, by deciding what kind of information one wants, one sacrifices other kinds of information.

predecessor in that he believes the fiction that saves him from death. What I am trying to point to here is a lacuna in the semiotic processing of phenomena that allows for the creation of “shadow” entities that not only serve as explanations for the phenomena in question, but also, due to the highly reflexive nature of human language systems, become agential. Thus, through feedback, the Yoyodyne executive reifies the existence of the Trystero by not only presupposing its agency, but also by establishing an organization that employs that presupposition within its infrastructure. (Even though we know that he eventually creates his own secret entity, one that utilizes the W.A.S.T.E. mail system, it is never clear whether the IA founder knows anything about Tristero at all.)

Edward Mendelson has argued that *Lot 49* is a mystical tale of the same type as Borge’s “The Approach to Al’Mutasim,” but one that enacts a reconfiguration of the sacred and profane by accommodating a world after the failed excesses of modernism. The problem with Mendelson’s approach is that the theological entity remains outside the system, as the guarantor of good and evil, rather than being acknowledged as a quality produced by the system itself. The demon, however, as the sorter of information, is the entity on the inside, and it seems that for Pynchon all gods are demons in disguise. This can be seen in how the Yoyodyne executive thinks about his own potential suicide. He decides to set himself on fire after merely seeing in a newspaper the photograph of Buddhist monks self-immolating in Vietnam. Explaining himself to the nude pair of his wife and the efficiency expert, he says, “I was about to do the Buddhist monk thing” (93). There is no evidence that the executive knows or cares about the theological reasoning behind the monks’ behavior. Here, as in the case of his discovery of the muted posthorn, the executive is swayed by the appearance of (the sign of) something unexplained, not by its underlying reality. His theology is intra-systemic to the point of narcissism, intuiting powerful agential functions in the world as they are needed.

Pynchon renders the mysticism of *Lot 49* as a property of complex systems and thus as analogous to electronic circuitry. When Oedipa first comes to San Narciso, she experiences a “religious instant” upon seeing the town from above:

She looked down a slope, needing to squint for the sunlight, onto a vast sprawl of houses which had grown up all together, like a well-tended crop, from the dull brown earth; and she thought of the time she’d opened a transistor radio to replace a battery and seen her first printed circuit. The ordered swirl of houses and streets,

from this high angle, sprang at her now with the same unexpected, astonishing clarity as the circuit card had. Though she knew even less about radios than about Southern Californians, there were to both outward patterns a hieroglyphic sense of concealed meaning, of an intent to communicate. There'd seemed no limit to what the printed circuit could have told her (if she had tried to find out); so in her first minute of San Narciso, a revelation also trembled just past the threshold of her understanding. (14)

The “ordered swirl” that Oedipa witnesses reminds us of classical problems of thermodynamics and self-organization in high-entropy situations, like the swirling of cream in a cup of coffee. But in this case, the emergent process of the system is not its disintegration but its surprising abundance of organization. Pivotaly, the meaning of this organization is not conveyed clearly as a sign, but only as a “hieroglyphic sense of concealed meaning” evoked by patterning. Like Inverarity’s phone call, which foregrounds the events of the novel, Oedipa’s experience of witnessing San Narciso consists of being the recipient of a message the content of which is nonsense. The nonsense in *The Crying of Lot 49* has this way of becoming more and more particularized as Oedipa progresses through her adventure, but it never quite crystalizes into an individuated answer. Rather it becomes intertwined with social and institutional networks that transform signals from one kind to another, most notably the transformation of Tristero to Trystero to W.A.S.T.E. to the muted post horn. Here, in the moment when Oedipa sees the city from above, she sees the law of this transformation: here is the circuit within which infinite transformations of signals are possible. Pynchon writes that “There'd seemed no limit to what the printed circuit could have told her (if she had tried to find out).” But she *does* in fact try to find out what the circuit of San Narciso can say, which implies that she receives in turn a kind of revelation: an unlimited history of transforming processes. Ironically, even though the name of the city is San Narciso, and Oedipa’s paranoia implies an inflated sense of self-importance, this revelation is paradoxical with regard to the self: the limitless nature of the communique that the circuit represents really doesn’t have anything to do with Oedipa herself, but, by wanting to know, the excessive message of the circuit board threatens to represent her as one of its components too. “From one thing know ten thousand things” says Chinese saying. In *Lot 49* this saying takes the weight of a curse. Oedipa’s problem is that she recognizes the city as a circuit of analogical communications and gets close enough to tune in.

Without going too far into the minutia of what could be meant by “communication,” it will help to invoke Maxwell, but without his demon. In the late 1860s Maxwell was faced with a problem: steam engines were in their nascence, and suffered from problems with their governing system. Too much or too little heat and the engine would spin out of control or stop altogether, but not according to any recognizable pattern in the relationship of its reciprocating parts. Maxwell soon realized that, because the steam engine consisted of parts that acted upon each other through feedback, a governor would need some kind of a description of the whole continuous process in order to regulate its behaviors. Gregory Bateson, in *Mind and Nature*, cites Maxwell’s discovery as a proof for a kind of platonic reality, wherein the processes of stochastic and telic systems produce signs as the byproduct of the reflexive relation of parts that produce “invisible” wholes made intelligible through their function. Electrical circuits replace fire and water with current and voltage, but the principle remains the same. What the whole communicates depends upon the fluctuating state of its reciprocating parts, as well as the function being calibrated for control. The case of the steam engine emphasizes this latter aspect of communication, the control(ed) function, as something indispensable to a model of language: although the steam engine is a hugely complex network of interlocking mechanisms, each with its own ontology, the level of description for the steam engine qua steam engine concerns only its ability to produce work—in other words, the only parts of the whole that are recognized within its description are those that contribute to its nominal function. Does a steam engine do nothing more than its function? On the level physical description, this question is completely absurd, since the only kind of machine that produces only work without some other byproduct would violate the laws of thermodynamics (hence Maxwell’s demon). But what does a steam engine (or a circuit, or a city) do in addition to its function? A description that could furnish a total answer to this question is physically impossible, since it would violate the irreversibility of stochastic processes. (Here we run into Laplace’s demon.) Even though a stochastic system can have any number of functions (these of course having to do with ends, teleologies), these cannot become objects of knowledge without some kind of guess, experiment, or experience. You’ll never know until you try.

But even though not all of the possible functions of a system are obvious from the outside, this does not mean that the impression of function does not manifest itself. Oedipa recognizes the hint of potential discovery wavering just beyond her as she looks down upon San

Narciso, and this may not be the sign of her narcissism. After all, if steam engines and circuit boards produce so much “waste” energy in the form of heat, it is certainly conceivable that a city radiates a million secret alternate functions—each spiraling off of its officially maintained ontology. Thus, the suspicion of purposes—the “agent detection device”—functions as a (very fallible) way of testing these telic offshoots. Peirce himself attempted a theoretical explanation for this interpretation glitch in his semiotics: Alexander writes, “Peirce distinguishes between ‘real thirds,’ feedback in self-organizing phenomena, and ‘accidental thirds,’ accidental functionalities, which he, like Aristotle, associates with superstitious reasoning. Accidental thirds introduce ‘an idea not contained in the data, which gives connections which they would not otherwise have had’” (32). Thirdness—being itself the mode of full semiosis, since it is the level at which “a comparison full of inferences” is be represented—optimally conveys the real function of the system in question, but Peirce makes room for the eventuality that, on its way from Secondness to Thirdness, from (schema to confirmation), the interpretation of the present phenomena may go awry by abductively overreaching the given datum by assuming that it is governed, when its parts merely interact according to the natural propensity of chaos to organize itself through feedback. As Alexander writes, the cybernetic notion of a governor is an “apt appellation because a self-organizing system does appear to have a self that governs it” (27). While Peirce merely rejects this “accidental” self as a mistake in interpretation, Pynchon goes a step further by showing that the pursuit of the demon actually reveals self-organizing functionalities that go undetected because they are too chaotic (too close to noise) or merely hidden beneath more primary functions.

As to Mendelson’s idea that *Lot 49* is a mystical story like Borge’s “Al-Mu’tasim,” we must admit a certain similarity in form. In Borges’s story, a young Hindu lawyer finds himself on the run after murdering a Muslim man. He seeks absolution and grace, and discovers the trace of a man named “Al-Mu’tasim,” “an emblem of God” (85). Borges writes that “the detailed itineraries of the hero are somehow the progress of the soul in its ascent to mystical plenitude” (85). The story ends abruptly as the hero is just about to discover the identity of Al-Mu’tasim, and Borges editorializes this, using his characteristic metafictional flare, using a footnote that compares the narrative with Sufi poem *The Conference of the Birds*, where a group of birds go on a quest to find the king of birds only to discover after many trials that they were indeed the king they sought. The virtue of Mendelson’s reading consists of its acknowledgment that *Lot 49*

also ends in the same manner, with Oedipa about to discover the “secret identity” she has sought. And this is indeed an important discovery. But Mendelson does not address the method or the semiotic content within this similarity. Borges’ footnote in “Al-Mu’tasim” cites Plotinus’ mysticism as though paradigmatic of the story’s arc: “Any thing is all things” (87n). Importantly, Pynchon’s Electro-Mysticism (as Kittler calls it) highlights the capacious transferability of qualities that the universe evinces through analogical means. But Pynchon’s attention to the physical substrate of meaning prevents him from representing entities as interchangeable, as Borges does. Even though mysticism is fundamentally a premise that integrates the partitioned ontologies of religious ontologies, collapsing multiple worlds into one world (generalizing the idea that “the kingdom of heaven is within you”), this collapse usually implies that spiritual qualities (the sacred and profane, as Mendelson refers to them) are mapped onto reality as secret “real” properties. So, in “Al-Mu’tasim” we discover that everyone *is* actually their spiritual meaning, and *not* their immanent experience. In other words, the reader discovers that experience is fundamentally allegorical at its ontological roots. Things become symbols. Pynchon might very well be appropriating the shape of Borges’ story, but the former does not engage a semiotic paradigm that actualizes equivalents. In fact, while Mendelson’s reading is very compelling, it fails to account for the way that Pynchon always submits identity to entropy. Mendelson writes that the Tristero survives unchanged, but that would be to believe that all of the changing representations of the organization and its corresponding adjuncts are merely different names for the same thing, rather than different things that have a shared historical and formal relationship to the (probably) same thing.

The difference between these two forms of mysticism—one metaphorical and the other analogical—is decisive. The idea that the Tristero is a unified organization that has survived history unchanged is deeply at odds with the story’s attention to the entropic destiny of entities. In fact, we are nowhere led to believe that the organization has survived in any way that is not a transformation. Indeed, this seems to be the point of the Peter Pinguid Society, a group of anti-industrialists, who are perhaps anti-communists, and also anti-capitalists, whose founder grew rich on real estate speculation—the only aspect of the organization that remains the same over time being that they are generally kind of “disgruntled” (34-5). Thus, Pynchon’s mysticism isn’t one where the sacred shows itself by doing away with appearances, but a mysticism of flux: everything changes, but the qualities that persist form the irony, tragedy, and comedy of the

present. Knowledge, the source of irony, produces the awareness that the promise of the past has been compromised; all things veer toward entropy; but the hope of redundancies spring eternal.

Returning to the model of the delay machine, the noisy ghost that circulates inside the delay line can only be accessed via “taps”—outputs taken at intervals along the length of the memory substrate. In the bucket brigade metaphor, this is usually the last firefighter (or capacitor) in the line, but in older tape-based units, multiple taps were used, playing back the signal at different positions along the line. From the mid-1950s on, tape machines were used to create echoes, often in large and cumbersome setups involving multiple full reel-to-reel recording machines. In 1960 Ikutaro Kakehashi, founder of Ace Electronic Industries and later of Roland Corporation, released the Ace Tone EC-1 Echo Chamber, an all-in-one tape delay that featured selectable taps—the ability to listen to the output of the tape from different play-heads (Wikipedia). Most of these play-heads are evenly spaced, but one is mounted on a movable rail, allowing the user to select from what distance to the input the output will come. Aside from being just really cool (moving the adjustable play-head during operation creates fantastic warbles and time distortions), the concept of delay taps illustrates a dynamic at work within *Lot 49*: Oedipa’s journey through the story is one of tapping into the ongoing feedback loop of the Tryster. First, she encounters Inverarity’s shadow through the telephone, then by mail, then through the television, then ultimately through tape.

Lot 49 represents a series of taps, some audio and some visual, into the secret status of circuitry, both electronic and social. Oedipa and her consort Metzger find themselves at a bar called The Scope. “The Scope proved to be a haunt for electronics assembly people from Yoyodyne. The green neon sign outside ingeniously depicted the face of an oscilloscope tube, over which flowed an ever-changing dance of Lissajous figures” (34). Lissajous shapes are a way of visualizing electronic signals in two dimensions by using two inputs to provide X and Y coordinates for a (usually green) oscilloscope ray. Like Oedipa’s meeting with Mr. Thoth, The Scope, and the oscilloscope for which it is named, translates the content of the inside of a circuit into visual signals that “dance” with their own life. Moreover the visual image in both cases indexes the motion of an entity within the circuit. As foregrounded by Oedipa’s “religious instant” when she sees the entirety of San Narciso as a circuit, the different points at which she encounters electrically mediated signals reveal an ambiguous entity within. And, as

foregrounded by the shadow that initiates her pursuit of the Trystero, the phenomena that Oedipa discovers within The Scope confounds and intrigues her.

A sudden chorus of whoops and yibbles burst from a kind of juke box at the far end of the room. Everybody quit talking. The bartender tiptoed back, with the drinks.

“What’s happening?” Oedipa whispered.

“That’s by Stockhausen,” the hip graybeard informed her, “the early crowd tends to dig your Radio Cologne sound. Later on we really swing. We’re the only bar in the area, you know, has a strictly electronic music policy. Come on around Saturdays, starting midnight we have your Sinewave Session, that’s a live get-together, fellas come in just to jam from all over the state, San Jose, Santa Barbara, San Diego—”

“Live?” Metzger said, “electronic music, live?” (34)

Let’s note three of the things that are happening here. First, this is where Oedipa officially discovers the W.A.S.T.E. mail system that seems to manifest out of the mysterious Trystero. Second, as Christian Hänggi notes, “Pynchon shows awareness of [the military-industrial lineage of *avant garde* music] when he has music by Stockhausen play at the Scope” (154). Third, a historical link that connects the first two points, The Scope itself appears to be a reference to the real electronic music culture of early-sixties California, particularly the San Francisco Tape Music Center, which commissioned Terry Riley’s “In C” and where Stockhausen himself lectured (Pinch 37). Notably, the San Francisco Tape Music Center was the forefront for experimentation in electronic music, serving as a catalyst for much of the avant garde sound art of the sixties. Contrary to the image popularized by Wendy Carlos that represents experimental music as classist, overly abstract, and inaccessible, the Tape Music Center was a porous hub of composers, engineers, and lay performers, which connected to the diverse aesthetic projects of the Haight-Ashbury moment. As Trevor Pinch points out, “The ambience of rock ‘n’ roll was starting to mingle with the more arty avant-garde and multimedia happenings that the Tape Center specialized in” (90). Pynchon’s depiction of The Scope is probably a cheeky allusion to the Tape Center. Note that Metzger cuts off his interlocutor before he is able to list San Francisco as a contributing city. Additionally, Metzger’s surprise about the possibility of “live” electronic music harkens to the idea, common at the time, that electronic music could only be programmed

in advance, a concept that, in part, was countered by performances using the Buchla synthesizer, the Music Center's tool of choice.⁵⁸

One will notice that Pynchon uses the visual to index the content of circuits. Mr Thoth's cartoon, the distorted replay of the Baby Igor film, and the oscilloscope outside of the The Scope all reflect the status of a circuit, but augmented by its medium. Unlike the novel's icons, like the voice of the shadow or the muted posthorn, the visual signals provide a sense of relation, rather than a mere quality. While inchoate icons act as a call to explore and investigate, these moving pictures reveal a series of relationships in several forms. First, the visual signs, like the Porky Pig cartoon, depict entities that have particular relations; second, the relation between the signal and the medium is indexed by distortion, as when the Baby Igor movie is played out of order; and third, the relation of relations, which is the analogy formed between the first and/or second sets of relations and the viewer. This third form of indexicality encompasses Mr Thoth's collapse of the Porky Pig cartoon with the life of his ancestor, and how the malfunctioning of the Baby Igor film undermines Metzger's trustworthiness. The relationality of indexes is made explicit in Lissajous figures, which output the differential relationship between two signals as a two-dimensional shape. They provide a way to look within a circuit to examine the causal relationship between components. In sonic applications, an oscilloscope is often used at the same time as hearing the signal, for calibrating, testing, and tuning. The advantage of hearing and seeing the signal is that, while tuning is possible with only hearing, redundancy between sound and sight allows for consistency that goes beyond the contingencies of aurality alone. Bands can tune by ear, and "tuning to each other" is a common practice, but using a calibrating tuner that uses a "standard" reference pitch allows for joint playing without accommodating situational contingencies of pitch.⁵⁹ A tuner, like a Lissajous figure, compares the input of an instrument to

⁵⁸ Not to mention Buchla himself, whose presence at drug-fueled "happenings," where he improvised electronic sounds using an instrument of his own design, was a model for the Tape Center group (Pinch 95).

⁵⁹ The history of tuning standards is, as they say, a whole thing. It is a topic that in recent years has accumulated a remarkable amount of controversy, and even without the inflated debate over 440hz versus 432hz constitutes a fascinating history. Those who advocate for 432hz as a standard tuning frequency argue that the current Western standard, which defines that the fourth A on a piano should be tuned to 440hz, is the product of a Nazi conspiracy to make people more docile and anxious through music. This premise, it turns out, is itself a fiction maintained by an actual cabal of conservative researchers, who have a financial interest in manipulating the Italian opera system. The whole situation very much resembles something out of Pynchon. I refuse to cite anything relating to this scandal, because it is honestly just too silly to warrant a bibliography. I bring it up because it points to two interpretations of tuning that are relevant here. The first is pragmatic: tuning allows multiple instruments to achieve harmony. In this sense, even tuning to a standard is relative, since many elements of timbre and even harmony exceed tuning because of the enharmonic overtones of sonic media. In other words, you can't tune the entire thermodynamic system, only one important node that functions that steers the rest. In the second sense, which doesn't have a name but which we might call "conspiracy-oriented," tuning represents a form of absolute control.

to an oscillator running at the pitch standard, and visually registers the proximity of the two signals via a compass-like pointer. In the Lissajous figure, one input creates only a straight line, since no signal provides the second dimension; two signals running at the same frequency create a (very boring) static circle; and two signals that differ by even ratios make stable knots. But in order to make an oscilloscope dance, as is described by Pynchon, its two inputs must have a continuous non-linear relationship.

Lissajous oscilloscope renderings are similar to binaural hearing in their representation of depth. Creating depth in the stereo field requires difference between each ear. The brain perceives equality between ears as spaceless and unmoving. In the non-artificial context of the evolution of hearing, binaurality creates a sense of space and context that allows animals to navigate, explore and hunt. Two ears triangulate objects in space. Sound, even noises that are close to silence, in ordinary spaces are normally non-linear with regard to their stereo image—in other words, what the left ear hears is, on average, very different than what the right ear hears, such that redundancy between the two is perceived as the source of the emission. Lissajous figures perform this triangulation visually. The two dimensional figures attain a new kind of dimensionality when they translate even slight discrepancies between the two input signals. Stereo sounds, when fed into the Lissajous translation, register the features of the room they were recorded in as alien three-dimensional objects that dance and metamorphose. In a very literal sense, the creation of depth occurs through the embodied comparison of qualities. This is what the index affords. The weathervane is a way of comparing the rotational quality of the object itself with the quality of the wind, providing a sense of direction. The Scope is where Oedipa begins her exploration of the Tristero's mysteries, but it also functions as her introduction to the complexities that are the context for her movement. In addition to the other ways in which Pynchon depicts non-linearities in *Lot 49*, it would appear that his representation of Lissajous figures points to the way that indexicality provides direction. It is not a map, but a sense of space that comes furnished with its own particularities—an invitation to an adventure. Notably, the question that Oedipa asks inside The Scope is “What’s happening?” Rather than asking questions regarding the W.A.S.T.E. system, she seems perpetually focused on situating her in the foreign network of San Narciso. It is her exploration of this space that leads her away from the flat “exitlessness” of her life into a circuit full of depth (141).

Pynchon's depiction of The Scope also emphasizes the real military-industrial situation of early synthesists at the Tape Center. Pynchon is clear about the relationship between The Scope and Yoyodyne, the industrial manufacturer that many have connected to the author's experience with Boeing: the bar, and its techno-centric activities are supported by the unsanctioned efforts of Yoyodyne workers. The oscilloscope itself is a common feature of any testing rig in the industrial sector, and it is clear that the bar's clientele have brought their engineering expertise, if not their equipment, from Yoyodyne itself. This situation could not be closer to the historical truth of the San Francisco cohort of music experimentalists. Buchla himself was a frequent freelance consultant on NASA projects (including managing an inquiry into sending chimpanzees to Neptune) (Pinch 34). Moreover, the Tape Center, being a joint effort of individuals rather than an institutionally supported organization, used outdated and unused military and research equipment from UC Berkeley to supplement their work. Pinch and Trocco write,

The musicians used just about anything they could lay their hands on for sounds. They raided junk-yards, borrowed from local industries and universities, and accumulated piles of war surplus. As Bill Maginnis, the center's technician, told us: "There were bits and pieces of World War II bombers that we had. Also... Someone had raided the rad lab [Radiation Lab] at Berkeley, and we had bits and pieces of stuff that said 'University of California Department of Physics and Cosmic Rays' on it." (37)

Aside from the conceptual or abstract connection between music technology and military technology, the Tape Center shows that the use of military and scientific apparatus for sonic experimentation had its basis in economic necessity: musician/engineers could only afford to appropriate the technological run-off from military and university institutions. As Buchla admitted about his time with NASA, "They don't pay much, but they pay more than music..." (Pinch 34). The environment, formed by a strange rubbing of musical culture against military technology, creates a kind of unsanctioned secondary science. Rather than a governmentally or academically sanctioned science, which follows research plans organized by strict power structures, this other science is conducted by amateurs (often, marginal and marginalized), for purposes unknown. The question, similar to that asked by Kittler, is what happens when laborers and other alienated subjects find themselves in possession of the apparatus of modernization.

Pynchon connects this theme (of the laborer's appropriation of the instruments of modernization) to the concept of feedback. I initially avoided paying close attention to the reference to Stockhausen, it being well documented. But then, listening to Stockhausen, I heard a familiar voice. As in Pink Floyd's *Astronomy Domine*, the tell-tale textures of self-oscillation can be heard throughout Stockhausen's *Kontakte* (1958-9), but become even more central in his *Solo, für Melodie-Instrument mit Rückkopplung* (1965-6), a piece that consists, as the title suggests (*Rückkopplung* means feedback), of a single instrument accompanied only by its own echoes, initially achieved by tape machines. Thus, the reference to Stockhausen is not merely a way to signal awareness of the incipient economies of electronic music, furnished by post-war technology—but also an invocation of the aesthetic deployment of the patterns generated by running a system's output back into its input. In *Solo*, Stockhausen builds upon the aleatoric strategies that became the central to experimental music of the mid-century by emphasizing the random sequencing that occurs when the solo instrument plays with and against its own sonic reflection, which gathers and recycles the past and the present into new forms. While real science was using delay lines to store information, keeping it safe from the ravages of noise and time, musicians like Stockhausen used the same technology to emphasize the stochasticity of repetition. Not only do tape machines not repeat with perfect fidelity, synchronizing the rate of repetition with the tempo of the music requires careful calibration, and even then the echoes drift in and out of time, introducing randomness into the music it repeats.

At the Tape Center, feedback as a means of aleatoric production was taken to new heights through the use of advanced synthesis techniques. Unlike the Moog school of synthesis exemplified and advanced by Wendy Carlos, the “west coast” school of synthesis, masterminded by Don Buchla, eschewed the ideals of classical instrumentality by putting randomness at the center of its design principle. Where the Moog synthesizers use low frequency oscillators (LFOs) with symmetrical sine or triangle waves to add expressiveness to the pitch or timbre of tones (imitating the vibrato of strings, horns, and woodwinds), Buchla contributed a different expressive function to his synthesizer: the Source of Uncertainty. The concept behind this component is relatively simple, and a common characteristic in many designs. Noise is fed into a circuit that remembers the voltage of the input only at the moment of a trigger, producing a stable random voltage. The generic name for this type of circuit is “sample and hold,” since it takes a sample from its input and holds it. But the Buchla design, as its name suggests, is not

meant for practical functions: by connecting a consistent pulse to the trigger input and filtering the output (to create smooth fluctuations between values), Buchla created a machine that generates continuous nonsense. The Source of Uncertainty is not itself an instrument, but influences the behavior of the instrument, introducing a feeling of life into otherwise predictable timbres and sequences. Oddly, the lack of redundancy that noise introduces into a semiotic system increases the opportunity for interpretation, including the “agent detection device” that Dennett theorizes.

Pynchon plays with this idea in *Lot 49*'s finale, when Oedipa's husband, car salesman turned radio reporter Mucho Maas, arrives at the shootout at the Hilarius Psychiatric Clinic. He has Oedipa relate the tale over the radio in the mobile broadcasting van, but reports her name as Edna Mosh. “‘Edna Mosh?’ Oedipa said. ‘It’ll come out the right way,’ Mucho said. ‘I was allowing for the distortion on these rigs, and then when they put it on tape’” (114). The humor in this scene is remarkable. From the Nefastis machine, we already know that far-from-equilibrium systems don't tend to become organized by accident. Yet, every glimpse that Oedipa gets into the working of the mysterious circuit of San Narciso shows that, even as a system's memories degrade over time, new entities form from their repetition. Oedipa's adventure through the various organizations that use the W.A.S.T.E. mail system reveals this: each organization she encounters is the distortion of some other moment's ideas. This goes beyond dialectic, because the formal change in these organizations cannot be reduced to the idea that an entity always-already contains its contradiction—information is massively subject to uncertainty. Mucho short-circuits entropy by doing away with fidelity: in order to get Oedipa's name right on radio and tape, he reduces it to a shape, to a sonic pattern that suits the electromechanical means of transmission. “The right way” is thus not a faithful reconstruction of a name, nor a reverse-engineering of the distortion introduced by the machine (which would require an algorithm like Laplace's demon, that could reverse irreversible phenomena), but the introduction of uncertainty that encourages a kind of grace concerning information. The telos of the machine itself can only be discerned by “allowing for distortion.”

If there is an ethic in *The Crying of Lot 49*, it is the responsibility to tap into and interpret the emergent echoes of minor cultures. This a more humble act than participating in cultures that are fully formed, ideologically complete, and institutionally sanctioned. By attending to the way that minor cultures emerge and transform—by listening to the ghost in the machine of San

Narciso—Oedipa shifts from being a subject of a prescribed future as a white-middle-class-young-republican, to an interpreter of many possible futures. By attending to the echoes of the Tristero through the W.A.S.T.E. system, she becomes part of the machine through which those entities proliferate and transform. This state of affairs calls to mind the much misunderstood uncertainty principle founded by Heisenberg: one cannot have your cake and eat it too—one cannot define the properties of a system and also observe its future. The thing that goes misunderstood about Heisenberg’s principle is that it does not imply “many worlds,” only that we don’t know which world we will get. Oedipa rehearses this either/or in the novel’s final moment:

Either Oedipa in the orbiting ecstasy of a true paranoia, or a real Tristero. For there either was some Tristero beyond the appearance of the legacy America, or there was just America and if there was just America then it seemed the only way she could continue, and manage to be at all relevant to it, was as an alien, unfurrowed, assumed full circle into some paranoia. (150-151)

While this seems like she has lapsed into the same binaristic paradigm as the Yoyodyne executive, there is a hitch. Waiting in San Narciso’s oldest building to discover who will bid on Inverarities collection of stamps bearing the sign of the muted post horn, Oedipa considers the efficacy of involving the authorities, but desists *because she is too much a part of the conspiracy*: “Perhaps she’d be hounded someday as far as joining Tristero itself, if it existed, in its twilight, its aloofness, its waiting” (150). Instead of continuing life as a northern californian housewife, she now must contend with a paranoia that permeates the subject who is contaminated by the noisy self-oscillations of history, always distinguishing between signal and distortion, and sometimes, necessarily, making signal out of distortion. Paranoia is an ugly word that evokes critical regimes of psychoanalysis, class critique, and deconstruction, but I want to emphasize another sense of paranoia in *Lot 49*. Yes, there are traditional paranoiacs all through the texts: the rock band The Paranoids, Dr Hilarius, and Mike Fallopian are only a few, and they represent the risks of truly believing a historical narrative about conspiratorial bad actors. But Oedipa’s paranoia seems to be of a different variety. Oedipa’s paranoia is a result of becoming connected to a circuit of unsanctioned and noisy operations, circulating in feedback loops of constant regeneration and transformation. The fearful aspect of this epistemic shift stems from the awareness that that systems of control, homogeneous and linear as they appear, cannot offer

the stability they promise—that the *real* postal system doesn't carry bills or advertisements, but “a secret richness and concealed density of dream” (140-1). The alienation that this evokes is the terror of defamiliarization: The machines that Oedipa continually reads, the ambiguous shadows that emanate from televisions, radios, oscilloscopes, and amplifiers, communicate the reality that the sanctioned communication systems cannot afford to admit: “a real alternative to the exitlessness, to the absence of surprise to life, that harrows the head of everybody American you know, and you too, sweetie” (141). At the final tap of the novel's delay line, the auction house, we find that Oedipa has become a receptive component of the filthy machine, a network of memory and noise, whose message is no less than the sum of the chaotic and marginal operations that subtend American life. We do not “find out what happens”—there is no sense of linear, representable progress. Instead, we find that Oedipa, having been drawn into a system that is more noise than signal, has the chance (literally, an increased statistical distribution of choices) to escape the monotony of suburban life for an adventure that brings her into contact with the secret voices of America. In this dynamic, progress is really deathly stasis, since, even though (as in the case of the Yoyodyne executive) increased computational efficiency brings more power, this power does not translate into any sort of freedom. While feedback and noise might seem static, they allow for the navigation of hitherto uncalculated environments, and provide infinite depth to the shadows of everyday life.

Article I. Chapter 5 Conclusion

These nonhumans, lacking souls but endowed with meaning,
are even more reliable than ordinary mortals,
to whom will is attributed but who lack the capacity to indicate phenomena in a reliable way.

—Robert Boyle

I have shown in this dissertation a throughline of techniques that persist through the thought and art of the mid-century that can be called analog, and which are intelligible through the mechanics of analog sonic technologies.

In chapter one, I argue that analogical processes set the limit for what can even be considered experience, in the form of circuits that balance the conscious and the subliminal. Art in the context of the analog paradigm explicated by Bateson and Peirce consists of shifting the border between what is routinely conscious and that which is subliminal, and thus restoring the animal grace to human life by reminding us of the continuities between bodily substrata and resonating medium that furnish experience (Shklovsky thus emerges as exemplary of a style of analog reading).

In chapter two, “The Unseen Powers,” I show that symbolically-focused criticism Ballard’s “The Voice of Time” has missed the analogical diagram within the text, and that this diagram points us to a consideration of how technology mediates radiation and human progress. I show how the moment of improvised radiological saturation in the story’s climax mirrors the discovery of sonic saturation that changed the course of music history. I read these two phenomena through each other to argue that the exacerbation of sensation that they both represent indicates a primordial capacity for living beings to grow into semiotically unintelligible conditions by relying on the basic sense of hearing analog icons.

In chapter three, “Filthy Machines,” I read Pynchon’s *Crying of Lot 49* as an analog of early delay machines to show how information that is caught in feedback loops can not only

become life-like, it can become part of the indeterminate nature of life, hybridizing it. At the same time, the indeterminacy is filtered by real mechanisms that influence its form. So while there is no solution to the mysteries of the text, there is the possibility of being drawn into the same circuit as the mysterious entities, which is its own solution. I suggest that this is how the novel ends, with Oedipa ambiguously part of the system she investigates. Moreover, I show a potential historical source for Pynchon's engagement with sonic technology, the San Francisco Tape Music Center, a connection that both substantiates the sonic reading of *Lot 49* and shows the relevance of the concepts of aleatoric sequencing and feedback within his work.

To conclude, I will connect the consideration of analog techniques in literature and music to a wider social, cultural, and historical context that prioritizes digital signs. While the project has moved away from a critique of poststructuralism, it is still necessary to place analog insights alongside the history of criticism that valorizes digital-centric methods, which include the former. I explain the historical benefits that digitalism represents for the advancement of Western modernity. Finally, I offer Robert Johnson and H. P. Lovecraft as examples of artists that deploy techniques that contradict the digitalizing trend of modernity, and use Bruno Latour's theory of hybrids to show how the subsequent forms of science fiction and rock music produce postmodern subjectivity, setting the stage for authors like Ballard and Pynchon.

Initially, when I started upon this research program, it was as a counterpoint to the linguistic turn and its legacy in the study of literature. It had seemed to me for a long time that analyzing texts that were influenced by technical and scientific concepts (i.e., science fiction, conceptual fiction, even metafiction) required a semiotic technique that could account for natural signs. Having been, like many, a student of both Edgar Allan Poe's stories and the subsequent academic controversy about "The Purloined Letter" promulgated by Derrida, Lacan, and Barbara Johnson, I wanted a way to talk about signs that would do justice to the former's attention to mechanics but would also be as evocative as the latter. But I also wished to avoid what I had come to see as poststructuralism's greatest flaw, its general emphasis on symbolic signs. As I narrowed my focus on the literary productions of the mid-twentieth century, this need became stronger, since my bibliography increasingly consisted of books that represented gradients of animal, human, and machine subjectivities. I found that I was not alone in my frustration with the nature-culture

divide in semiotics. Wendy Wheeler's *The Whole Creature* provided the critical vocabulary I had been searching for. Wheeler describes the problem thus:

[Raymond] Williams's own sense that 'all living forms have communication systems of a kind', and of the idea of the importance of human semiosis more widely understood as an evolved complexity in which nature, in humans, produces culture, was thus to some extent displaced by the post-structuralist tendency to place emphasis on the defiles (and metaphysical assumptions) of articulate language alone. The postmodern linguistic turn thus inhibited the range of its own insights, in its tendency to confine itself to a focus on Saussurean semiology rather than the wider transdisciplinary (including evolutionary biology) development of semiotics found in the work of writers such as Charles Sanders Peirce and, later, Thomas A. Sebeok. (16)

The defining feature of Peirce that allows for the parity of culture and nature is, of course, the natural (or analogical) sign. The defiles of language and metaphysics fell short, especially when I stumbled onto representations that seemed to depend on the operations of functions tied to stochasticity, self-organization, modularity, and evolution.

As this project matured, I realized that a critique of poststructuralism was outside its scope. As Alexander Galloway has put it recently, one would be hard pressed to find rank-and-file post-structural interpretations being published anymore, as academic institutions have shifted toward methodologies that acknowledge a complex real world, like eco-criticism, animal studies, affect studies, and disability studies. My interest in analog signs in literature and my experience as a musician-engineer drew me to sound studies, another of these discourses, where ontology is still a central question, but where the embodied and mechanical reality of bodies is still implicit in the very object of study. So I had a rich bed of alternatives to the linguistic turn. But even though this dissertation is not devoted to a critique of poststructural thought, it must attend to its historical corollary, digitalism.

"Digitalism," by which I mean the culture of digital computation, must be addressed for two reasons: first, because we live in a culture that is dominated by digital technologies and their techniques, and second, because this culture also exacerbates the dualisms that persist within the linguistic turn. So, even though academic literary studies may not put much emphasis on poststructural techniques of interpretation, the world of financial institutions, information

technology, and social media are nonetheless performing operations that inherently function on a nature-culture semiotic dichotomy.

As I have noted in my reading of *Lot 49*, writers of the midcentury were aware of cultural consequences of reducing the continuities of human experience into quantitative systems, but let's consider it again. Oedipa Maas, on her quest to understand the recurring symbol of the muted post-horn that is the narrative's centerpiece, hears of the ill-starred executive who considers ending his life upon being replaced by a computer. Recall that he says, "I was about to do the Buddhist monk thing," to the wife who has left him and the efficiency expert who fired him, who are naked. He has discovered them *in flagrante delicto* just as he is planning to set himself on fire. "'Nearly three weeks it takes him,' marvelled [sic] the efficiency expert, 'to decide. You know how long it would've taken the IBM 7094? Twelve microseconds. No wonder you were replaced'" (93). This is the punchline to a section that is structured like a joke, where the executive, who "could not make the decision without first hearing the ideas of a committee," makes earnest inquiries about the pros and cons of suicide. As much as the executive's tale is played for laughs, it nonetheless points to the (albeit caricatured) social and subjective experience of digital technologies. Not only is the executive replaced by a computer—he is seen (and sees himself) in terms of digital computation, ultimately behaving just like the IBM 7094, but slower. As I and others have pointed out, Pynchon's sentences are often also descriptions of technical processes, and his depiction of the Yoyodyne executive is a fine example. The executive is here described, in very accurate detail, as a form of binary digital processor, a machine that shuns noise, is unaware of its own function, and ceases to have ontological value if no meaningful information is processed. While this dehumanization is an extreme caricature of the subjective effect of digital processing, we must still see how this dehumanization fits into a capitalist economy of instrumental exchange that is our historical inheritance: modernity has grown fat off of digitalization, which is itself a war against noise.

We can understand the nature of the digital by studying the electromechanical operations that produce it. Those operations are composed of logical gates, which, as the term implies, can be either open or closed, on or off. Gates are mechanical structures that can be made out of any number of things (e.g., gears, pipes, chemicals), but electronic components like vacuum tubes and transistors allow for an increase in speed, automaticity, and efficiency. Logic gates come in types represented by the functions of logical calculus and their combinations: AND, OR, NAND,

NOR, XOR, XNOR, and NOT. Each of these types of gate detects an input value, compares it with another input (or, in the case of NOT, negates it), and outputs the logical result. Electronic gates “read” standardized high voltages as 1 (or YES, or ON) and standardized low voltages 0 (or NO, or OFF) in order to perform logical operations. The digital is all the things you can do with digits. “All the possible values of a digital signal can be counted,” writes computer historian Kenneth Stieglitz, “and there is a definite gap between them,” (6). There are different digital schemes, but they are all compatible, because their common principle is the value of absolute difference: True is absolutely distinct from False, 1 is different from 0, and there is no gradation between them. Herein lies the way in which digital systems employ symbols. There is nothing meaningful about the voltage that the transistor “sees” as 1 or 0; it is only meaningful given the context of the highest part of the system, which defines the laws of interaction, the coding language. Calculating complex problems means making digital processing as fast as possible (you’ll get the same answer from a computer made of wood, but you wouldn’t want to wait a hundred years for it to figure out the third digit of pi). However, the perennial problem of the computer engineer is that, in reality, energetic signals don’t tend to change very quickly or very accurately. Physical nonlinearities, the entropic character of material things, introduce other signals into the flow from one voltage to another. Steiglitz writes, “Electronic components like resistors very naturally contribute thermal noise, and the power that each component contributes is proportional to its temperature” (12). Electricity and the materials that conduct it are analog: it is a continuous flow of energy, unstandardized and unstriated. Logic gates are how you make the analog world(s) perform the labor of discrete calculation. If noise is introduced into the path of logic (gates), there is an increased chance for error: “The important point is that an analog signal gets blurrier as it gets *corrupted by noise*, and in general this is an irreversible process” (Steiglitz 10, my italics). Thus, the material history of the digital is not only the mechanical implementation of discrete calculus, but also a linearization of unpredictable and nonlinear processes.

Imagine that you are given the task of choosing between buttons marked “white” and “black” depending on what you see on a screen; the screen turns on, and all you see is television snow—undulating waves of gray. You are a logic gate, trying to make sense of a noisy signal. Now imagine sitting again at the two buttons, but now the screen is everywhere, wrapping around you. There is no light, so your finger holds the “black” button. With no preparation, and

with an immediacy that is painful, the room is now blindingly white, compelling you to hit the “white” button. There is no chance of mistaking, no noise. You are the ideal digital component, identical to the billions of neighbors that accompany you inside the average computer. As this thought experiment shows, the digital is a form of semiosis because it is fundamentally a way of dealing with signs. All semiosis, as Bateson argues, consists of “Differences that make a difference,” but digital semiosis proceeds by way of extreme difference. Digital systems perform efficient and repeatable labor (calculation, communication, and storage) using discrete signs, a process that presupposes standardization and the reduction of noise.

But once noise and standardization are dealt with, digital semiosis can do things that are impossible within purely analog systems. Hoffmeyer points to three advantages of the digital: first, “messages expressed in digital codes do not have to obey the limitations of freedom imposed by natural laws”; second, digital codes offer “time independence and consensual objectivity”; and third, the digital “can be used as tools for abstraction” (86). While icons and indices are fundamentally linked to the phenomena they represent, symbols can, through the reification of lexical and grammatical schema, be separated from their object. This allows symbolic information to be free of natural law, in the sense that a message about an object no longer relies on the object, since it relies more on structural rules of description. This leads to time independence—or the ability to signify states that no longer obtain in reality—as well as abstract counter-factual representations like fiction, lies, or hypotheses. Because the rules of digital representation only hold for the symbols themselves, and not their link to the physical world, a tremendous world of representation becomes possible. The only necessity is a system that remembers the rules (the code), which today is usually a computer. Digital semiosis precedes the computer. Humans did not invent it, but it is convenient to believe that we did. The form of quantitative logic, and the submission of continuous events to quantitative logic (digitization) are pre-or non-human, as is evident in the fact that genetic code is digital, and that it functions much the same as newer digital computation. But the human history of the digital is spectacular because of its cultural effects. Anthropologists, semioticians, and evolutionary biologists alike celebrate the symbolic as a revolutionary tool that has allowed for the flowering of human potential via the development of agriculture, history, science, and art. And while this narrative in part reflects the power that the symbolic/digital has afforded the species, it also elides the experiential and material dynamics that subtend it. As Walter Benjamin writes, “There

is no document of civilization which is not at the same time a document of barbarism.” Benjamin is thinking about Western history here, but the aphorism applies to deep semiotic history as well.

“Digitalism” signifies the cultural predominance of instrumental striation, prevalent in Western history. I cannot begin to offer a history of Western digitalism (a volume in itself) but would refer the reader to Donald Favareau’s “Introduction: An Evolutionary History of Biosemiotics” from *Essential Readings in Biosemiotics*, and John Deely’s *Four Ages of Understanding*, which analyze the status of semiosis within the history of Western philosophy at great length, and what they depict is a tragicomedy of mistranslations, misunderstandings, and misuses from antiquity to the present, filing from the ancients, the early moderns, the moderns, the postmoderns, the ultramoderns, to now. The tragedy of this history lies in the accidents that obscured the concept of the natural (or analog) sign, which is present in both Aristotle’s biology and in early modern semiotics, all but disappears in the Enlightenment’s proto-digital rationalism, and is blotted out under modern regimes of symbolism. As Deely writes, the discussion about how signs can be both objects of nature and culture occupied a great deal of medieval scholarship from Augustine to Poincaré, but “discussion after Poincaré increasingly moved in the direction [...] of making all signification instrumental, reducing concepts to representations directly known as objects—the key to modernity as “rationalism” and “empiricism” (444). Under rationalism and empiricism, the sign becomes a token only of control, divided between mind and body (via Cartesian dualism). The natural sign goes underground once the digital (as we know it) is born. I have already noted Hoffmeyer’s assertion that digitalism is a central premise in Western thinking. Deleuze and Guattari refer to this same bias toward representable difference “striation.” “Striated space, where ‘lines or trajectories tend to be subordinated to points,’ is the space of the State, of firm bureaucratic and governmental orders, of the grid, of maps, coordinate orientations, of territorialization, tree-like (hierarchical) organization, settlement and agriculture” (Golumbia 23). The binary striations that issue from digital thinking—mind/body, plan/execution, nature/culture—are instrumental distinctions that aid in processes of modernization, industrialization, and colonization. Digitalism is thus a historical phenomenon visible throughout industrialization, with different technological articulations. Ruskin’s “On the Nature of Gothic” offers a prime glimpse of historical digitalism: the shift from creative execution to homogenized plan-following signifies the digital’s conquest over culture. Hoffmeyer writes, “Since the execution of work in industrial production is

supposed to follow deterministically from the pre-given plan, there is left little or no space for *interpretation* at the level of execution. In traditional industrial production, all creativity was delegated to the planners, and workers were not supposed to add anything innovative to the process. The element of creativity was not part of work on the floor” (79). While the digital itself is an ancient layer of semiotic potential, Western society’s unchecked investment in leveraging digital codes for the purposes of socioeconomic development and control (against free execution) has raised the semiotic mode to the level of total ideological opacity, a progression that leads to the global market and the commodification culture.

While postmodernism (the cultural projects that together form a departure from or reconfiguration of the idealist subjectivities of both political and aesthetic modernism) exceeds any unitary theoretical interpretation, it has been *de rigueur* in academic environments to treat it as prima facie exemplary of poststructuralist dynamics. Within the humanistic disciplines especially, the postmodern is all but synonymous with poststructuralism (as Hoffmeyer’s statement about the “postmodernist wave” reflects). As a postmodern philosophy, however, poststructuralism, depends on the premises of modern philosophy. In the history of semiotics, semiology and poststructuralism represent transformations or accelerations of modernity, since they are analytics formulated for reading structures’ striation. Deely argues that what we have come to call postmodern philosophy—namely, poststructuralism—is for this reason an extension of the modernist impulse toward discretization, fundamentally rooted as it is in Ferdinand Saussure’s refusal to incorporate natural (analogical) signs into the semiological system. Deely designates the poststructural tradition “ultramodern” rather than “postmodern,” reserving the latter for philosophical positions that attend to analogical processes, against the cultural/analytical primacy of dualistic models. For Deely, Peirce is the first of the postmoderns—a premise that I will complicate but also appreciate: Peirce’s passion for reintegrating the analog parts of reality into scientific and philosophical thought represents a theoretically robust branch of a genealogy of thinking that is genuinely postmodern not only in its antagonism toward the digitizing methods of modernization, but in its capacity to theorize outside of them. And even though the ultramodern does not, perhaps, live up to its promise, it deserves its due as an analytic for describing the predominant techniques of modernity. The Peircian tradition is admittedly harsh toward poststructuralism, especially since, as Galloway points out, the latter does accommodate some analog effects. That said, even Deleuze

characterizes poststructuralism as generally prohibitive of immediacy. Ultramodern thought (i.e. poststructuralism) is a manifestation of the effects of accelerated modernity, whose power is that of digitization, but it also contains a kernel of antagonism toward modernity's hegemonies, hence "the end of grand narratives," the emphasis on complexity, freedom, and, perhaps most importantly, entropy.

The fact that ultramodernism has been called "postmodern" for so long is indicative of the hope that its methods might relieve the pains of the modern. But the tools of ultramodernism turned out to be modern tools, calibrated to a higher degree of specificity. Hoffmeyer writes, "The [ultramodern] wave did serve us well in pointing to the dependence of our preferred stories upon the contextual matrices of our personal and social lives..." (2). The realization of dependence on context (contingency in other words) is the root of the philosophical contributions of Derrida, Foucault, and Lacan. The suspicion of "grand narratives" (a suspicion we often equate with the ultramodern) is a byproduct of this paradigm shift from text—myth, religion, and political ideology—to an analysis of the history, economy, and politics of cultural texts. But let us put some pressure on "text," since it is indeed the operative term here. Saussure insists that linguistics "can become the master-pattern for all branches of semiology" and in so doing makes the linguistic sign (symbol in the Peircian triangle) the model for proto- para- and quasi-linguistic phenomena (Deely 675). On the one hand, ultramodern philosophy's contextualization of deeply determining textualities is a powerful paradigm shift. But on the other hand, it merely represents an expansion of text's territory, concluding with Baudrillard's *Precession of the Simulacra*: "Simulation is no longer that of a territory, a referential being or substance. It is the generation by models of a real without origin or reality: a hyperreal. ...It is the map that engenders the territory" (342-343). Limited to the realm of text, context, and megatext, the proliferation of the hyperreal thus becomes both the object the ultramoderns analyze as well as the structure they reproduce: intertextuality, ideology, and the internet become synonyms for the entire world. Thus, even if the linguistic turn benefits us by drawing attention to the importance of signs to our everyday lives, it also hinders us by encouraging our fixation on linguistic signs, omitting natural signs from the purview of postmodern philosophy completely. Hoffmeyer continues the quote passage from above: , "...[the ultramodern wave] has served us badly in extinguishing all confidence in realism in the sense of a search for knowledge about mind-independent reality" (Hoffmeyer 2). I almost blush when I read the words "mind-independent

reality.” The humanities have changed a great deal since the linguistic turn that dominated English and other humanities and some social science departments at the end of the twentieth century, but I will never forget a certain distinguished scholar who told me that they would have nothing to do with my project if it contained even a hint of naturalism. The linguistic turn casts a long shadow. Moreover, while the linguistic turn has diminished in institutional power, the divide between reality and representation has become more determining in general culture. The idea that we live in a simulation has been transformed from a rarified theoretical position to a ubiquitous factor in popular science, conspiracy theory, and internet philosophizing. All the while, bodies, animals, and machines engage in the work of creating partnerships unrepresented and unrepresentable via digital simulation.

To reiterate Bateson’s comment that no living system can be aware of all of its functions, digital systems must survive atop a vast subliminal pool of analog functions, and so with Western modernity. As Bruno Latour argues in *We Have Never Been Modern*, modernity functions by using the sciences to create an “official” subject of humanity, that requires a covert and unofficial hybridization with the non-human, both animal and machine. Latour writes,

The obscurity of the olden days, which illegitimately blended together social needs and natural reality, meanings and mechanisms, signs and things, gave way to a luminous dawn that cleanly separated material causality from human fantasy. The natural sciences at last defined what Nature was, and each new emerging scientific discipline was experienced as a total revolution by means of which it was finally liberated from its prescientific past, from its Old Regime. No one who has not felt the beauty of this dawn and thrilled to its promises is modern. (35)

Of course those moderns who have thrilled to the promise of a culture expunged of nature are actually a privileged group of technocracy’s inheritors. Thus, digitalism, as modernity’s method, leads to a consideration of the marginalized masses whose thought and labor are integrated into the logic of modernity while remaining central to its production—the obscurity of modernity’s unconscious.

This obscurity is historically both epistemological and racial. While causality and fantasy are unified in the pre-modern “olden days,” they are also unified through minoritized cultural projects that fail to meet the standards of modern Culture or Science. But these black sciences furnish mainstream culture with life. The epistemological sense of black sciences is exemplified

by the history of science fiction; the racial sense concerns the blues. Today it is common to think of science fiction as a genre that, above all else, extrapolates, thus inspiring research directions for the applied sciences, toward the development of social solutions. Consider Elon Musk's explicit emulation of novels by Robert A. Heinlein and Isaac Asimov. But alongside this relation between science and science fiction, there is another: not extrapolative, but speculative. While the extrapolative tradition traces its provenance to H. G. Wells and other early scientific romances of social engineering, the speculative tradition's godfather is Edgar Allan Poe, whose interest in the social is eclipsed by his interest in internal landscapes and their transformations. The important distinction is that the extrapolative mode tends to reduce the feelings of the senses to the symbols of rational calculation while the speculative mode anticipates alternative forms of semiosis. H. P. Lovecraft, a disciple of Poe, exemplifies the speculative mode: his fictions invariably depict the discovery (furnished by science, magic, or both) that the visible world is but a tiny haven in an otherwise roiling and unintelligible continuum of invisible energies and dynamics. These discoveries are always destructive to the status quo, and especially to the sanity of the individual. Lovecraft's synthesis of scientific/philosophical premises (a cocktail of early twentieth-century astronomical pursuits and Nietzsche's *Principium Individuationis*) and black magic results in a black science. Anticipating Arthur C. Clarke's adage that "Any sufficiently advanced technology is indistinguishable from magic," Lovecraft reverses this order of operations to show that magic is just a technology whose laws are (as of yet) unintelligible. Black science suspends the concept of law in favor of a technology that reveals a secret about the Real.

The other definition of "black science" is represented by one of Lovecraft's contemporaries. John Akomfrah writes,

Now the story goes that Robert Johnson sold his soul to the devil at the crossroads in the DeepSouth. He sold his soul, and in return, he was given a secret of a black technology, a black secret technology, which we know now to be the blues.

(Schulz 2)

Of course "black" with regard to race differs from its deployment in science or magic, but if Lovecraft's science is black by dint of its suspension of law, so is Johnson's—they share the Faustian acknowledgement of a secret motility attained only by relinquishing the value of laws, whether they be of European music, Jim Crow, acknowledged science, or conventional religion.

But what is the content of the “black secret technology” that Johnson discovered? In songs like “Me and The Devil Blues” and “Hellhound on My Trail,” Johnson’s voice and guitar create an atmosphere of rhythmic dissonance, surprising harmony, and a warbling counterpoint: the guitar is context and commentary to the vocal melody and lyric, and it too is crying in its own voice. The blues is attuned to the machine, and engages it in a dialogue. As Kodwo Eshun writes, “Reverse traditional accounts of Black Music. Traditionally, they’ve been autobiographical or biographical, or they’ve been heavily social and heavily political. My aim is to suspend all of that, absolutely, and then, in the shock of these absences, you put in everything else, you put in this huge world opened up by a microperception of the actual material vinyl” (179). Rather than repeating sociopolitical facts in an attempt to augment reality, Eshun endorses microperception, a detailed relationship to the generation of sound as constitutive of a new world. Listening is apparently more radical than it seems.

Let’s attend to the other obvious parallel between Johnson and Lovecraft—their occultism—to see its function in the black science they represent. Lovecraft is of course known for his menagerie of occult beings, such as Cthulhu and Yog-Sothoth, which he depicts as primordial forces whose scale far outreaches the provincial concerns of the human species. And yet, the intrigue of Lovecraft’s stories stems from the existence of humans in league with such non-human forces. Nearly every Lovecraft tale involves a character who is tempted to forsake the stability of modern society for “old ways”—ritual association with the pantheon of old gods. Here, the Christian devil is always depicted as a mere bowdlerization of actual occult power, which predates the Christian god, and which is older than our known universe. Those who, in the Lovecraftian universe, cast their lot in with the old gods, do so for the sake of reality—acknowledging that the old gods were here first. For instance, in “The Dunwich Horror,” a derelict family in rural Massachusetts is found to be continuing the ancient witches’ sabbaths for the purpose of bringing forth a race of human-deity hybrids. Lovecraft scholar S. T. Joshi writes,

Its plot is well known, and centres upon the efforts of Wilbur Whateley, his mother Lavinia, and his grandfather, Old Whateley, to bring in a horde of monsters from another dimension to overwhelm the earth. One monster in particular has been locked up in their house for years; and, after Wilbur dies in attempting to pilfer the Necronomicon from the Miskatonic University Library, the creature breaks out and causes sundry destruction before being dispatched by

means of incantations uttered by the Miskatonic University librarian, Henry Armitage, and two of his colleagues. It is then discovered that the monster in question was Wilbur's twin brother. (273)

Wilbur and his invisible brother, both children of Yog-Sothoth, stand for the promise of restoring earth to its original status as a domain of hybrids. While Joshi dismisses this story as a pastiche of Arthur Machen's "The Great God Pan" and other early weird tales,⁶⁰ there remains in it an insight which contains immense historical significance: the ancient link between the human and nonhuman world returns as a sonic encounter. Unlike in "The Great God Pan," where seeing the ancient god causes insanity and death, Lovecraft depicts a monster that cannot be seen at all, but whose sound evokes the knowledge of the union of the human and non-human at the foundation of reality.

This dynamic occult hybridization as agency is even more explicit with Johnson. While biographers, most notably in *Up Jumped the Devil: The Real Life of Robert Johnson*, have recently attempted to dispel the crossroads myth, Johnson's deal with the devil turns out to be impossible to extricate from the meaning of the blues. Even in the most mundane retelling, being a bluesman in Johnson's day meant risking social belonging, since it veered from the social norms established by Christian society in the Jim Crow south. In other words, songs that reflected, either lyrically or timbrally, the realities of slavery, addiction, poverty, or abuse were excluded from acceptable representation by the religious system that colluded with the modernization that justified slavery. Intercourse with the devil thus signifies the inherent non-modernism of the blues, a forsaking of the benefits of systemic power, reserving the genre for dispatches from the living machines upon which modernity depends.

Johnson and Lovecraft both survived the World War I acceleration of technology that, as Kittler reminds us, made recording, amplification, and radio technologies available to the world. They both conceived of a black science that brackets the codes of modern science in favor of a lawless exploration of reality. But whereas in Lovecraft, the protagonist's use of black science always results in a horrific loss of intelligibility (a position that, in his study of Lovecraft, Michel

⁶⁰ This type of critique is typical of Joshi, who single handedly made Lovecraft studies tone deaf and historically naive by subjecting the history of speculative fiction to evaluations of aesthetic proportion, rather than being sensitive to the patterns that connect it to neighboring artistic forms. Joshi, who resembles Wynton Marsalis in his adamant defense of canon formation and indoctrination of tradition, always comes out on the side of Purification (in the Latourian dynamic, wherein modernity is the vacillation between Purification and Hybridization), not noticing that his subject matter manifests to a high degree the chaotic, free, and generative work of hybridity.

Houellebecq refers to as “against the world, against life”), Johnson makes a deal with the devil for a technology that allows him to navigate an already horrific world. That technology is the blues. Ralph Ellison writes,

Slavery was a most vicious system, and those who endured and survived it a tough people, but it was not...a state of absolute repression. A slave was, to the extent that he was a musician, one who realized himself in the world of sound. For the art—the blues, the spirituals, the jazz, the dance—was what we had in place of freedom. Techniques (i.e. the ability to be nimble, to change the joke and slip the yoke) was then, as today, the key to creative freedom, but before this came a will toward expression...enslaved and politically weak men successfully impos[ed] their values upon a powerful society through song and dance. (Schulz 69)

Necessity is the mother of invention, so they say. Johnson, a black man from the Mississippi delta (where there were more lynchings than anywhere else) discovered the blues (the root of Black American music) out of a relationship with an instrument. But, as in the case of the guitar amplifier, the inherent nonlinearities of this relation—the unpredictable asymmetry between cause and effect—became the medium for another medium. What is so striking about Johnson can be heard clearly in songs like “Come on in my kitchen,” where he achieves a strange counterpoint: at uneven intervals of time, Johnson slides the guitar to a high note and applies vibrato, creating an aleatoric instability. It is a ghostly sound that haunts Johnson’s playing: the consistency of his vibrato, a wobble of mechanical regularity contrasts with accidental harmonics of the lower strings as they graze the slide, technique and machine colliding unpredictably. Johnson’s voice is of course central to his aesthetic value, but it is the characteristic environment created by his guitar’s meandering melodies that inspired his occult legend. Instruments that are generative of creative interaction require both technical (scientific) knowledge as well another thing, the heart of the unsanctioned sciences, which is not, properly speaking, knowledge at all, but rather a hunger for a secret but real world. In the midst of accelerating modernization, black science explores realities unsanctioned by law, thus generating and illuminating an unmodern subjectivity.

Black science can be defined as a site of hybridization, both necessary and invisible to the function of modernity itself. Bruno Latour posits that modernity itself relies on what I would

call an unconscious of unmodern realities—whole zones where the distinction between human and non-human, god and man, science and fantasy, are merged within the practices of real people, but unintegrated into their representation at the political or scientific level. The work of the unmodern sustains the systems of modernity, and for this reason we have “never been modern”:

The essential point of this modern Constitution is that it renders the work of mediation that assembles hybrids invisible, unthinkable, unrepresentable. Does this lack of representation limit the work of mediation in any way? No, for the modern world would immediately cease to function. Like all other collectives it lives on that blending. On the contrary, (and here is the beauty of the mechanism that comes to light) *the modern Constitution allows the expanded proliferation of the hybrids whose existence, whose very possibility, it denies.* (34)

Zones of hybridity function as the invisible organs of the body politic/scientific, creating deep relationships with the nonhuman world that support the precarious island which is the modern. The modern is sustained by these layers of blending simply because there is no life or growth without the nonhuman.⁶¹ The reason for this is of course more a matter of physics and biology than of politics or ideology: there are no truly closed systems, and living systems require access to their exterior in order to grow and change. In short, life is a dissipative structure—entropy is where all life begins and ends. Latour’s insight about modernity consists of the necessarily paradoxical nature of modernity, which must simultaneously deny the nonhuman world’s determination over human existence (creating the institutions of politics and science), while also allowing the nonhuman to quietly influence the very texture of life through hybridity.

The obscure sciences of Lovecraft and Johnson amplify and synthesize the edges of the modern world, expressing the mixtures of animal, demon, machine, and human that are inherent

⁶¹ David R. Bunch is a prophet of a modernity without the nonhuman. His Moderan cycle of stories depicts a future wherein humans have sacrificed the body in order to become fully mechanized and immortal. The logic of this future is of power, misogyny, and hatred. There is no movement, communication is limited to missile strikes on neighboring strongholds, and life is but an interminable defense against contamination. It is a world in which there is no feedback between political/scientific institutions and the nonhuman, because the nonhuman has been utterly destroyed. Animal and plant life are all but eradicated. But what about the ubiquity of machines, that other nonhuman voice? In the Moderan stories, the realm of the machine represents not an extension of sense or agency, but rather the restriction of these faculties for the sake of impermeability and permanence. For the inhabitants of Bunch’s future, technology is a means to reduce life to its most basic structures to prolong the life of the individual, thus negating the evolution that is made possible by synthesis with an external world. The machine in this case does not mediate, it insulates. Moderan is a fantasy of closed systems, and as such a meditation on modernity’s most solipsistic and moribund extreme.

to the experience of those who occupy the mixed development surrounding modernization, and their techniques reach us today through the parallel practices of science fiction and rock music.⁶² These forms have little representation in the official discourses of politics, science, or even in institutionally sanctioned art, but without them the last century would be unimaginable, not because, as the futurists and capitalists would say, they innovate new commodities, but because they attest to the real and primordial state of affairs: we survive only by a series of communications with the machine and the animal. I mean this literally: a single human life depends on the millions upon millions of semiotic processes that involve biota and automata that exist just within the body. Outside the body is just as complex and just as replete with paralinguistic communication. Science fiction and rock music defamiliarize this inheritance.⁶³

It is not surprising then that both of these forms in our own time are under the attack of modernity's homogenizing influence. Today, science fiction is everywhere, particularly in the "properties" distributed by the Disney corporation, like Star Wars and the Marvel Cinematic Universe. Likewise rock music is a ubiquitous background to shopping, dining, sports, television, and social media. And in these instances the forms that were once the inarticulate scream of modernity's unrepresentable monsters are sanitized beyond recognition, translated into the impotent language of the market, the language of the modern subject. But under the neutered tokens of modernity's new-found computational abilities, there persists the obscure culture of the analog. You find it where there is not much money, where no one thrills at the promise of the modern. In the record shop, the punk bar, the thrift store, in sheds and garages, where media do

⁶² One would be well justified in objecting to the exclusion of jazz from this dynamic. While it is true that the legacy of Black American music is most concentrated in the jazz tradition, fate would have it that in practice, jazz has become a highly institutionalized artform, whose boundaries are enforced by powerful gatekeepers, reducing its relevance as an experimental form evocative of the experience of postmodern hybridity. There are many exceptions to this, particularly with regard to the history of free jazz artists like Alice Coltrane, Sun Ra, and Don Cherry, but it is notable that these artists found a high degree of acceptance among rock circles, while free jazz found less support in the world of academically institutionalized jazz.

⁶³ Science fiction has long meditated on the problem of inheritance as it pertains to non-human influence. John Wyndham's *The Midwich Cuckoos* (1957) depicts a small English town upon which befalls a great catastrophe: one day, after a mysterious sleep overtakes the population, all the women awake pregnant by some extraterrestrial influence. The children of this event turn out to be identical, rapidly-maturing, telepathic beings endowed with preternatural abilities and a complete lack of compassion for human life. It is hard to ignore the shadow of Nazism in Wyndham's representation of the children, evincing an anxiety that the alien among/within humanity is merely a genocidal colonizer biding its time. But the theme of alien inheritance achieves greater clarity in Boris and Arkady Strugatsky's 1972 novel *Roadside Picnic* (which bears clear marks of Wyndham's influence), where an extraterrestrial visit has occurred, but was apparently not motivated by colonization. This turns out to be almost a worse state of affairs than colonization, since the debris left behind at the landing sites is either inexplicable, poisonous, or technologically revolutionary. The difference between the 1957 and 1972 visions of alien inheritance are telling: Wyndham's fear of a political other that has destabilizing intentions is deeply modern, and reflects the realities of war, but in the Strugatskys' narrative the children born out of the extraterrestrial incident are not envoys of an enemy power, they instead devolve into speechless proto-humans. *Roadside Picnic's* approach is postmodern, depicting humanity as always hybrid, and vulnerable to evolutionary accident.

not come prepackaged as miniaturized endorsements of the values of the modernity's symbolic/economic network, there is the potential for the development of hybrid cultures.

The texts I have analyzed from the age of the transistor revolution show that modernity, even in the ascendancy of its greatest tool—the digital gate—was fundamentally composed of hybridized processes and cultures. Not only this, but the amplification that the transistor facilitated created a new regime of deeply hybridizing techniques. I find Ballard and Pynchon to be particularly good examples of this situation because of their proximity to the discourses and institutions of scientific modernity proper, as well as their attentiveness to its entropic outskirts. For Ballard, a witness to the Sino-Japanese wars of the nineteen-thirties and forties, evolution is not a matter of technocratic selection and progressive success against genetic corruption, but a capacity to attend to and participate with the technologies and environments that corrupts you. For Pynchon, a technical writer who saw the industrialization of California, the gentrifying institutions of modernity are ultimately no match for the greater nameless living machine that parasitizes (positively and negatively) and remembers the disenfranchised masses. These texts are postmodern in that they serve as commentary about modernity, but also in the sense that they return attention to the forms of becoming that are a byproduct of nature and culture's specific historical collisions through the machines of modern life. Modernity will persist, but as long as it does, there will also persist a noisy signal from its undifferentiated innards: the voice of the hybrid, the cry of the machine. While it is clear that human influence has changed the very texture of life on our planet, it will never be too late to listen to the voice that emanates from our most intimate interactions with instruments. This call is not a call to progress, but to a reciprocating connection between self and other.

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