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Complex Occasions: The Cybernetic Attunement of American Poetry

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Complex Occasions: The Cybernetic Attunement of American Poetry

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Advisor: John Johnston, Ph.D

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Abstract

Complex Occasions: The Cybernetic Attunement of American Poetry
By Michael Hessel-Mial

The present study explores the relationship between American poetry and the early computer and information sciences called cybernetics. Arguing that the roots of contemporary digital culture lie in this intersection, I examine the role of information theory in the writings of Norbert Wiener, Martin Heidegger, Charles Olson, various early computer artists, and John Cage. These each examine, from widely varying disciplinary backgrounds, the significance of information's application of scientific measure and functionality to language. The first chapter describes the key terms in Norbert Wiener's cybernetics, information and feedback, as being motivated by both mathematical considerations and Wiener's considerable anxiety about the potential negative impact of automatic machinery on society. The second chapter examines Charles Olson's early poetry as witness to historical crisis, with the turning point being the arrival of cybernetics in his early masterwork, "The Kingfishers." Archival sources to show that feedback plays in conceptualizing his poetics, which is then elaborated over the Olson's later writings to join poetry and technology in his concept of "quantity." The third chapter outlines Martin Heidegger's critique of cybernetics as the "essence of technology," showing that his predicted results of cybernetics - globalization and increasing precarity in lived experience - characterize most later political critiques of cybernetics, as well as Heidegger's belief in the redemptive power of poetry. The fourth chapter offers a general survey of the application of cybernetics to aesthetics, focusing on two competing approaches: feedback-based works of automata and performance, and information-based works of computer-generated images, music and text. The fifth chapter examines the role of communications science in John Cage's writings in his book, *Silence*. Cage's term, "interpenetration," is examined as an adaptation of information principles to society itself, made interconnected by communications technology. "Complex Occasions" is a genealogy of digital culture, showing that key scientists, philosophers and poets identify the persistent aesthetic and political concerns surrounding digital technology.

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Contents

Introduction. The Cybernetic Moment

Cybernetics, coined by mathematician Norbert Wiener, comes from the Greek word *kybernetes*, or "steersman." Thinking of the steersman, of prime importance for the development of cybernetics is the ocean, as metaphorical resource for thinking about chaos, totality, and our means of controlling it. So what does the ocean mean for us? Though the ocean contains well-populated ecosystems in its depths, with currents below that maintain the atmosphere above, we have spent most of our time fixated on what takes place on top of it. The ocean is a place of material transportation, invention, and warfare, across whose surface the course of human evolution has dramatically changed, often with profound violence. The ocean is a place of fear, bounded on all sides by an isolation, sense of smallness, and vulnerability in the face of death by drowning. We find in our language, despite the beauty of the waves, a much more primordial terror at its depths. The technologies of maintaining control over the sea's forces begin to take on additional weight, and the ship itself becomes a metaphor for refuge and control. Ancient lyric poetry, beginning with Theognis and Alcaeus, has given us the famous metaphor of the "ship of state." Our understanding of governance is founded on this metaphor. The root of the verb, "to govern," is the Greek *kybernan*, "to steer."

By the late 1940s, mathematician Norbert Wiener would weave these metaphorical threads into a novel science, coining the word "cybernetics" as the science of communication and control. Wiener had pursued communications research during the Second World War, improving anti aircraft weaponry by introducing feedback, and providing recommendations that would lead to the first proper digital computer. In parallel with research by Claude Shannon, who published the landmark

"Mathematical Theory of Communication" in 1948, Wiener would define information as an extension of thermodynamics. And drawing explicitly on the root of the word "governor," Wiener would imply that the science of information is bound up in steering and guidance, against an ocean of disorder.

At the time when cybernetic principles were being formulated, the world appeared on the brink of disorder. In the uncertain years immediately following the Second World War, history was set on the edge of itself. Not only did the Second World War still linger in the popular imagination, but the sense of an impending future society subject to rational technological control, faceless, even fascistic, seemed just around the corner. This in-between point of history, which hardly corresponds to the rosy picture of the later 1950s in our historical memory, was fundamentally undecidable. The notion that world history - with its arts, sciences and traditions of thought - had come to an end had taken material force. The events of the war, especially including the Holocaust, were so colossal as to tear history itself. The only ontological certainty was change, as some would have it. It is in this moment that cybernetics as an idea begins to crystallize.

Beginning with wartime developments in electronic computing, communications engineering, cryptography and servomechanisms, cybernetics as a program for a general science emerged. From 1946-1953, interdisciplinary meetings named the "Macy Conferences" (after the Josiah Macy, Jr. foundation, their principal benefactor) developed the general principles of this new science and dramatically expanded its reach, redefining physiology, brain science, anthropology and sociology (among other disciplines) as "teleological mechanisms" defined in terms of their communications circuitry. In the ensuing decades, these researchers would team up

with biologists, neurologists and others across scattered disciplines to formalize the scientific metadiscipline that would supersede all others.

Cybernetics would uncover the information circuits underlying every natural process, from the weather to brains to society, understanding and rationalizing all of them. This aim was not shared by every participant, but the thrust of its ambitions were colossal. Norbert Wiener's 1948 book *Cybernetics*, in dense alternations of prose and pure mathematics, attempted no less than a step by step derivation of its principles from classical thermodynamics to information theory to mechanical and biological feedback, then using the platform to describe, or prescribe, matters ranging from mental health to economics. The book was enough of a sensation in the scientific community to merit a lay audience popularization, optimistically titled *The Human Use of Human Beings*. It made cybernetics more accessible, situated in a history of science and philosophy and applied to the analysis of a society dominated by mass media and automatic machinery.

Cybernetics became a scientific vogue, aided by the early adoption of Wiener's writings by engineers and Wiener's general willingness to serve as its public face. This vogue became increasingly tied with public enthusiasm for the future promised by mass media and high-speed computing. This led to the adoption of cybernetic principles by theorists of media and technology like Marshall McLuhan and Buckminster Fuller, increasingly becoming imbued in arts discourses, significantly aided by Jasia Reichardt's curatorial work in cybernetic arts, culminating in the "Cybernetic Serendipity" exhibition in London in 1968. In parallel with these engineering and cultural developments, cybernetics increasingly retreated from its ties to mainstream military-industrial research projects, as mostly a private cybernetics

was conducted by figures like Ross Ashby, Gordon Pask and Stafford Beer. These works, emphasizing autonomous and emergent dynamic systems, allowed for the appearance of an intellectually robust, if eccentric, "second cybernetics" whose concerns were increasingly epistemological, ethical and, significantly, ecological. Aligning itself with 1960s counterculture, cybernetics morphed from a wartime technology of communication and control into a spiritual science of self-organization and environmental relationality. Cybernetics' history reflects something intrinsic to its broad reach; straddling the poles of war and deep ecology, the Cold War industrial research laboratory and the tinkerings of the mad scientist, cybernetics becomes a site of projection and contention, whose stakes would be the tenor of globalization itself.

Cybernetics has two key terms: feedback and information. Feedback is a process that uses the output of a system as input, as in a thermostat that responds to changes in temperature by adjusting the amount of heat, until the temperature is stabilized. Cybernetics suggests that this is a fundamental feature of living beings. Information is a statistical measurement of communication for the purpose of efficient encoding, where the greater the likelihood of the message, the less information it contains. Cybernetics suggests information describes all physical processes as messages. Together, they are a science of "communication and control," that defined the versatility of living things as communications circuits.

The novel claim was that information processing had general features that could be applied to phenomena that wouldn't appear to involve information. The roots of this claim lay in parallel discoveries by Norbert Wiener and Claude Shannon, who wrote the famous 1948 paper, "A Mathematical Theory of Communication," of an apparent identity between the equations for the thermodynamic principle of entropy

and the measurable quantity of information in a message. Entropy, the steadily increasing disorder in the universe, found an analog in the hiss of noise in a communications channel.

The identity between the two allowed for two basic assumptions. First, that communication was a physical process following mathematical laws, with effects that could be theoretically outlined regardless of whether the message was written, spoken or a physical-biological "message." Second, that information could define life as a pocket of negative entropy, likened by Wiener to an island of order against a sea of disorder. By communicating, and preserving itself through feedback loops, an organism defined itself in an orderly manner through information. This assumption lies somewhere between mathematical modeling and ontology of language, and as such resists easy scientific falsifiability. Wiener and his cohort were absolutely convinced of its truth and devoted their time to exploring its implications. It is today considered for the most part a misleading analogy, now bracketed as a philosophical claim or limited to questions of energy loss in research on quantum computing, without the brashness of claiming to describe the nature of life and consciousness.

Cybernetics occupies a rare place between the hard-boiled results of the research laboratory and a form of broader investment and imagination of other possibilities that cybernetics may hold. What makes it so tricky, and so delightful to think through, is how the two are never fully separable. We talk about information technology like Shannon, Wiener and others do, right and wrong. After a certain point, cybernetics becomes an indicator of what people wanted science to say about their time; relentless change, randomness, and the mysterious power of communication raised questions that cybernetics was happy to answer.

In many ways, the answer lay in the mysterious poetry of cybernetics. The metaphor of the steersman depends on the ocean becoming a metaphor for three things: the source from which all things come, the vastness of all that is, and the chance occurrences by which which all that may be will be. There is something compelling about a meditation on the sounds of the sea as the condition of all potential language. We may put our ears to a telephone pole as we would a seashell, imagining faintly audible traces of conversation dissolving into a wash of static. Or we might recite Hart Crane's lines on the cables of the Brooklyn Bridge, in heroic suspension over the East river, as Crane writes, "Taut miles of shuttling moonlight syncopate / The whispered rush, telepathy of wires" ("Atlantis," lines 3-4, *The Bridge*).

As later cybernetician Gordon Pask would put it, cybernetics is the art of acceptable metaphor. Indeed, starting with Wiener in his book, *Cybernetics: or control and communication in the animal and in the machine*, the following metaphors appear again and again: the brain as a computer, neurons as vacuum tubes, sense-perception as the transmission of information, DNA as a computer program, entropy as noise in a communications channel, and society as a cybernetic system.

I define poetry as an art that uses communication itself as its medium. In parallel, cybernetics takes communication as its primary object of study, in organisms and machines. The second half of the 20th century observed perhaps the most dramatic shift in communications media since the advent of phonetic writing in the form of a comprehensive mathematical theory of information, and attendant proliferation of computers and mass media. The engineers who developed it frequently invoked the metaphors described above, while heralding a rationally

planned cybernetic society just around the corner. Some of those claims became so commonplace we forgot their novelty - cyberspace is so taken for granted that the word has become passe. Others are half forgotten. But throughout, cybernetics looms in philosophical and poetic texts both familiar to their implied readers, and remote to us.

By instrumentalizing communication, cybernetics is inherently making a claim about poetic language. Given the Romantic lineage pitting the aesthetic against the scientific, a mathematical definition of communication offers fuel for a great conflict. Instead, the 20th century saw artists finding promise in computers and mass media, reshaping the historical avant-garde with a new sense of what art could be. Likewise, the scientists invested in cybernetics were enormously playful, basing their practice on wild metaphorical leaps and speculation on an automated, ideal society. From this emerged a cybernetic poetics.

Is the matter of finding a cybernetic poetics simply in poetry 'about' cybernetics? This would certainly provide many candidates. Computers, cybernetics and information theory peppers the poetry of this moment, always in tantalizing, hard to pin down ways. Charles Olson's first great poem of 1950, "The Kingfishers," lifts quotations directly from the writings of Norbert Wiener, father of cybernetics, as Olson writes,

> To be in different states without a change
> is not a possibility
> We can be precise. The factors are
> in the animal and / or the machine the factors are
> communication and / or control, both involve
> the message. And what is the message? The message is
> a discrete or continuous sequence of measurable events distributed in time
> (170-171, *Selected Writings*)

Just a decade later, Langston Hughes' last long work, the jazz-scored performance poem *Ask Your Mama!*, hints at possible unforeseen tensions at the intersection of information technology, music and pan-African liberation movements. He writes,

> IN THE QUARTER OF THE NEGROES
> WHERE THE MASK IS PLACED BY OTHERS
> IBM ELECTRIC BONGO DRUMS ARE COSTLY (*The Collected Poems of Langston Hughes*, 524)

Around the same time, A.R. Ammons' poem "Identity" describes a spider web on information-specific lines as a general occasion for reflecting on then-novel ideas of entropy and emergent form, writing:

> order
> diminishes toward the
> periphery
> allowing at the points of contact
> entropy equal to entropy (116, *Collected Poems 1951-1971*).

These references to the information sciences assume in advance the reader's familiarity with the subject, while still preserving a space of opacity and mystery. Why this language? Is it merely in the air, or something more? Enough invocations of cybernetics in the time period led me to this inquiry into cybernetic poetics. But the most significant influences are not to be found by citation alone.

Over the following five chapters, I will examine the course of this cybernetic poetics, from their origins in postwar anxiety to the dreams of an anarchic utopian future supplemented by cybernetic technologies. The first three chapters engage common concerns of three figures - Norbert Wiener, Charles Olson, and Martin Heidegger - in texts written from 1948-1950. It is in these years that we may find the origins of what has been called "postmodernity." In each figure, we find a historically

motivated synthesis and departure from the classic tropes of modernity, such that disciplinary boundaries are reshaped and a poetic sensibility emerges. The final two chapters address cybernetic culture more explicitly. The fourth engages the application of cybernetic and information theory to the arts. Beginning with the 1968 *Cybernetic Serendipity* exhibition and working backward to the cross-disciplinary roots of computer art, I propose two opposed cybernetic metaphors for the work of art: a feedback metaphor joining a dynamic character of art with its surrounding social milieu, and an information metaphor understanding computer-generated images, texts and music as a statistical phenomenon. The last chapter aligns the aesthetic writings of Cage with the information paradigm of art discussed in the previous chapter, concluding by thinking of Cagean performance as revealing the poetic potential of information in its event quality.

In this treatment, a certain notion of information will repeatedly emerge as star of the show - communication that not only "controls," but transforms. The ever-elusive radical redefinition of information will be precisely what poetry is. Further, an attention to the hidden controversies of information theory will show that much of what is held most dearly in cybernetics can be found there. On first glimpse this is counter to most of the histories of cybernetics, which celebrate the dynamism of feedback and centrality to cybernetic conceptions of consciousness. Indeed, every model of cybernetic society, from Norbert Wiener to Niklas Luhmann, frames the interdependence of subjects along the recursive lines of feedback. Information is often, rightly or not, understood as an afterthought.

In reading texts on the history of cybernetics, responses tend toward either celebratory accounts, not short of revisionism and notions of cybernetics as a "lost

cause," or suspicious reads of cybernetics as either a faceless technological manipulation or as a metonym for the technoscientific milieu it came from. From the Invisible Group's haunting *The Cybernetic Hypothesis*, which forcefully joins cybernetics with the use of computing in the Holocaust as a new interpretation of biopolitics; to Andrew Pickering's *The Cybernetic Brain: Visions of Another Future*, which shows the potential of cybernetics as a visionary science qua aesthetic practice; cybernetics looms as a historical event that demands to be understood on its own terms. This project attempts to shoot past both approaches in describing what cybernetics was and what was accomplished in its name.

It was a moment of interdisciplinary activity and enormous theoretical ambition that depended not only on scientific facts, but support by military-funded research labs, a splash of ontology and metaphor, and (perhaps least understood) an unshakeable belief in its timeliness and triumph over the history of thought. Geoffrey Bowker's *Memory Practices in the Sciences* treats of cyberneticians' frequent invocations of the historical place of cybernetics with a generous but strong critical eye, and indeed, the cybernetic moment was a created thing. And yet, cybernetics *did* enjoy enormous prestige beyond the laboratory, and the strange temporality of the cybernetic moment persists well beyond cybernetics' mainstream demise by the late 60s. Indeed, the historicity of cybernetics lived past cybernetics itself, authorizing a technocentric, semi-philosophical discourse around everything from chaos theory to fractals to more recent enthusiasm about big data and blockchain technologies, and related developments in media theory and the European structuralist craze.

Today, cybernetics' standing as a novel science remains exciting but is hardly a sure bet, as critiques of the key scientific principles - especially the analogy between

thermodynamics and information - have risen to complicate the just-so stories told by cybernetics enthusiasts. In addition, both beautifully and frustratingly, cybernetics shows up when needed, only to fade away, with the implication that whatever the fruits, it sprang in and of itself from the discipline that created it. It has been been argued that the cybernetic framework gave key principles to everything from computer science, neuroscience, structural linguistics, ecology and computer graphics - and yet, none of these current disciplines demonstrate significant awareness of this history. This comprehensiveness of cybernetics' scope is argued to be a strength in its claim to be an all-encompassing metascience. This aspect of the cybernetic project still calls for a revival, which Bruce Clarke and Derek Woods engage, informed by the urgency of climate change and the whole earth picture afforded by earth systems science.

This project takes a different path in its focus on poetry, on the one hand, and its primarily social and historical approach on the other. Though assisted at every turn by the total picture of second-order systems theory, I focus primarily on the moment of cybernetics' greatest prominence, roughly 1948 to 1968, rooted in the writings of the early cyberneticians. In addition, rather than reviving cybernetics today based on a myth of cybernetics' past, I opt for understanding more completely cybernetics as it was to find how we still work under its key principles. As such, my source for understanding cybernetics will come primarily from Norbert Wiener. It was his *Cybernetics* that was most widely read by artists of the period, and we will find that his understanding of the social role of cybernetics informs the concerns of the period, time and time again.

This allows us to see cybernetics' failures not as as holes that can sink a ship, which has decidedly sailed into history, but as the artifacts of a decommissioned vessel, proof of its strange voyage. I choose a more challenging, and possibly necessary interpretation of cybernetics - time-bound, frequently wrong, and for a brief time of seemingly infinite resourcefulness in conceptualizing whatever happened to fall under its purview. In being infinitely resourceful and easily forgotten, it slips into the hidden recesses of our cultural imaginary to become naturalized, a vocabulary. Early computer science, as it was understood in its time and not as we understand it now, still echoes in contemporary digital culture: its language, its social concerns, its art, its poetry. Cybernetics operates as a hidden supplement to the intellectual productions of postmodernity and after.

Chapter 1. Cybernetics Against Itself: Norbert Wiener and Cybernetics in History

In cybernetics, the two most significant concepts are information and feedback. Nearly all of the ideas that would follow can be defined in terms of them. No history of the discipline is complete without them, though it must be noted that of the two, feedback has clear pride of place. Feedback describes how systems stabilize themselves *and* how they spiral into chaos, tantalizingly offering a definition of life as a dynamic interaction with an environment. Living systems respond to their environment in the form of a recursive loop, taking the result of previous actions and feeding them back to the beginning, adjusting their behavior as a result. This largely formal definition is recursive at its heart, and looks both forward and backward in time: feedback can be found in living organisms as their bodies maintain internal temperature, or as predators and prey mutually maintain one another's populations. Feedback can also be found in machines, increasingly approximating life as they adjust to hard-coded variables in their environment. Feedback can rightly be said to be a formal principle of life as it changes, which the second-generation cyberneticians interpreted to mean a fundamentally circular, self-referential characteristic of life itself, if not all matter.

What is often forgotten in this definition is that feedback is fundamentally a formal definition of the interactive properties of a communication circuit. Feedback depends on an abstract definition of information, in which material phenomena we may refer to metaphorically as "communication" are circularly organized in a feedback loop. The power of the concept of feedback depends not only on a scientific definition of communication, but also on the ability to expand that definition

analogically to phenomena we would not immediately identify as "communication." This chapter will undertake the disentanglement of feedback from information. Exploring the relationship will allow for the history of cybernetics to emerge, and its invitation to create formal analogies across disciplinary and material boundaries.

In considering the relationship between information and analogy, I will pay as close attention as possible to their place in the broader history of science, as well as the specific scientific and engineering developments that served as points of inspiration. As a scholar of literature my reading practices are oriented toward close readings and intertextual connections. For example, though Claude Shannon is the founder of information theory and has a range of scientific sources informing his work and firmly placed in the history of information science, I will pay closer attention to Norbert Wiener's professed indebtedness to J. Willard Gibbs and Henri Lebesgue, who arguably hew closer to the more epistemologically daring claims of the second-generation cyberneticians. Though this is clearly (and for perhaps good reason) not the standard mode for histories of science, we will see that, like in works of literature, scientific traditions can be read as intricate and multi-nodal textual networks. Wiener, who I give pride of place in this chapter, makes particular choices that are informed by his influences, most of which have not been critically examined. We will see that such an interpretive method, informed by close reading and intertextual connections, allows for a more supple response to the controversies generated by cybernetic thinking.

The controversies are many. Though they should not overshadow the truly exciting ideas that emerge, they have to be taken seriously in order to understand cybernetics in its historical moment, and to take seriously the stakes of its claims. In

that regard, critical commentary by Lily Kay, Peter Galison and William Wimsatt will be invaluable in understanding the limitations of the cybernetic project. What will it mean to say that certain cybernetic claims are rejected by mainstream science? Further, what will it mean if thes claims are central to the foundation of cybernetics as a discipline? We will find that, just as Gordon Pask is said to have referred to cybernetics as "the art of manipulating defensible metaphors," the earliest claims of cybernetics are *analogical*, constructing parallels that give life to new forms of description.

I begin, however, with some elementary definitions of information, to show some of their divergences and why. Information's definitions often compress a long history of development simple heuristics. There are significant differences among these definitions that indicate not merely discrete camps in how we describe information, but also the deeper assumptions about what the mathematical definition of information ultimately entails.

> Suppose I send a message that contains the series 2, 4, 6, 8 . . . and ask you to continue the sequence. Because you grasp the underlying pattern, you can expand the series indefinitely even though only a few numbers are specified. Information that has a pattern can be compressed into more compact form. ... You may object that although the numbers are always new and surprising, they do not *mean* anything. The objection illustrates why it was necessary to separate information from meaning.
>
> -N. Katherine Hayles, *Chaos Bound*, 1990

> "if in nine cases out of ten I send a dot each second, but in the tenth case omit it, it is only when I omit it that I am furnishing significant information."
>
> -Norbert Wiener, "Time, Communication, and the Nervous System," 1948

> In fact, what we mean by information--the elementary unit of information--is a *difference which makes a difference*.
>
> -Gregory Bateson, *Steps to an Ecology of Mind*, 1972

What are we doing when we impart a heuristic about information? We begin simply enough, with Hayles' emphasis on the condensation of patterns, divorced from meaning. Indeed, Hayles might be making things a bit too easy on us - are we to believe that communication is simply the transmission of a function? What is information? Norbert Wiener would have us believe that it is not patterns, but their disruption. This is a key trope of information, which Bateson seizes on to suggest is a function at the heart of difference itself. From the first to the last, we find in the cybernetic moment a definition of information that is estranged from our conception of knowledge, and risks (or offers, depending on one's outlook) a different axis by which to view the physical world.

The writings of Claude Shannon provide a useful counterpoint to Wiener's thinking on the matter, but I will demonstrate that his concerns, while important, are not what provides the conceptual weight that the cyberneticians take up. I will show, in a close examination of the claim that information is defined in the same terms as thermodynamic entropy, that Wiener's form of information is indeed bound up in considerations of thermodynamic systems. This entails communication becomes a mathematically definable part of the behavior of all systems.

Hayles' account assumes that the problem lies in encoding, and how we talk about it. Following Claude Shannon, Hayles requires us to distinguish between information and meaning in order to mathematically determine 'how much'

information a message 'contains.' The problem is that this is not what early information theory is concerned with. Contemporary accounts of information theory often emphasize encoding (and whether it is 'efficient'), and in the process elide the very problem early information theory set out to resolve - the noisy channel. This is not to say that encoding hasn't been at the heart of information theory, but when we characterize pattern and uncertainty in messages, we find that beginning from the standpoint of encoding has only the ghost of the original analysis that led to it. It is notable that Hayles' account is very amenable to speech; the presumably full self-presence of speech covers over the messy translational work required to design communications apparatuses in the first place. Wiener, conversely, was grappling with precisely this translation; Wiener's moments of invention often involve a translation from a mechanical to a theoretical problem. I hope to demonstrate that this provides much of the impetus of the more ambitious claims of early cybernetics.

We must be generous with who we name as the name-givers; Norbert Wiener named cybernetics, while Claude Shannon named "the mathematical theory of communication." And yet, Wiener was also involved in the development of information theory in a significant way. Both Hayles and Lily Kay observe that Shannon and Wiener's information theories are almost entirely complementary, with some naming it the Wiener-Shannon model of communication after the two of them. In terms of the overall *reception* of these theories, the legacy of Shannon is invariably toward the theory of encoding proper, while Wiener's emphasis is, more controversially, on the nature of information entropy. In the question of the information-theoretical usages of the word “entropy,” we may make this initial judgment: where for Shannon the link appeared to be a happy accident, cemented into

history by naming it so, for Wiener it was a hard-fought concept that emerged (real or no) from his early work in statistical mechanics. For Wiener, information is analogous to thermodynamics because he was actually taking it on as a thermodynamic problem. It is not unfair to say that Wiener work is simply not 'digital,' in that while he could envision the key elements required to shift from an analog computer to its digital counterpart, it is hard to imagine his body of interests resulting in something like ENIAC.

Norbert Wiener presents difficulties by uncomfortably straddling the divide between the analog and digital. He is frequently understood to be on the 'side' of the analog, and in a comparable set of questions understood to be more inclined toward the 'continuous' over the 'discrete.' And yet, Wiener makes frequent mention, like other cyberneticians, of specifically rendering problems in a form that can be quantifiable. In a later chapter of *Cybernetics*, "Computing Machines And The Nervous System," Wiener makes a direct comparison between the two. He contrasts "*analogy machines*, where the data are represented by measurements on some continuous scale," with "*numerical machines*, where the data are represented by a set of choices among a number of contingencies." The latter is preferable to Wiener as a matter of principle, because of the precise ways that accuracy is preserved in each. In the former, "the accuracy of the machine is determined by the accuracy of construction of the scale" (117). Wiener's example of the slide rule, in *The Human Use of Human Beings*, helps clarify this: "A ten-foot slide rule will give only one decimal place more accuracy than a one-foot slide rule, and in order to do this, . . . each foot of the larger slide rule be constructed with the same precision as the smaller one" (65). The problem, for Wiener, is that analogy-based machines depend on a

precise set of relations between the components, relations which cannot exceed material limits in the construction. Precision is limited to scale. Conversely, for numerical (or digital) machines, "the accuracy is determined by the sharpness with which the contingencies are distinguished, the number of alternative contingencies presented at every choice, and the number of choices given" (117). The general direction of this is toward encoding in discrete elements. Already by use of the word "choice," Wiener is speaking the language of information as a matter of sharply defined alternative contingencies.

Though Wiener clearly saw the benefits of modern approaches to computing (specifically digital components and internal logic-processing), much of his work was directly concerned with analog computing, which had advanced significantly past slide rules by the Second World War. The fire-control computer, to which Wiener famously applied predictive feedback as a extension of the capacity of servomechanisms, was electronically aided but still analogical in its computation. Indeed, the signature "ball-and-disk" integrator used was merely a streamlined version of that first developed by Lord Kelvin in the 1880s. This is all to counter an oversimplified reading of the relationship between analog and digital, as the translation from one to the other did not take place in a single leap. Wiener's work is based in the analogical and pointing to the digital as a matter of principle, and it is this point which we can clarify in order to understand better how cybernetics could emerge from this intersection.

As I will show, the properly 'cybernetic' approach is a matter of translation between the two. The act of translation gives a hidden weight to analogy-formation, serving the double role of proof and hypothesis, inroads to future analysis. Further, we

will find that the analogical straddling of analog and digital contains a covert phenomenology, wrestling with its 'object' as a fluctuating stream of data whose logical-mathematical elaboration is only possible by the givenness of that stream. But first, we turn to Wiener's description of information, to see how the fundamental analogy between thermodynamic entropy and information entropy emerges.

Wiener's starting point for thinking about information is in the statistical mechanics of Josiah Willard Gibbs, who is responsible for the "introduction of probability into physics," augmenting Newton's laws by thinking of systems as ensembles of probable states. Gibbs is paramount for Wiener, for whom "it is ... Gibbs rather than Einstein or Heisenberg or Planck to whom we must attribute the first great revolution of twentieth century physics." Further, Wiener holds that "the Gibbsian contingency now stands in its complete nakedness as the full basis of physics" (*The Human Use of Human Beings*, 10). Interestingly enough, for Wiener the revolutions in relativity and quantum mechanics are actually *less* radical than Gibbs, as Wiener suggests that they "still content that a rigid deterministic world is more acceptable than a contingent one." Such a "rear-guard action" will be outstripped by Wiener's "contingent," or statistical approach, which takes the interpretation of Gibbs' statistical mechanics to its full completion in cybernetics (11).

In Wiener's assessment of Gibbs, and to a lesser extent that of Boltzmann, the novelty of statistical mechanics is the use of the findings of thermodynamics to describe indeterminate systems. The Newtonian framework, identified as being orderable in advance irrespective of the temporal direction of the physical interactions, is replaced by aggregates of particles whose momenta can be determined only in their statistical distribution, and whose interactions are largely irreversible.

These two factors - indeterminacy and irreversibility - which will prove decisive for thinking about the key features of cybernetics, including the seemingly opposed notion of statistical equilibrium (rendered biologically as homeostasis), which as a result of feedback becomes a consequence of these principles. Wiener points to Gibbs as an early example of these principles, which initially augments the Newtonian system but increasingly supplants them.

Earlier in 1948, Wiener published an essay titled "Time, Communication, and the Nervous System," which neatly outlines much of what would appear more thoroughly in *Cybernetics*. Where the full treatment is given in mathematical language over the course of several chapters, here the moves are more straightforward, compacted. It is fruitful here, because the discussion of Gibbs is rich, addressing the philosophical stakes of the earlier scientist's work without recourse to pure mathematics. Here Wiener credits him with providing new physical concepts:

> The new notion which has been added is that no system is random in itself, but can become random only by losing its identity in a set, or ensemble, of systems. More than that, an ensemble is not adequately defined by the mere listing of the individual systems it contains, but requires the notion of a distribution of these systems. This notion of distribution is equivalent to the notion of probability (199).

The abstraction and generality with which the words "ensemble" and "distribution" are used allows for any class of systems or possible states to be defined. We may already intuit that this is a different way to describe things than what we may term a properly "Newtonian" approach, as it pays more attention to particular states of the system as a whole rather than parts of the system. A system is understood in terms of all, the ensemble, of its possible states, each of which has a particular statistical

distribution over the timeline of the system. Whether a system may be properly described as "random" is here not precisely the point; rather, the impossibility of knowing everything about the system's components necessitates that it be treated as random in its succession of states. Wiener continues by attributing to Gibbs a sharpening of this definition of the distribution to any, "arbitrarily small" degree of freedom, allowing for greater flexibility of analysis, and the idea of statistical equilibrium as a definite and limited number of possible states (ibid).

It won't be too much further into the essay that Wiener will explicitly connect these considerations from statistical mechanics with problems relating to messages. Wiener writes, "It is, perhaps, not quite as obvious that the message not only presumes an ensemble of messages to carry a meaning, but it presumes an *a priori* distribution over the ensemble" (203, emphasis in original). What Wiener is pointing toward is that communications engineering must take as its object not the particular message being sent, but all the possible messages that can be sent through a particular channel. We may think of the ensemble here as all possible *combinations* of elements, exemplified in *The Neverending Story* in the "Palace of Old Emperors," where former rulers with nothing to do shuffle letters around interminably, waiting for phrases from Shakespeare to appear. John R. Pierce, an exponent of the Shannon strain of information theory, points to the statistical distribution in something as simple as letter frequency in a particular language. He illustrates this with several examples in the history of communication. In his anecdotal account of Samuel F.B. Morse's selection of which letters received which combination of dots and dashes, Morse used the amounts of individual metal letter types in a printers box to approximate relative letter frequency (24, *An Introduction to Information Theory: Symbols, Signals and*

Noise). The relative frequency of, say, the letter E, corresponds to the greater preponderance of E types in the printers' box, suggesting that its frequency of use merits a shorter combination of impulses in Morse code. Likewise, Pierce describes Shannon's research in approximating English not only in the likelihood of individual letters, but also conditional probabilities to a first and second order, determining the likelihood of particular letter pairs (bigrams) and triplets (trigrams). T is much more likely to be followed by H than by Z, and likewise Q is more likely to be followed by U than by V. Distribution here pertains not merely to individual elements, but also to their relationships. This approach to distribution is significant for the purposes of encoding, or the selection of units of communication to stand for what is to be communicated. Single-letter encoding draws upon different statistical relationships than encoding with multi-letter fragments or entire words, and the matter becomes even more complicated when the signal is continuous, as in a radio wave, rather than in discrete impulses like the telegraph. For the purposes of our discussion, what we should recall from these remarks is that the distribution depends not only on the statistical likelihood of particular components, but also takes into account the *relations between components*. This last phrase will be of signature importance in later discussions of autopoiesis.

However, we have moved somewhat away from the precise link that Wiener elaborates, digressing somewhat (though necessarily) toward the much neater realm of encoding. This heuristic parallel remains at the level of formal analogy between a message and a thermodynamic system, and does not get to the synthesis that Wiener sees as a condition of possibility for cybernetics in its own right.

While Gibbs provides key terms of analysis that hint, as I've tried to suggest, at what would later emerge fully fledged in theories of complex systems, Wiener is frank about key limitations in Gibbs' work. Wiener's relationship with Gibbs is marked by fondness and a sort of condescending rebelliousness, clearly admiring him almost as an intellectual father figure while making statements like, "Gibbs, though a very powerful mathematician, was never a very subtle one" (46, *Cybernetics*). Wiener's chief complaint is that Gibbs lacked the particular ability to formalize the randomness underlying distribution over the ensemble, resulting in a peculiar hypothesis called the "ergodic hypothesis." Drawn from the Greek words for "work" and "path," Gibbs' assumption, according to Wiener, was "that in a system from which all the invariants had been removed as extra coordinates almost all paths of points in phase space passed through all coordinates in such a space" (49). What this means is that all the possible permutations comprising the total ensemble would manifest in the system itself over time, a claim that is odd on the face of it. Applying this to the above example of the English alphabet, do messages really exhaust all possible combinations of components? The problem that Gibbs couldn't resolve is how statistical distributions appear without all possible combinations of states having to take place. Wiener reminds us that Gibbs largely tackled these problems intuitively, still approximating the systems despite an inadequate theoretical formulation for it (ibid). That formulation would come from elsewhere, but ergodic theory proper still takes its name from the questions raised by Gibbs work.

Wiener prides himself on discovering how Lebesgue integration can help resolve Gibbs' problems. Working in parallel with Gibbs, Henri Lebesgue developed a new and more applicable form of integration that proved, for Wiener, to resolve many

of Gibbs' problems. To put it simply, the Lebesgue integral defines a function with an updated, more set-theoretically rigorous definition of measure. Whereas previous forms of integration would only measure along infinitesimal units on the X-axis as a means of determining the area, Lebesgue measure could do the same thing by decomposing a function into sets of functions. This would prove especially useful for trigonometric wave functions, as well as the theory of the time series, which for Wiener was the most significant discovery of cybernetics. Wiener's approach to Lebesgue allowed for the contradictions in Gibbs' ergodic hypothesis to be resolved, in a manner that decomposed the complex behavior of a system into a time series. Wiener writes:

> the resolution of a complex contingency into an infinite sequence of more special contingencies--a first, a second, a third, and so on, each of which has a known probability; and the expression of the probability of this larger contingency as the sum of the probabilities of the more special contingencies, which form an infinite sequence. Thus we *cannot* sum probabilities in all conceivable cases, to get a probability of the total event--for the sum of any number of zeroes is zero--while we *can* sum them if there is a first, a second, a third member, and so on, forming a sequence of contingencies in which every term has a definite position given by a positive integer (46).

Wiener is explicit at the beginning of the chapter that complex phenomena - readouts of weather, for example - are best understood as a set of statistically determined events distributed over time (60-61). This is the nature of the time series as he derives it from Gibbs and Lebesgue, and this is Wiener's definition of communication. Wiener writes:

> It will be seen that the processes which lose information are, as we should expect, closely analogous to the processes which gain entropy. they consist in the fusion of regions of probability which were

> originally distinct. For example, if we replace the distribution of a certain variable by the distribution of a function of that variable which takes the same value for different arguments, or if in a function of several variables we allow some of them to range unimpeded over their natural range of variability, we lose information. No operation on a message can gain information on the average. Here we have a precise application of the second law of thermodynamics in communication engineering (64-65)

It is in this intersection of Gibbs and Lebesgue, where the statistical distribution of factors in a dynamic system is rendered in the form of a time series, that the relationship between communication and thermodynamics becomes most productive. It is not in the possibility that telecommunications and heat engines share a constant, or that messages have a "temperature," or that information storage and transmission have energy costs, though all of these are remarkable extrapolations from Wiener's claim. What makes Wiener's claim remarkable is that communications technology becomes a subset of the behavior of dynamic systems. Communication is redefined as a feature in the behavior of all systems. What will haunt the cybernetic project is that this principle of the immanent communication of dynamic systems is vulnerable to the problems of translation and incommensurability. Not only is it possible to 'misunderstand' what a system is telling us, it can also refuse to speak, as we will see.

The link between thermodynamics and information, and more specifically the interpretation Wiener provides, is the most significant feature of cybernetics; it emerges as a result not only of 'hard math,' but also of an analogical impulse that gives way to ontological claims about the nature of systems. The more simplified notion of 'an analogy between information and thermodynamics,' which more frequently makes the rounds in cybernetic discourse, somewhat misleadingly suggests that the translation is given in advance as possible without problems or limits.

Treating the link between thermodynamics and information as *the* orienting metaphor of cybernetics invites productive reflection alongside serious problems and worthwhile criticism. Rolf Landauer, for example, announces the dictum "information is physical" as a basis for research into the energy cost of computation, and remains at the center of fierce debates in theoretical computing. Lily Kay devotes the entirety of her final book, *Who Wrote the Book of Life? a history of the genetic code*, to showing the misleading and disastrous role that analogizing information plays in the history of the genetic "code." Among other rich stories, she tells us how Henry Quastler's work, based fundamentally on this concept, literally treats the chromosome as a "coded tape of instructions" and DNA as "a chromosomal error control" as a way of making Shannon's theories legible. Quastler, Kay recounts, heroically brought his mathematical acumen to calculate the number of "bits" in the genetic code - in some ways succeeding, in other ways failing to advance an understanding of the code. Other researchers would compare the statistical distribution of proteins to that of symbols in English, without finding a correspondence to human language (118-120). The link between information and the genetic "code" will become ever distant, while never fully separable, remaining in circulation among the Black Mountain poets, and (on the other side of the Atlantic) passing from structuralism in Roman Jakobson and Claude Levi-Strauss to Jacques Derrida, who would identify this explicitly cybernetic connection as a horizon for the future of writing.

These sorts of "mistranslations" are a part of the cybernetic project in a way that cybernetics must itself recognize. Andrew Pickering tells us how Ross Ashby and Stafford Beer, flush with the discovery of the principle of mutually regulating autonomous systems, come to failure when trying to engineer a link between a pond

ecosystem and a factory control computer. They surmise that, by coupling the homeostatic self-preservation of this ecosystem to the operations of a factory, decisions about resources in the latter might be steered by the former. Where they fail is in the communicative link between the two. In an ingenious series of attempts by Ashby and Beer to make the pond communicate without affecting its operations, including reading the magnetic charge of iron filings sprinkled into the pond's bottom, they couldn't find a way to communicate the self-preservation of the pond ecosystem in any meaningful way, let alone use this to regulate another social-mechanical system (Pickering 478-481). It seems, that if we accept that all systems communicate, we still must learn to listen before attempting to translate their messages. Or further, we perhaps must allow systems their reticence, and respect their silence. The pond might prefer to keep its thoughts to itself.

Because of this, it makes some sense that the cybernetic project would be identified as a failed project, especially to those for whom the analogical connections were discrete scientific arguments rather than the fruits of an approach to analogy-formation as such, informed by the suggestion that all systems are alive and communicate. The analogy between thermodynamics and information is seen as a monstrous overreach, rather than a simplified form of a much more intricate ontological claim. David Porush will come to refer to this as "one of the great philosophical tricks of the century." Porush forcefully argues, not without merit, that cybernetics merely links one form of randomness (thermodynamic) to another (communicational), with the assumption being that the ontological features of indeterminacy are sufficient ground for scientific inquiry. He continues:

> This little trick had powerful consequences. It appropriated the idea that the human introduced uncertainty into the system--which many

> phenomenologists, but especially Heidegger and Poincare, have subsequently viewed as a refutation of determinism from within science's own method--and defined it as nothing more or less than a precondition for having a quantifiable amount of information. Cybernetics thereby managed to subsume the messiness of the human observer's role into a system of positive math (375).

Porush identifies the stakes of this as a cybernetic *appropriation* of ongoing intellectual developments largely outside of its scope; we'll soon be addressing the relationship between cybernetics and phenomenology, but it is worth taking seriously the ways that Wiener's claims to a science of contingency are largely based on work that precedes it. On an even more sinister note, cybernetics' assurance that it is the science to speak to contingency, whose principles are satisfactory in and for itself with no need of further intellectual supplement, naturalizes its relationship to the military-industrial complex in the very least, and even more destructive regimes of knowledge that we have not yet elaborated.

Lily Kay, as we have seen, is also unsparing in her assessment of the information/entropy linking. Though the language of modern genetics is laden with information terms (the genetic "code") being the most obvious, for Kay it is based on an implicit definition of information that borrows the weight of Shannon and Wiener's models, while largely consigning the term to a metaphorical role abstracted from the material processes they describe. She writes that "'information' is a metaphor of a metaphor and thus a signifier without a referent, a *catachresis*. As such, it became a rich repository for the scientific imaginaries of the genetic code as an information system and a Book of Life" (2-3). Kay's work, a masterful archival reconstitution of information as metaphor, raises key questions but is also plagued by its constructivist rigor. On the hunt for any taint of reference to the information metaphor in biology,

Kay often implicates none other than almost the entire generation of scientists who cracked the code, perversely proving the power of the information metaphor in the very least as a conceptual tool. Where Kay's reading is ungenerous to the lurking possibility of cybernetics having a new ontological ground, she is uncannily apt with her assessment of cybernetics' fate in scientific research in general, noting frequently where the cybernetic model shows "an inability to generate an experimental agenda" (115). In this regard, her assessment is tragically accurate; the sciences as they stood were able to happily proceed without recourse to the cybernetic language that proved so striking in 1949.

What is the "point" of cybernetics, then, and especially that of the analogical power of information theory? For Kay "information theory furnished a sort of thread that enabled [cyberneticians] to sense a continuum in the order of the universe, a means of regulating existence to the nonexistence of life, a quest for regularities in irregular phenomena" (126). Cybernetics presents itself as a new metaphysics, whose treatment of contingency as a first principle allows for a new recursive definition of the material world, where dynamic systems as communicative allows for all of matter to be construed as living, given the proper frame. Kay does miss something, which will depend both on a more generous reading of the analogical role of information, as well as an awareness of what the later cyberneticians pursued largely *outside* of the research agendas of mainstream technoscience. Further, at least some of the basis for critiquing the notion of code comes from cybernetics itself, as she invokes the second-generation concept of autopoiesis to suggest that “information is not an independent, prespecified quantity functioning as input for the genomic system; rather, the ‘meaning’ of information is continually adjusted, not only by the

contextualities *within* the system but also by the system's interaction with the *outside*" (35). Kay is drawing on this concept for good reason; as we will see, Maturana and Varela's autopoiesis is an attempt to conceive a cybernetics without recourse to information, preferring instead a phenomenologically inflected 'meaning' in the operational self-reference of the living organism's cognitive self-production. However, while this is a significant part of the appeal of autopoiesis, to use this feature - as Kay does - to dismiss the broader interpretation of information is to lose sight of its supple power. Information's potential exceeds the bounds set by Kay's otherwise important work. At issue is whether the specific linking of thermodynamic and information entropy is the most adequate representation of the phenomena it describes, as its status as an "independent, prespecified quantity" appears to lead to issues in translation.

As this brief description of the thermodynamics of communication/computation, and from there to biology, suggests, the controversy is not simply over whether a particular mathematical model fits in two domains; rather, the analogy is embedded in broader historical questions about the nature of knowledge itself, as well as the role of analogies in science and, of course, determining ways of understanding the power of language and meaning. The new mathematical theories of communication were key places where new futures were mapped out, and in particular, proposed as the new, and all-encompassing first principles of physics, over and above quantum mechanics, extending into all scales and physical substrates. Though feedback, as a comparatively analogous causal model for both biological homeostasis and physical equilibrium, is the other key player in the construction of cybernetics as a new science, it is the new definition of

information that plays a key supplementary role in the culture of the cybernetic age, an age where the key terms are change, flux, inconstancy.

To read cybernetics as a historical phenomenon is to take seriously its complicity in an emergent form of normative science - at best overly optimistic about the possibilities of technology, assured of the permanence of its novel formations; at worst complicit in a hyper-militarized, nationalistic research agenda. However, following Kay, if we understand cybernetics as a high moment of scientific imagination, a historical reading allows us a stronger picture of cybernetics' impact. Focusing on the slippery notion of contingency, we find that Wiener, perhaps without realizing, is effecting a novel interpretation of the role of science. As he writes in *Cybernetics*:

> The essence of an effective rule for a game or a useful law of physics is that it be statable in advance, and that it apply to more than one case. Ideally, it should represent a property of the system discussed which remains the same under the flux of particular circumstances. In the simplest case, it is a property which is *invariant* to a set of *transformations* to which the system is subject. (50).

This statement of the aim of science should be appreciated for its uniqueness, as a definition rooted in invariance and transformation. It is at a level of abstraction that claims to speak to multiple material strata at a level of generality where it may be universally applicable. Further, its debt is to a spatial sensibility non-Euclidian in nature - Wiener is implicitly defining the scientific object as manifold. Lastly, these terms are admittedly selective and rooted in an observer, concerning "a property" under "particular circumstances," anticipating quite similar definitions of the aims of science appearing in Bertalanffy and Ashby. This is a definition of science specific to

the cybernetic age, rooted in a paradoxical search for what is invariant, given a universe in transformation.

We now situate Wiener's *Cybernetics* in this historical moment. A first turn toward the work reveals that it is not a typical “popular science” work, with nearly half of its chapters relying on mathematical proofs for evidence, breathlessly overtaking the prose sections. And yet, unlike earlier volumes, like his classified wartime monograph *Extrapolation, Interpolation and Smoothing of Stationary Time Series*, the 1948 text was not written for specialists. *Cybernetics* may have required a heroic mathematical acumen, but it was written for general academic audiences. The later chapters on physiology, psychology and society, in particular, are admitted imaginative leaps, meant to demonstrate a certain cybernetic approach to problems. The text is split in two, with one half presenting a rigorous intellectual history of the statistical approach to information, and the later half demonstrating, by way of certain foundational analogies, the analytic reach of a cybernetic approach in ways that are both fanciful and prescient. Much of the latter tendency would be developed further in *The Human Use of Human Beings* and other popularizing texts[4].

How was Wiener’s text able straddle these lines? Other than appealing to Wiener’s famous eccentricity, we find that the intricacies of the text are bound up in Wiener’s interest in establishing cybernetics as a generalizable science. The chapters are ordered sequentially, with a first philosophically-inclined chapter followed by a move from statistical mechanics to information, then in turn feedback, computation as a model for the nervous system, general psychology and mental illness; Wiener concludes with remarks on society that anticipate his truly 'popular' work, *the Human Use of Human Beings*.

Importantly, Wiener's analysis appears at a strange time for physics, when the twin revolutions of relativity and quantum mechanics were effectively institutionalized, but . Cybernetics' key features were developed by Wiener from the late 1920s to the early 1940s, just after the Copenhagen interpretation, and Wiener's writing frequently shows discomfort with the latter's conclusions. This discomfort is illustrated in a brief 1956 editorial, "What is Information Theory," published in *IRE Transactions On Information Theory*. Here, Wiener protests the reduction of information theory to the mere measurement of information, arguing instead for an attention to its basis in a generalized science of the time series. In making this argument, he makes the remarkable claim, "It is generally recognized that the quantum theory which now dominates the whole of physics is at root a statistical theory; although it is perhaps not yet as generally recognized as it should be, the quantum theory is strictly a branch of the theory of time series" (48).

Unfortunately, time would not side with Wiener. Why was Wiener concerned about the dominance of quantum mechanics, such that he would devote much of his later work to attempting to reduce it to a branch of the theory of the time series? This work, conducted with Armand Siegel, is considered to be part of the "hidden variables" critique of quantum mechanics. Was this interest a covert Newtonianism on Wiener's part, an attempt to tamp down a growing and undecidable part of the scientific landscape? Not precisely; Wiener's conception of the universe was just as 'contingent' as that of quantum mechanics, if not more so. Rather, I propose that Wiener was motivated by ontological concerns that are shared (and elaborated) by many of the cyberneticians that would follow. Near the end of "What is Information Theory," Wiener writes,

> In my opinion we are in a dangerous age of overspecialization. To me the danger of this period is not primarily that we are studying very special problems that the development of science has forced us to go into, but rather that we are in great danger of finding our outlook so limited that we may fail to see the bearing of important ideas because they have been formulated in what our organization of science has decreed to be alien territory.

Here Wiener repeats his earlier concern with overspecialization, with the difference being that now his own discipline appears to be caught up in it. We can see that Wiener is suggesting the era of overspecialization has two effects - on the one hand limiting the broader implications of the time-series to serve as a general theory, and on the other allowing for the prominence of quantum mechanics to lead to a diminished world-view. So is the issue whether quantum mechanics or information theory wins the day? To a degree, yes.

What remains is information, as a property immanent to dynamic systems, manifest in the time series. The fluctuating variables, treated as a series of events distributed in time, have a given degree of statistical variation that 'describes' or 'communicates' the system. Further, this property of communication is not simply that it can be read, but that it participates in the behavior of the system, most significantly in the form of feedback. In the reading of Wiener's account of feedback that follows, I highlight three significant features: 1) like information, it is analogical, in both senses of the term; it is based primarily on analog models, while also translating explicitly from the analog to the digital 2) it introduces the figure of circularity into the discussion in ways that will be foundational for later cyberneticians, though not without its problems; 3) it is the point where cybernetics enters conversation with

phenomenology. We will see the basics of this activated in Wiener's chapter on feedback, and in the reception of these ideas by later cyberneticians.

Feedback is celebrated because, in the hands of the second-generation cyberneticians, a model of the recursive self-organization of any living system. Maturana and Varela will write, "an autopoietic machine is an homeostatic (or rather a relations-static) system which has its own organization (defining network of relations) as the fundamental variable which it maintains constant" (79). Here, the notion of feedback maintaining the stability of a given variable is folded onto itself; the organism if a feedback loop writ large, maintaining its very processes of self-maintenance. The definition is circular by design, both as an epistemological feature (acknowledging that what can be known is only known through a circular interaction with the organism) and also ontological: something in the nature of life takes on the form of an intricate recursive manifold. On first blush, Wiener's conception of feedback is amenable to this. In the earliest properly cybernetic articulation of feedback, which appears in Wiener's essay co-written with Arturo Rosenblueth and Julian Bigelow, "Behavior, Purpose, and Teleology," the authors provide a compact diagram that appears to fold feedbacks into one another. In it, the authors subdivide behavior into increasingly reflexive forms: active and passive behavior, the purposeful and random, then teleological and non-teleological. From there, they attempt to take on behaviors that increasingly approach willful human activity. By treating them as occurring at multiple orders, are they thinking in a properly recursive model? Almost, but not quite, as we will see ("Behavior, Purpose, and Teleology," *Philosophy of Science*, 21).

In the feedback-themed chapter in *Cybernetics*, we find another moment that might indicate a recursive understanding of feedback. Drawing on Wiener's rich background in the theory of servomechanisms, the steering of a ship suggests a recursive model of feedback; it requires not merely a feedback mechanism to steer it, but an additional feedback on the feedback mechanism itself, as any rudder will respond to the steering mechanism with too great a force and need to be itself corrected (106). Further, and decisively, Wiener notes that "we regulate the position of the valves of the steering engine, not by the discrepancy between the actual and the desired course but by the *difference* between this quantity and the angular position of the rudder" (107, emphasis in original). We will see that difference is what's at stake here.

Wiener begins this chapter by describing two forms of neurological impairment; one patient is unable to walk without gazing intently at his feet, while another has lost the refined motor control required to successfully reach for and pick up objects. Wiener will propose for both the failure to communicate the results of the given action. For the first, the patient has lost the proprioceptive sense of his own movement that comes from "the receptors in the joints and tendons and muscles and the soles of his feet, which ordinarily convey to him the position and state of motion of his legs" (95). For the second, the patient suffers an injury to the cerebellum, which "likely . . . has some function of proportioning the muscular response to the proprioceptive input" (96). The problem, for Wiener, is that communication fails, and in the process leads to a failed coordination of parts of complex behavior. Wiener will call this failed process feedback, and compare it to track switching in railroad lines, the repetition of orders in the military, and other more specifically mechanical

devices. Feedback can be loosely defined as a circular communication process that feeds the results of a given output back in as input, with the aim of maintaining a particular variable within bounded limits. However, the term will travel just as much as information, if not more so. Lying in the intersection of biological homeostasis, the statistical equilibrium of thermodynamics, and the phase space of complex functions used in control engineering, its origins are just as nuanced as information, and just as bound up in problems of analogy. Prior to a discussion of the more widespread conceptual work it does (especially in ecology), it's worth spending time in these ambiguities.

Wiener will define manual grasping in terms of negative feedback, which subtracts the difference in the outcome from the action until the action has been completed. Though making some intuitive sense, we must recognize how strange this definition is, as it depends on treating an exceedingly complex phenomenon, based as much on concepts of 'goals' as on material parts. Inasmuch as this can be navigated we have no problems, though from the beginning of the chapter Wiener registers some strain, raising the thorny problem of human agency in the process. He writes, "We do not will the motions of certain muscles, and indeed we generally do not know which muscles are to be moved to accomplish a given task . . .. Our motion is regulated by some measure of the amount by which it has not yet been accomplished" (97). Wiener, utilizing the 'black box' paradigm that emphasizes the behavior of wholes prior to their decomposition into parts, is admitting that we do not fully know the components. This lack of knowledge is corrected by an analysis in terms of feedback, which serves as a formal role as an analogy between self-correcting systems. What is the form employed?

Though it is tempting to identify circularity as the basic unifying structure, which will be what will persist in later cybernetic employment of the concept of feedback, this is not Wiener's first move. Wiener is writing prior to the intellectual vogue of recursion - these appear more distinctly in computer programming, Mandelbrot's analysis of fractals, and the theory of biological self-reference appearing in Maturana and Varela's concept of autopoiesis. All of these are closer to the tenor of the 1960s and 70s, when cybernetics became fully developed as a conceptual model while largely eclipsed as a form of mainstream scientific research. Wiener's analysis is more specific, identifying feedback as being when "motion is regulated by some measure of the amount by which it has not yet been accomplished." That is, feedback is rendered in terms of simple arithmetic. The behavior is one variable, the results of the behavior is another that is subtracted from it.

Recalling the earlier discussion about the relationship between the analog and the digital, it is significant that Wiener begins with analog phenomena: the human body, Maxwell's 'governor' of a steam engine, and the gyrocompass of a ship's steering control. The latter two, as products of engineering, are amenable to mathematical description; the others can only be described at first by analogy. We recall that while the analogical can be translated into the digital, it can only in limited cases be treated as information-based in the Shannon model. If we follow Wiener's lead, that communication is a fundamental component of the behavior of systems, then we encounter as a matter of principle the problems of translatability and commensurability.

The mathematical basis of feedback, like information, straddles the line between the analog and the digital. Here, feedback is elaborated in terms of complex

functions (complex in the sense of combinations of real and imaginary numbers). Long a feature of electrical engineering, especially in the preceding developments in control theory, complex functions outline a bounded area on a cartesian plane that may be understood as a phase space, or statistical range of behavior of a dynamic system. Wiener's mathematical formulation for feedback effectively translates the behavior of a system into a bounded phase space defined by a complex function, the inclusion or exclusion of which is defined by a negative or positive value, respectively. This value is connected by a delay mechanism, also represented by a function, the results of which are subtracted from the initial output. Feedback is a subtractive process. A behavior quantified by a particular function gives a value (velocity, amount of fuel, temperature, etc.) from which the resulting value of a control mechanism is subtracted.

What is significant is that by defining feedback in this way, rendered in the binary form of positive and negative, it is a form of automatic decision-making that can respond to the contingency of the environment. That feedback represents the translation of analog uncertainty into digital decision-making is key to McCulloch and Pitts' formal model of nervous networks. This model, a major early development in artificial intelligence research, specifically adapts feedback to a broader relationships between logical neurons to determine the different decisions an artificial brain can make. As Wimsatt notes, however, it is not dependent on their circular construction (244). Why then, is feedback understood as a circle?

Remarkably, the impaired body as a figure of discourse is not limited to cybernetics alone, but is also the province of Maurice Merleau-Ponty's phenomenological description of the body in *Structure of Behavior* and *The*

Phenomenology of Perception. We will see that, inasmuch as cybernetics is rooted in a historical concern for a new ontology, the concerns of the phenomenologists are not merely relevant for a comparative discussion, but perhaps supplement cybernetics in significant ways.

Like Wiener, Merleau-Ponty is staging his work against the dominant behavioral paradigm. While Wiener will appropriate the behavioralist language of stimulus and response to translate goal-directed behavior into inputs and outputs, Merleau-Ponty will emphasize the givenness of behavior as a phenomenon in its own right, and it is here that we will find a more clearly elaborated notion of an embodied phenomenon as circularly constituted. In *The Structure of Behavior*, Merleau-Ponty will devote the first third of the book to indicating the appearance of the phenomenon as a rupture in the decomposed reflex actions described by Pavlov. It is only later that Merleau-Ponty will identify "forms," constituted "dialectically," as underlying most conscious, goal-directed behavior. Significantly, this circular form appears at the physical, biological and human orders. He writes, "Situation and reaction are linked internally by their common participation in a structure in which the mode of activity proper is expressed. Hence, they cannot be placed one after another as cause and effect: they are two moments of a circular process" (130). Perception and judgment are constituted circularly; they form a whole that spans subject and object, and this is what is meant by Merleau-Ponty's frequent use of the term dialectic. Subject and object, in perception, take on a unity in the body that has a definite form. Merleau-Ponty, I argue, is talking about the same phenomenon as Wiener, but making the circle much more significant with the same ability to travel analogically as

feedback. Most compellingly, Merleau-Ponty will attempt to see these circular forms at all levels of organization in the world. He will write, on physics:

> Nevertheless, Koehler has found examples of form in classical physics without difficulty: the distribution of electrical charges in a conductor, the difference of potential, and the electric current. If one considers the state of equilibriated distribution and maximal entrophy toward which energies at work in a system tend according to the second principle of thermodynamics as a form, one can presume that the notion of form will be present in physics everywhere that a historical direction is assigned to natural events (138).

Merleau-Ponty follows the cybernetic line of analysis straight to its core, reading statistical equilibrium in electro-mechanical systems as the same phenomenon as entropy in thermodynamics. On this basis, Merleau-Ponty will also examine a similar phenomenon, physical impairment resulting from neurological damage, with remarks that are quite contrary to Wiener. Where Wiener appears to treat goals as something that can be determined as a quantifiable sum, Merleau-Ponty will treat as an indication of the failure of the actual process that guides goal-directed behavior. Wiener does not forgo the circle, but it should be recognized that the problem of feedback for him is a translation of the analog to the digital. Further, following his line of analysis, it is not a problem that his emphasis is, as I've called it, "subtractive." This is not to pose Wiener as the calculative villain to Merleau-Ponty's phenomenological hero, the "real" discoverer of the ontological power of feedback. Rather, that Wiener's emphasis is on a different feature of the problem, one which will again recall, not the circularity of feedback, but the communicative potential of systems.

I emphasize this because, as we've already seen above, circularity and recursion become the themes of the second cybernetics, and I follow Depuy, in *The Mechanization of the Mind*, in suggesting that the circle does not follow directly from feedback, but is a concern of the second-generation cyberneticians in particular. As we will see in the third chapter, part of this will be due to the unstated debt to phenomenology, an instructive example of which may be seen in Gordon Pask. One of the later cyberneticians who was engaged with private research in chemical computing and cybernetic models of learning, Pask at the end of his life was devoted to a cybernetic theory of conversation as the root of learning. For Pask, as he writes in an essay called "Conversation Theory and Proto-Logic," the principles of conversation theory, and thus cybernetics, "are founded on hermeneutic grounds (a refinement of meaning, by repeated iteration of a cyclic argument) and are essentially dependent on consensual, or, more accurately, coherence truth-validation" (15). One of many, mostly offhand references to phenomenology found in the second-generation cybernetic corpus, we see that feedback has become a feedback loop, a circle in which a mutual interaction does not stabilize but rather refines itself over time. There is undoubtedly a debt to Wiener here, but the language of the circle implied by the reference to hermeneutics is borrowed from phenomenology. Why the fascination with circles? Or, more to the point, what is Wiener doing differently?

These final remarks will suggest that what Wiener is building on is less a proto-phenomenological interest in circularity than an extension of our earlier discussion of communication. I do so by following a line of analysis by cybernetic philosopher Gregory Bateson, who picks up what might be Wiener's more immediate focus in his discussion of feedback, information as difference. I draw this out in

another strange point of intersection between cybernetics and phenomenology, where Merleau-Ponty and Bateson engage the same problem: a blind man and his cane. Roughly analogous considerations appear. In *The Phenomenology of Perception*, Merleau-Ponty writes,

> The blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch, and providing a parallel to sight. In the exploration of things, the length of the stick does not enter expressly as a middle term: the blind man is rather aware of it through the position of objects through it. . . . (165-166).

Compare to Bateson, in his essay "Form, Substance, and Difference" :

> Suppose I am a blind man, and I use a stick. I go tap, tap tap. Where do *I* start? Is my mental system bounded at the handle of the stick? Is it bounded by my skin? Does it start halfway up the stick? Does it start at the tip of the stick? But these are nonsense questions. The stick is a pathway along which transforms of difference are being transmitted. The way to delineate the system is to draw the limiting line in such a way that you do not cut any of these pathways in ways which leave things inexplicable (459).

Both thinkers are noting where the stick becomes an interface for the world, calling into question where the boundary between the stick and the man can be delimited. In much the same way that for Merleau-Ponty, "the length of the stick does not enter expressly as a middle term," for Bateson questions about whether "*I*" begins at the handle, middle or end of the stick are "nonsense questions." For both, the man and the stick become a composite figure, but with different orientations. For Merleau-Ponty, the stick does not 'become' a part of the body, but rather becomes evidence for a feature of the body, an "encorporation" that renders objects as instruments of perception. For Bateson, the two become a "system" with "pathways," in some ways allowing both the man and the stick to become one larger identity who is not quite

named. Merleau-Ponty will emphasize the role of the perceiving subject; what might be the analogue for perception here? In Bateson, it will be "difference." The stick, as "a pathway along which transforms of difference are being transmitted," is following in an oblique way the role of feedback, formalized not as a positive or negative but as the communication of a difference. Indeed, in the same essay Bateson will call information nothing but a "difference that makes a difference." Wiener's emphasis of difference as the key term in feedback indicates that this is the same principle at work. Feedback, though circularly constituted in a way that allows significant contributions from phenomenology, even historically decisive ones, is predicated first on information. What feedback adds is a relationship with the environment, or world. This "difference that makes a difference" has a debt, not to phenomenology, but to the time series; Wiener's discovery that systems communicate.

I conclude by recalling Wiener's anxiety with and disaffection from the very scientific community. His mathematical genius, which found its place in a society that needed him for the purposes of war, increasingly found itself purposeless after abstaining from further military research. Though he would utilize cybernetics to critique the new post-war society, making especially incisive remarks about the free market that gesture toward a cybernetic Marxism, his critiques of technology would be mostly free of the sort of analysis he would apply to his scientific work. Near the end of Wiener's introduction to *Cybernetics*, he will write,

> Those of us who have contributed to the new science of cybernetics thus stand in a moral position which is, to say the least, not very comfortable. We have contributed to the initiation of a new science which, as I have said, embraces technical developments with great possibilities for good and for evil. We can only hand it over into the world that exists about us, and this is the world of Belsen and Hiroshima (28).

Commentators on Wiener's relationship with technology have called him naive. When we bring Wiener into conversation with Martin Heidegger's philosophy of technology, I will counter instead that Wiener was facing a thornier problem, the historical nuance of which he was just intuitive enough to grasp. There are reasons, ethical and epistemological, for Wiener's often confused remarks on technology. Here I close by emphasizing that the proposed universality of the time series never appeared. Was Wiener's insight here, so founded on a historical conception of science, and so attuned to the temporality of living organisms, left to lie where it might have been most fruitful? In the next chapter, we will see that to properly think the time series historically, it would take a poet.

Chapter 2. To Prove the Law: Charles Olson and the New Poetic Way

Thus far, we have examined some of the major concepts of cybernetics, showing through a modified form of literary analysis the complex negotiation underlying feedback and information. We found that the controversial aspects of feedback and the joining of thermodynamics and information theory rest on deeper questions than whether they are correct. Rather, they speak to a negotiation over the project of science, in which the cyberneticians, with varying degrees of reflection, attempted to rethink the project of science on historical and ontological grounds. At stake in this is the role of analogy, specifically between the analog and the digital; and a more intricate sense of the bounds of communication, defined axiomatically as a property of all systems. In the chapter to follow, we will take an alternate path, to determine the ways that Charles Olson sought to articulate a poetry adequate to the needs of the historical moment, a moment in which a new ontology was required to grapple with the monstrosity of historical change. I will attempt to illustrate how cybernetics plays a pivotal role in Olson's early poetry. After an overview of the critical reception of Olson, especially commentary linking Olson with cybernetics and Heidegger respectively, we will examine Olson's early poems and critical writings. Focusing on the role of cybernetics in the archival manuscripts of "The Kingfishers," we will find that feedback and information provides resources for Olson to understand his historical moment in ways that significantly shape his poetics. Where other commentary takes this on piecemeal, I will argue that a robust engagement of cybernetics as Olson understood it shows that its influence was systematic and resonant with the core themes of his project. We will engage the poems, "La Préface," "The Kingfishers" and "In Cold Hell, In Thicket," which together show a shift from

the post-war anxiety of "La Préface" to a cybernetic conception of human agency in "The Kingfishers," then

We will spend comparatively little time on Olson's prose writings and *The Maximus Poems*, despite their significance in the broader Olson oeuvre. Part of this is in the interests of space; Olson's critical language becomes increasingly refined, requiring more exposition and cross-reference between Olson's poetry, theoretical writings and personal reading. To properly treat the relationship between these ideas and cybernetics is another, larger-scale project. More productively, we find that these poems represent an encounter between Olson and a historical milieu defined by the emergence of cybernetics; Olson's relatively less developed ideas offer greater insight into the significance of cybernetics and its stakes for poetry.

Olson is the first poet to engage cybernetics. It is fitting that this would be the case, as critics have acknowledged his uniquely interdisciplinary approach to poetry. Stephen Voyce, in *Poetic Community: Avant-Garde Activism and Cold War Culture*, writes, "Olson's mind, fueled by enthusiasm, can range over a wide terrain which encompasses nothing that might be construed as inherently poetic" (197). This 'wide terrain' is in part due to his approach to composition, "projectivism." Voyce tells us, "Projectivism emphasizes immediacy, a writing that responds to a continuously changing environment in which the poet works with the resources available within her field of action" (37). It is a poetics engaged with one's surroundings, just as cybernetics formalizes the relationship between a system and its environment. The poetry we will consider in this chapter was written in a unique environment, Black Mountain College, where Olson served as rector and enjoyed a collaborative, interdisciplinary milieu, not unlike the interdisciplinarity that characterized the rise of

cybernetics. Voyce, thinking of the Black Mountain group as a new experiment in literary community, observes that the "multi-authored development of field composition, the early writings that emerge from these developments in poetics, in addition to the interdisciplinary experimentation undertaken at the college are consciously conceived within this milieu of a new collectivity responding to totality" (30-31).

Olson's literary eclecticism allows him to dissolve boundaries between genres that will characterize his contribution to postmodern letters. Robert Von Hallberg, in *Charles Olson: The Scholar's Art*, observes that Olson writes "as though the offices of poetry and of expository prose have not been separate and distinct for two hundred years" (1-2). Much of this is understood through Olson's forceful personality. One of the earliest Olson critics, Sherman Paul, has explored what he calls Olson's "push," that is, a self-willed poetic endeavor that interrupts the determinative forces of history. It is an attempt to engage any forces that appear to be decided in advance and determinative, on the basis of Olson's belief that things are shaping forces in history, and not simply shaped. He writes, "His push involved the double work of the great intellectual effort since romanticism -- that of reconceiving the nature of the cosmos and the nature of man, to the end not only of overcoming our estrangement from the familiar world … but . . . of restoring the humility, care and letting-be necessary to its very existence" (xviii). As a postmodern poet, Olson alternated between what he understood as the limitations of past and present thinking, and seeking the conditions of new modes of poetic engagement. Paul suggests that this project, responding to but not reducible to predecessors in romanticism, is a willed task of renewal.

In Olson scholarship, some have found resonance between the poet's work and that of Martin Heidegger. Paul Christensen observes that Olson's research on language is echoed by the "European phenomenologists, led by Martin Heidegger, [who] made a more rigorous criticism of language from the same perspective" (8). Most thoroughly, Paul Bové's *Destructive Poetics* and William Spanos' *Repetitions: The Postmodern Occasion in Literature and Culture* each devote substantial chapters on Olson's use of poetry for the "destruction" (or deconstruction) of Western metaphysics. Drawing primarily on *Being and Time* era notions of "care," "being in the world," and the "they," and Derrida's utilization of Heidegger in his critiques of the logocentrism of metaphysics, Spanos understands Olson's poetry as "attempting to 'destroy' the hardened logocentric metaphysical tradition beginning with Plato and Aristotle. For in assuming presence, that is, in beginning from the end, this tradition encloses the errancy of words within an absolutely uniform system'" (109-110). Olson's poetry is indeed concerned with rethinking the word, advancing a writing-centered "logography" influenced by his readings of Edward Sapir and Ernest Fenollosa. But there are places where Olson shows strong intellectual independence from the phenomenological tradition, notably on the subject of 'presence.' In "The Present Is Prologue," Olson famously proclaimed an affinity for "the post-modern, the post-humanist, the post-historic, the going live present, the 'Beautiful Thing'" (207, *Collected Prose*). Olson's sophisticated but unmistakably "present" frame of mind suggests that while Olson and more continental-inclined critics may share a common enemy in traditional modes of thought, they go by different names and have different attributes.

Bové in particular builds on Olson's open-form poetics to advance the claim that the New Critical orthodoxy Olson rebelled against represents the "metaphysics" of traditional poetry, as the stage of Olson's "destructive poetics." Olson's unconventional language, for Bové, not only disrupts the Western tradition, it also reveals "that the very notions both of 'tradition' as a centered canon and of 'history' are Western *myths* used to defend the aesthetic, distanced, disinterested privilege of antihistorical metaphysics" (xiv-xv). Though Olson, with many other poets of the era, resists the dominance of what Bové sees as poetic metaphysics, we will find that Olson's concerns are distinct, concerned less with poets than with finding a poetry adequate to the situation he found himself in. Bové and Spanos each provide fruitful phenomenological analyses of Olson's work, that are alternately fruitful and misguided depending on the strength of the reading. Unfortunately, both of these authors remain hamstrung in their analysis by their emphasis on the early Heidegger; the point of greatest overlapping concern is when the two thinkers were writing about cybernetics and technology in the 1950s and 60s. We shall see, as the chapters unfold, the more precise nature of Olson and Heidegger's shared interests, beyond plotting conceptual overlaps between the two.

Among Olson scholars, the most germane to cybernetics is Don Byrd. Don Byrd's work does not simply read Olson as a literary critic would, but engages the philosophical substance of Olson's writings as new epistemological resources. These resources stem from but also move past postmodernism. Compellingly, Byrd extensively engages cybernetics, reading its principles past even what Olson imagined it was capable of. What Byrd highlights in Olson's usage of cybernetics is a resituating of information outside of its electronic capacity. Where electronic

transmissions risk sliding into the regulated and commercialized social world that Olson despised, information as an understanding of physical events is an essential part of Olson's poetic ontology. In *The Poetics of the Common Knowledge*, Byrd helpfully distinguishes between two understandings of information. On the one hand, information "is a static quantity that describes the size of the channel required to transmit a message of a given quantity." This is along the lines of the doctrine of encoding that Claude Shannon advanced in his version of information theory, the less epistemologically adventurous side of cybernetics that primarily emphasizes efficient communication. On the other hand, Byrd describes a notion of "kinetic information" employed in feedback (283). Kinetic information is physical and transformative, and follows Wiener's definition of information as a series of measurable events distributed in time. Donald Byrd tells us in an anecdote that fellow Black Mountain poet Robert Duncan believed he and Olson to be the *only* truly cybernetic poets (Byrd 1, *Electronic Poetry Center*). Following up on this anecdote through readings of Olson's poems, we will find that not only does Olson remark on cybernetics, he takes the first step toward a cybernetic poetics, in which "information belongs as much to the physical world as matter and energy. The measure of the poet is physical measure in physical space and time" (5).

First, we'll briefly trace Charles Olson's relationship with world history in his early poetry, to set the stage for the role that cybernetics plays in "The Kingfishers." Unlike the cyberneticians, so close to the war effort as to be nearly blind to its broader functionings, Olson observed the war as an outsider, sufficiently distant from it to be horrified by it. The atomic bomb, and the discoveries of the concentration camps, were enough to cause Olson to quit his government job and become a poet. Olson's

poems of the late 1940s, collected in *In Cold Hell, In Thicket* and published in 1953, are the poems of the static crisis of the post-war period. They are the root of Olson's conception of postmodernity, born not in the optimism of a new era (as artists in Olson's wake would have in the 1960s) but in a helpless apprehension that historical trauma was not only the reality of his time, but of all time.

In the 1940s, Olson gradually transitions from an immediate postwar horror at the atrocities then coming to light, to a revulsion at the crass technocratic commercialism of civil society that he came to term "pejorocracy." In this transition Olson occupied what he perceived to be a rupture in history, a crisis that required the development of a new poetic ontology. This period, from 1945 to roughly 1951, saw Olson resign from his position in the Roosevelt administration to devote his life to poetry. Olson's experience of these years reflects a common perception of the immediate postwar years as still marked by the war and gloomily anticipating a lifeless postwar society, centralized and scientifically perfected but empty.

Robert Von Hallberg, in *American Poetry and Culture, 1945-1980*, observes an emerging cultural (and poetic) hegemony of this "Augustan" age in which an increasingly centralized and scientific consensus shapes American priorities at home and abroad (30). In poetry, this would be voiced by John Hollander's urbane but uneasy formalism, in which "we are somewhat at sea socially," facing precarious social cohesion navigated by high literary style (30-31). In science, crucially, technocratic consensus would take the form of cybernetics, which Von Hallberg identifies as "a dramatically expansionist approach to knowledge, for its advocates propose to explain and manage vast fields of inquiry, from electronics to political theory to social policy" (37). Cybernetics encapsulates the attitudes of American

postwar expansion, neatly absorbing disciplines into itself with unquestioned confidence in its ability to manage it smoothly. The result is a society of rationalization and centralized control. It is a totalizing force, and American cybernetic society is a totalizing society. As Stephen Voyce observes in *Poetic Community*, the context of the founding of Olson's poetics, and that of Black Mountain College, as marked by "not merely a conservative 1950s culture, but by a notion of totalizing governmentality at national and international levels" (30). It was possible to identify the key features of cybernetic society as a totalizing force to be resisted or circumvented by a literary culture occupying the margins, as both Von Hallberg and Voyce emphasize in their analysis.

Olson it necessary to resist postwar American society, beginning with his departure from political life and taking root in his post as rector of Black Mountain College. Von Hallberg notes that Olson, disgusted with the corruption of the Truman White House, felt that political life "lacked not effective political power but intellectual coherence" (33). Writing in *Charles Olson: The Scholar's Art*, Von Hallberg notes that Olson advocates escape rather than direct resistance, where, "The heroes of [*The Maximus Poems*] establish their integrity by withdrawing from corruption" (15). Because of, and not in spite of technological society, Olson would identify this corruption as a general condition of things, the corruption of one's understanding of the world by concepts, famously naming this lifeless technological society "pejorocracy." Paul Bové understands pejoracracy as "the American technological assault on nature and mankind" (229-230). This assault takes the form of facile representations of the natural world, replacing it with "a world of words" or "universe of discourse" (237). Don Byrd continues this line of analysis, understanding

these representations in terms of information. The proliferation of media and advertisements are "profound attacks on the last vestiges of human autonomy." Language as information appear to be cheapened as a result, reducing the human to "an input-output device." Byrd identifies Olson as resisting by making recourse to the real, "The common world cannot be a *representation*; the world is local to the integrity of the organism itself" (273). If communication plays some role in "the organism itself," we find a tension between information in technological society, or pejorocracy, and information's role in "the integrity of the organism itself." Though somewhat resolvable by recourse to a cybernetics of nature, rather than a cybernetics of machinery, there remains an ambiguity that cannot be fully resolved, merely explored for its conceptual riches. The ambiguity is expressed in temporal terms, beginning in the poem "La Préface" and culminating in "The Kingfishers."

"La Préface" raises questions about the standing of history in Olson's work that will only be clarified in the cybernetic passages of "The Kingfishers." What is the standing of history in "La Préface"? In that poem, Olson famously treats the testimony of Buchenwald survivors, and the holocaust in general. Olson's treatment of this theme is essential to the arc of development we explore in the poems of this chapter, despite his not being a 'holocaust poet' per se. Critics have observed that the holocaust wasn't simply an atrocity in its own right, but a rupture in history and an indicator of the conditions of modernity. For Ralph Maud, the poem is an essential stepping stone to "The Kingfishers," demonstrating the stakes for the poet, while also providing him the poetic and emotional tools to navigate the challenges of this historical moment. He writes, "We have seen an Olson strengthened by facing the fact of the holocaust as though here were a survivor having only his body with which to

resist it. From this he intuits a philosophy of physicality, which gets him to the other side of despair" (80). Though compelling, other critics find significance elsewhere. Von Hallberg, emphasizing Olson's debt to the witness of artist Corrado Cagli, notes that part of the stakes for Olson was the role of history. "Cagli had seen for himself the concentration camps and had made drawings: a pile of bones is the monument history left behind" (8). According to Sherman Paul, "The primacy of Buchenwald . . . stands for the 'l'univers concentrationnaire,' the death to which the humanist enterprise of abstraction, power, and ego has contributed, for the fact that changes everything and demands the new birth he speaks of" (8). Buchenwald is the image of the death of traditional modes of thought, having reached their climax in unspeakable atrocity. A "new birth is needed," which Olson will come to announce in the poem. The poem begins in a space of calm, with an ambiguous speaker:

The dead in via

in vita nuova

in the way

You shall lament who know they are as tender as the horse is.

You, do not you speak who know not.

"I will die about April 1st . . . " going off

"I weigh, I think, 80 pounds . . ." scratch

"My name is NO RACE" address

Buchenwald new Altamira cave

With a nail they drew the object of the hunt

Put war away with time, come into space (160, *Selected Writings*, 1966).

The poem begins with a complex three-line image of death, mediation, and rebirth. The first line begins a halted phrase, "The dead in," substituting its term until it finds its complementary half, "in the way." The completion of an adequate saying of the dead is their own mediation, in between which is in fact the beginning, "in vita nuova." Though by *The Maximus Poems* this implicitly textual and differential poetics would be put to more systematic uses, in Olson's early writings the choppiness (and what lies in between the cuts) is also an act of historical diagnosis.

It begins this way. Olson's later poetry will not frequently dwell on the Holocaust in particular, but here his late start to poetry is marked by camp testimony on the first page. Following an exhortation to not speak of what one does not know, Olson grants the floor to other, anonymous voices, speaking only of the camp's after-effects. One voice, "going off," will not live past the spring, another's impossible weight nearly wastes away, "scratch[ed]." Olson calls up a voice on the verge of disappearance, and erases it. Or, better yet, Olson preserves the incomplete erasure in the staging of it. It is an example, as Olson's early writing consistently shows, of the strange poetic powers of citation, and what it means to give voice by citing. As a figure of erasure, the camp survivor illuminates the historical position Olson diagnoses, as liminal, nearly gone and yet persisting.

Importantly, Olson ties these losses, these erasures, to a distant past, rendering "Buchenwald [as] new Altamira cave" we draw upon as the basis of a new civilization. In so doing, Olson anticipates the juxtaposition of ancient and

contemporary that will animate the cybernetic passages of "The Kingfishers." Robert Von Hallberg reads this passage as a rejection of history as we understand it, noting that as "Olson shoves Nazi barbarism back through Polyphemus to Aurignacian man; he will have nothing to do with history." The juxtaposition itself is "antihistorical" and provides a partial escape from the temporality of the Shoah (8). Further, the "DPS" (Displaced Persons) are understood as the

> deathhead
> at the apex
> of the pyramid (160).

The deathhead, referred to in German as the Totenkopf and used as the S.S. insignia, is placed both spiritually and geometrically at the top of a figure that resonates both with the hierarchical order that causes so much suffering, and with the mythic figure which still holds traces of potential for the future. This is a deliberately ambiguous position, produced by the juxtaposition. Later, in a command echoing that to "[p]ut war away with time," the speaker asks that we "Mark that arm. It is no longer gun. / We are born not of the buried but these unburied dead" (161). Playing on the double meaning of the words "mark" and "arm" in reference to weapons and the identifying tattoos of camp survivors, Olson argues for an end to wars not merely as an ethical project, but as a turning point inseparable from the possibility of racially motivated and technologically enhanced genocide.

Olson, who first published the poem with a facing illustration by Cagli, puns on their shared birthday with the following, "Draw it thus: ( ) 1910 (" (160). The pair

stages themselves as the fulcrum point between the "open" and the "closed," as Olson continues:

> The closed parenthesis reads: the dead bury the dead,
> and it is not very interesting.
> Open, the figure stands at the door, horror his
> and gone, possessed, o new Osiris, Odysseus ship (161)

Olson stands at the edge, reading to leap to "what's on the other side of despair," as he often remarked ("The Materials and the Weights of Herman Melville," *Collected Prose*, 117). Whether this is an adequate response to the Holocaust or not, the poem in the very least operates in a signature understanding of the post-war moment, where the very direction of time appears to be turned upon itself.

These concerns would be synthesized in Olson's early career highlight, "The Kingfishers." His most important poem, "The Kingfishers," is a testimony to change. Its famous beginning, "What does not change / is the will to change," opens with a paradox that activates the entire poem, following which each textual block is orchestrated as elements of a broad sweep of thought (*Selected Writings*, 167). Sherman Paul observes that the opening line is "a text for meditation, containing the poem that activity of thought unfolds. Ideogrammic form enables this activity, permits the poet to explore the field of thought, to cluster and hold in tension the many elements cast up by thought in its movement" (11). Guy Davenport, in "Scholia and Conjectures for Olson's 'The Kingfishers'", confirms that Olson's writing is ideogrammatic, activating spatial relations between discrete textual elements to create

a dynamic differential figure (252). Ralph Maud, in *What Does Not Change*, avers that the poem is "discursive, not ideogrammatic" (51), based more on Olson's experience in public debate and academic explication than Pound's signature innovation (56-57). The reader is certainly confronted with a variety of images from diverse time periods, and passages in varying registers from the impassioned to the clinical to the ritualistic.

Rather than treating the relation between the images on strictly formal lines, the poem's relation to the previously examined concerns over history stand out, allowing us to understand the figures as each, in some way, related to change. The kingfisher bird and the collapse of its mythic-ritualistic significance becomes the figure for world-historical trauma, which the speaker grapples with as a consequence of the ontological primacy of change itself. The kingfisher shifts from a living bird to a stuffed museum piece, and again from a dry naturalist's account to a Mayan statue rendered in solid gold and rare feathers. Likewise, quotations from Mao Zedong (standing in for the revolutionary social transformations that seemed just around the corner) are contrasted with accounts of Cortes' conquest of Mexico, turning the relations between East and West into a chiasmus of mutual transformation and destruction. Von Hallberg interprets this change as an escape from the historical forces that preoccupied Olson, writing that the poet now is posthistorical, having escaped from history. This gives Olson an unseen advantage in understanding the world: "the poet can go outside his tradition, without apologies, to get what he wants, and only what he wants, from another language; he can speak with the authority of closed books written in language that grew through history but are now complete and can be summed up from a bird's-eye view" (18-19).

But the poem is not only a world-historical poem, and its conclusion does not advocate a particular action. Rather, at the end of its tumultuous five pages, comes an answer focusing on the self "I hunt among stones" (173, *Selected Writings*). The poem is a meditation on change with the focal point on the person. Maud reminds us of Olson's outline, indicating that the poem turns near the end to "the feed-back & person," redefining the person in relation to change (73, *What Does Not Change*). Crucially, this is the entry point of cybernetics, termed by Olson in letters as "that science of measure which is the 'latest thing'." Cybernetics appears decisively in the poem, joining history, ontology and the person. Olson had recently borrowed a proof copy of Norbert Wiener's *Cybernetics* from Natasha Goldowski, a colleague at Black Mountain, and had found its emphasis on communication and feedback germane to a poetics of change (Maud 81). The book's subtitle (but not the word 'cybernetics' itself) and definition of message are directly placed in the poem, in addition to Olson's remarkable phrase "the feed-back proves, the feedback is / the law." In what way does "The Kingfishers" use these cybernetic materials?

Don Byrd responds to Olson's usage of Wiener's definition of information, "a discrete or continuous sequence of measurable events distributed in time," by suggesting that kinetic information "'is the new *logos* -- the *logos* that is not an origin itself but derives from information, fully temporalized, self-absent, beyond both absolutism and dialectics" (356). That is, information not only contributes to a new understanding of language, but of the world. Information, treated as physical, underlies the structure of interactions such that we must think of meaning differently. Byrd recognizes that Olson is reinterpreting the role of the poet in light of information. Byrd argues that Olson "proposes a revision of the heroic stance of the

romantic poets. The poet is understood as an input-output machine, as in the organicist tradition, but an input-output machine on cybernetic principles." The person is defined on radically cybernetic grounds.

However, in Byrd's examination of the time series and its significance for Olson, he does not arrive at how it is formalized in this way *by* Olson.

To properly interpret the cybernetics passages, we must look at the way Olson arrived at the opening line. Burton Hatlen notes, "Logically, we have here a paradox ... the most assertively alogical of rhetorical figures. From its first line, "The Kingfishers" is setting out to enact an alternative to logos, to discourse" (Hatlen 554). This paradox can be traced back to Heraclitus, as Guy Davenport argues,

> The opening line is a translation of Heraclitus' Fragment 23 ... *Metabállon anapauete*: "Change is at rest." Or: "Change alone is unchanging." Sensing in the etymology of *metabállon* the idea of willfulness (*bállo*) I throw, is kin to *boúlomai*, I will), Olson translates *metabállon* as "the will to change" (Davenport 252).

I do not contest this claim, especially given that another Heraclitan paradox, "Into the same river no man steps twice," appears in the poem, alongside the passages from Norbert Wiener (170). As we saw above, with the linking of Buchenwald with Altamira, Olson re-enacts singular moments in the history of civilization in order to establish continuities between primordial humanity and its current state. This is a part of the paradox of changing and unchanging that the first line strikes. There is, however, another facet that this line of interpretation misses, around Olson's use of the word "will." Though Davenport's inclination to etymology is sound, the typescript drafts of the poem offer a simpler explanation that gives us purchase on other points in the work.

In the same way that relationships among the diverse components of Olson's poems render much of its sense, we find that Olson worked out many of the key phrases in earlier drafts, phrases which would often be put into new contexts. Without diminishing a reading of the poem *en face*, we can see by reading earlier iterations not only how key sections developed, but also how Olson struggled to find the terms appropriate to the movement of the poem. In a four-paragraph prose reflection on the will, we find the poem's beginnings (as well as other key moments, to which we will soon turn). These four paragraphs showcase a key Olsonian theme - knowing oneself as an epistemological anchor - and suggest that the "will" in "the will to change" is a human will.

> The law is, to go to the heart of your time to shoot for the core. And the only instrument is at the same time the material of it, which is the self. The old words on the stone at Delphi are correct, know thyself, but this extension of the principle, that the end of the knowing is the time, is the E hidden within the statement on the stone.
>
> The constant danger is the narrows of the self, the natural narrows. Only the mind and the heart can keep a man free. This is true on the plane of perception. But on the plane of expression only form can do it, not personality. That is why the triumph is rare. It takes a mastery of both personality and form, to manage to shoot for the core and to hit it.
>
> The danger is the very insturment [sic] itself, the self. For it must be used with an assurance of will, yet that very assurance leads to an assumption of self as power, and the confusion of the self with the truth.
>
> What is the truth? It is nothing but the permanence of human effort shifting as it does its direction. Why it shifts is not so easy to say. Is it for as elementary and animal a reason as the simplest need of the nerves - for change? I should imagine this is a more accurate a way to put it than we generally do when we talk of goals. They change. What doesnot [sic] change is the will to change (Charles Olson Research Collection, University of Connecticut at Storrs).

Though we do not know at which time this document composed relative to the rest of the poem, it is tempting to read the poem launching from the final line. These four paragraphs, typescript warts and all, walk through the problem of knowing and acting in a changing world, broken off from the determinate systems of thought that contribute to intellectual and material violence. How does one proceed, except by paradox?

Olson begins by embracing this paradox, not yet formulated as the famous opening line, but as an "extension" of the call, "know thyself," emanating from the oracle of Delphi. The paradox is in the extension, that "the only instrument is at the same time the material of it, which is the self." To know oneself is to embrace a recursive structure, where the very object of knowledge appears to be given as the means of knowing it. The self is both material and instrument, a thing in the world and the way that we know them. They are not so much opposed, as mutually spiralling from one to the next in an endless movement that we may understand as something essential in the dynamics of life itself. Knowing, self-knowing, knowing, and so on, in an endless turning. Maurice Merleau-Ponty would call it embodiment. Gregory Bateson would call it information. But Olson does not stop with this relation; knowing oneself is not merely a more corporealized form of self-reflection, but also a situating of oneself in history. "The law is, to go to the heart of your time to shoot for the core." This self-knowledge is informed by history and takes place in the form of a transformative act. Olsonian self-knowledge culminates in an intervention in the historical moment, where "the end of the knowing is the time." Olson advances self-knowledge not merely as a resolution of epistemological difficulties, but understands it as an eternal and ongoing engagement with history. We might do well

to consider how Olson, and the other figures whose stories we recount, straddle the line between identifying with eternal truths and historical particularity.

The second and third paragraphs together engage a thornier paradox, that grounding knowledge in the self also risks contamination by the limitations of the self, "the natural narrows." I don't believe this paradox can be resolved with certainty, but it can be navigated, activated. Here Olson explores additional rudimentary elements of the theories behind "Projective Verse," with an eye toward the paradoxical limits of self-knowledge. An attentive reader will note that "the mind and the heart" that can keep one free from these limitations appear as the "two halves" of the projective poet: "the HEAD, by way of the EAR, to the SYLLABLE" and "the HEART, by way of the BREATH, to the LINE" ("Projective Verse," *Collected Prose*, 242). Given that all of these epistemological problems are raised in the context of a poem that stages itself as a historical act, identifying the rudimentary distinctions of his signature manifesto indicates that this unpublished extract was elaborating the very conditions by which "The Kingfishers" could appear in the first place. Olson is distinguishing between the plane of perception, a prototypical "field" to compose by, where the mind and heart might grasp the problem, and the plane of expression, which gives itself in form and is echoed by the first poem in *The Maximus Poems*, where he insists that "love is form" (5). These twin planes lay out Olson's dual concerns for poetics in its own right. The "natural narrows" that emerge are such because the "danger" lines in the ways that the self is the instrument of this knowledge. The paradox is that, while the self is the anchor of all possible knowledge, its very limitations show that it cannot be completely reified. Self is neither "truth" nor "power." What is it? Can the self be fully elaborated? I repeat that I don't believe this

can be completely resolved once and for all in Olson's work, or anybody else's. For Olson, the negotiation lies in an attention to the history of language, informed by its straddling precisely between the twin historical developments of poetry and technology.

The final paragraph, which I argue serves as not a temporal origin of the poem, but another sort, asks directly, "What is truth?" The answer appears in one last paradox, "the permanence of human effort shifting as it does its direction." The matter has become somewhat more precise, in that these shifts of direction, as permanent, are the only available truth we have. Further, Olson situates this permanence in biology itself. Humans change for "as elementary and animal a reason as the simplest need of the nerves." When Olson talks about "nerves" and "goals" as being "elementary and animal," we need to understand that he is using a biological paradigm that could only appear in the cybernetic appropriation of behaviorist language - still using the formalism of goals, but using the explanatory mechanisms in the nerves. Olson has clearly read *Cybernetics* at this point in the composition of "The Kingfishers," finding in it an adequate language for a scientific, organismic description of the poet confronting the forces of history. In this "more accurate" way of capturing the thorny paradoxes he navigates, as described above, the difficulties of reconciling personal finitude with its standing as the only means of understanding the world. "They change. What does not change is the will to change."

The resulting poem has been extensively treated, nowhere more thoroughly than in Ralph Maud's small book devoted solely to "The Kingfishers," titled *What does not change*. Here, I emphasize passages specific to our themes of cybernetics, and their sub-problems of history, ontology and technology. The poem is divided into

three parts, the first of which is further subdivided into four parts, the last of these making explicit ontological claims based on cybernetics. Part I, section 4 explores an ontology of change by alternating passages of Norbert Wiener's *Cybernetics* text with textual allusions to Heraclitus and Plutarch. The section begins with the following assertion:

> Not one death but many,
> not accumulation but change, the feed-back proves, the feed-back is
> the law
>
> > Into the same river no man steps twice
> > When fire dies air dies
> > No one remains, nor is, one (170)

Olson here, as he does throughout this section, is staging a comparison between the key arguments of cybernetics with pre-Socratic and Hellenistic philosophers, in order to unpack the implications of change being the only unchanging continuity. Death is not the final perishing of a being, but the continuous spiraling instance of a living being's continual transformation. Beings are multiplicities, and subject to change. What persists is change, here appearing as "the law" of feedback. Knowing what we know from the reading above, the permanence of change is already for Olson a scientifically established phenomenon, proven by the appearance of cybernetics. We may read the early excursus as nothing other than what it means for feedback to be "the law" - a major term in Olson's early writings. Further, feedback is enacted as a

recursive figure: “not accumulation but change, the feed-back proves, the feed-back is / the law.” The ending phrase, as one complete utterance, scans as a full iambic pentameter line, which internally doubles back on itself. Not only does “the feed-back” prove the earlier phrase, “not accumulation but change,” as a rhetorically and grammatically complete statement, it also “proves” that “the feed-back is / the law.” The line literally feeds back onto itself, allowing :the feed-back” to be articulated multiply. Olson’s poetry not only borrows its ontology of change from the language of cybernetics, it employs it grammatically in the service of Olson’s recursive understanding of the importance of self-knowledge as a means of understanding the world. By interspersing these passages among lines from Heraclitus, Olson is not merely suggesting a thematic parallel between pre-Socratic philosophy and these novel scientific developments, he is attempting to account for both, joining them in the feedback loop of history. We will find that Olson is not alone in identifying feedback as evidence for a deeply recursive understanding of living beings, whether it be the reflecting subject of phenomenology or the observing systems of second-generation cybernetics.

This is one of two decisive employments of the language of cybernetics. The second closely follows. Following a citation from Plutarchs “On the E at Delphi,” Olson sneaks the subtitle to Wiener’s volume, *Cybernetics: or Control and Communication in the Animal and the Machine*, into a stanza that culminates in Wiener’s definition of information:

> We can be precise. The factors are
> in the animal and / or the machine the factors are

> communication and / or control, both involve
> the message. And what is the message? The message is
> a discrete or continuous sequence of measurable
> events distributed in time (170-171)

Maud's reading of feedback next to the Plutarch passages understands the former as "the argument for knowable reality as against Plutarch's scorn of appearances" (82). Less interested in the cybernetics passages proper, Maud still helpfully suggests Olson's scientific orientation toward facts, as opposed to the despair that a world of changing appearances gives us. Sherman Paul reminds us that feedback is itself historical. "Applied to history, it underwrites the cognitive motive and the more familiar notion of a usable past" (23). Despite Von Hallberg's assertion that Olson is strictly posthistorical, Paul's reading of feedback highlights that the cybernetics trope allows Olson a means of understanding the use of history in the first place. History, knowledge of the past, can 'feed back' and correct the present. Further, Paul reminds us that the presentation of both Wiener and Heraclitus "assumes process" in both, impelling both Olson and the reader "to become an agent of change, 'This very thing you are'" (23). Stephen Voyce observes how feedback leads to the concepts in the texts themselves feeding back on one another, in which "Mao is Mao in relation to cybernetic theory and Heraclitean ontology. . . . Indeed, according to the cybernetic trope Olson advances, each concept might be thought to 'feedback' into the others; each element reorients when encountered by another element" (49).

Voyce elegantly reads the form of the passage as enacting this feedback. "The continuous flow of the prose-poem line cleverly correlates to the cybernetic theory of

feedback, generating the image of a typewriter carriage moving back in order for the composition to travel forward" (50). We can look even more closely, at Olson's prosody and line breaks, to elaborate the *meaning* of cybernetics, in particular that of information, in these key passages of the poem. The first four lines end with the beginnings of sentences whose end is enjambed onto the next line. Each partial sentence is emphasized by its identical metrical pattern: a stressed syllable followed by an iamb. Read: "The fáctors áre," "the fáctors áre," "bóth invólve," "The méssage ís." The repeated syntactical and prosodic structure underscores the feature that this passage has in common with the other passage concerning cybernetics; phrasal and grammatical repetitions that suspend the completion of an utterance. Something in the treatment of cybernetic content calls for a language that is artificially segmented, almost dismembering sense. There are four utterances. There are two grammatically self-contained in a single line ("We can be precise." and "And what is the message?"), which are written by Olson. There is another utterance between the two, segmented over four lines and playing on the subtitle of Wiener's text: *Cybernetics: or communication and control in the animal and in the machine*. The text of the subtitle is artificially segmented by line breaks and by the famous "/" that divides decisive lines in the poem.

These first four lines, structured this way, build tension in the artificial divisions and formal repetitions, which the utterance breaks from, extending beyond the others on the page and creating a movement of escape. The last utterance is a verbatim transcription of Wiener's definition of a message, with some subtractions: "The message is a discrete or continuous sequence of measurable events distributed in time--precisely what is called a time series by the statisticians" (Wiener 8).

Information enters Charles Olson's poetry, and it is worth noting that it is the information of the time series, rather than the encoding and encryption model advanced by Claude Shannon. Systems speak, and the distribution over their variables over time is the message to which we must listen. Significantly, they are events; taking the analogical power of Wiener's information theory to its maximum, any sequence of events distributed over time can be understood as a message, provided we understand it. Is the message the poetic line? Further, will Olson connect this to poetry in a significant way? The notion of messages being sequences of "events" must have had a richness for Olson's deep interest in history. On another side, we will see that this passage speaks to a concern of Olson's that will only be developed in the 1950s, that of measurability. As these are elaborated, the joining of the historical and the mathematical remains of pivotal interest for Olson's theories of poetic form. Here, in lieu of Olson's own phrasing, Wiener serves to articulate Olson's own poetics better than Olson himself. After this poem it is not clear whether Olson will consciously pursue cybernetics again in great detail. He never owned a physical copy of *Cybernetics*, having borrowed a proof copy from a colleague; his second-edition paperback *The Human Use of Human Beings*, purchased no earlier than 1960, shows no evidence of having been read (Maud 257, *Charles Olson's Reading*). And yet, cybernetics will prove a point of articulation of nascent Olsonian themes, and though Olson will move forward in his scientific readings, the weight of this citation will remain.

Before we start to bring our reading of "The Kingfishers" to a close, we turn to one additional unpublished typescript variant. In this passage, the language of "The Kingfishers" is brought to bear on another signature contemporary science, that of

quantum mechanics and relativity. We will see, by attending to what Olson chose *not* to include, that for Olson as for Wiener, the competition over which conceptual framework would characterize the new historical moment would take place between cybernetics and modern physics. It would be won, if briefly, by cybernetics. Olson writes:

> What you are / all is
>
> a certain quantum, arrived at by accumulation,
> which quantum, by that accumulation, becomes
> what all is, what you are, that which may
> change
>
> which better be understood to be
> energy,
> given off
>
> light, which is now proved to be
> both particle and wave
>
> what you are, what all is
> uncertain.... yet, uncertain
> only in respect to when,
> in what direction, where

you shall express yourself,

la lumiere,

la lumiere et la matiere

is one

is energy in

and out, is constant,

is inconstant in respect solely to

choice

It is necessary now to put it another way:

the discontinuous is

the law, uncertainty is

the principle, nature

makes nothing but

jumps

We know now,

let Leibnitz holler, and go,

we know now how we must act,

we know

what the eye is, how

he who rules us

converts, what it is

we must do ("The Kingfishers," Charles Olson Research Collection, University of Connecticut at Storrs)

Ralph Maud, in his discussion of this extract, hesitates to identify it as discarded material from the finished poem, instead identifying it alternately as a contemporaneous “worksheet” or separate “poem” (83). Though this suspension of judgment is well motivated, the passage has enough signatures of the finished poem to identify it with the core textual conceits of "The Kingfishers." Not the least of which, the passage begins with a "/" dividing an enigmatic statement of paradox, which it unfolds over syntactic repetitions that, while obviously a part of Olson's oeuvre in general, are a signature part of how Olson casts the text in the poem.

Maud is mostly satisfied to keep the passage separate, writing, “He thought better, in the end, of using quantum theory. . . . Olson is far more interested in the *h* constant, which is a known thing. We can know ourselves and be constant. The essence of the poem is the glorious self-sufficiency of the human being” (84). Highlighting Olson’s turn to the self, Maud somewhat misleadingly poses it as fixed, in distinction the surrounding change. As we have observed, Olson is drawing on a cybernetic definition of himself that is predicated on change. The motivation to exclude the passage from the poem is in fact that Olson (despite turning to quantum mechanics later in his career) would reject it for cybernetics here.

What is surprising about the extract is that, given the ways that Olson's cadence lends itself elsewhere to a restrained referent, evocative but out of reach, here tends to converge on fairly literal content, at times awkwardly unsubtle. History appears, in "light, which is now proved to be / both particle and wave," and though in

some ways this is true, it is a development that is at least a generation prior to Olson. Does quantum mechanics and relativity have, at this particular moment in 1949, the same stamp of a history in progress? The translation of the equivalence of matter and energy into French, where "la lumiere, / la lumiere et la matiere / is one," self-consciously evokes his earlier citations of the Chairman Mao in French translation, an overt figure of postmodern historical transformation for whom "la lumiere" was a literal rising of the east and potential site of renewal. Here, Olson is attempting to join this with the new physics, in much the same way that his "E on the stone" refers jointly to the oracle of Delphi and the sigma of the calculus. Olson is clearly attempting to find in the new physics a sign of the historical condition, and I argue that at least at this point, is not satisfied with what comes of it. Following the previous passage, where "la lumiere et la matiere / is one," Olson proceeds, allowing his utterances to syntactically repeat:

> is energy in
> and out, is constant,
> is inconstant in respect solely to
> choice
>
> It is necessary now to put it another way:
> the discontinuous is
> the law, uncertainty is
> the principle, nature
> makes nothing but

jumps

Here, Olson is plainly attempting to outline an ontology that can speak to the needs of his historical moment. Drawing on his statements above, the constancy of energy and the uncertainty of physical observation are a possible form that the "law" can take. Of these, I find the dictum, "nature / makes nothing but / jumps" the most convincing as a candidate passage in the finished poem, not out of any judgment of quality, but rather because the lines appear to follow from their content; it, like nature, jumps.

Is this equivalence what's necessary for the historical intervention the poem is meant to stage? Is all being contravertible enough? Does this allow for difference? Evidently not. It is worth noting that in these lines, "the discontinuous is / the law," rather than feedback. Is there room for continuity in this law of history? Feedback may have provided it. Further, that these "jumps," if we take them as discontinuous, fit into the digital logic we've devoted considerable space to in the previous chapter; if Wiener was able to navigate the difference, however loaded with intellectual baggage, between the analog and the digital, the continuous and the discrete, perhaps Olson found it more to his taste.

Recalling the other unpublished extract, in which "the will to change" is rooted at least partly in a cybernetic conception of the body, it seems that what Olson was seeking didn't quite go far enough. He needed a scientific conception that offered to join poetry, history, change and the body together, and found that in a sequence of events distributed in change. The reference to Leibniz, using the same antiquated spelling Wiener used in *Cybernetics* and *The Human Use of Human Beings*, suggests that by the time this was written, Olson had already found what he'd needed in

cybernetics. This extract, suggesting alternative unrealized directions for "The Kingfishers," further underscores that for Olson's needs, cybernetics was unavoidable.

This poem does the work of grounding cybernetics in a deeper ontology, and in so doing is the defining gesture of the era. It consists in situating cybernetics against the backdrop of a universe of change, creating a retroactive continuity with previous modes of thought, and elaborating a more complicated picture of the will and human subjectivity. Charles Olson emerges from “The Kingfishers” with a sense of purpose—to participate in the ongoing process of history by pushing against it. By “hunt[ing] among stones” Olson would attempt to generalize and activate the conditions of renewal, and in the process gave the American avant-garde a sense of voiced, embodied praxis, to be found in projective verse. However, personal and historical crisis would not be completely overcome, arguably burdening his project in ways that must be carefully examined, as they become points of discovery and further elaboration of his methods and aims. Another significant poem of personal crisis, “In Cold Hell, In Thicket,” appears not soon after “The Kingfishers,” and illustrates another key methodical theme, that of measure.

The poem’s tone is notably different from “The Kingfishers,” in that the latter, earlier poem coordinates found textual sources, with major shifts in volume, while the former is is almost entirely in a single, meditative key, sharing the most in common with the final section of the earlier work. This “hell” is a “thicket” of unknowing, that leaves everything in abstraction. It may be productive to keep in mind a passage from the unpublished note cited above, “the narrows of the self, the natural narrows” as the danger of basing one’s measure on oneself. One can productively read “In Cold Hell, In Thicket” as a poem from the depths of these natural narrows.

Most readings of "In Cold Hell, In Thicket" engage its psychological content, framing it primarily as an exhibit of Olson's thought process, as well as of Olson's interest in Jungian archetypes. Sherman Paul beautifully notes the methodological significance of the personal struggle of this poem, "the recognition that poetry is not impersonal but inevitably moved by the twistings and turnings of the self, the unknown, hidden self revealed in dreams and nightmare" (37). It is productive because, like the dream passages of *The Maximus Poems*, they serve as reminders of the challenges of Olson's project. Ultimately, Paul's reading of the poem situates it as a struggle poem without relief, until Olson's trip to the Yucatan (58, 61). That is, for Paul the relief takes place outside of the poem.

Christensen extends Paul's analysis, better elaborating the relationship between the poem and Olson's epistemology. For Christensen, Olson's struggle is in his observations of the created object, unable to find "the creative form of its multiple particulars." At such a remove, the challenge echoes "The Kingfishers" in that it is an inward one, as Olson engages "the self's knotted complexities" (103, *Charles Olson: Call Him Ishmael*). Expanding on Olson's Jungian influences, Christensen catalogues the references to mythology, specifically to the Egyptian goddess Nut (105). These passages underscore the fixation of this poem on love and feminine energy as a lost ideal. And yet,a comprehensive reading eludes Christensen, as the final lines are not synthesized. Christensen suggests that some lines "refer presumably to being abstract" while others refer "to strength," ultimately focusing on how "the questioner is an intense witness to experience" (106). But the poem is not merely about intellectual confusion, it is a confusion about Olson's earlier-found purpose that resolves on questions relating to space.

Robert Von Hallberg zeroes in on this question in his reading. In the poem, Olson is understood to be reflecting on how "man, generalized here by quantification (from singular to plural) is challenged to remain abstract, strong, strung, and cold" (143). Von Hallberg intuits Olson's 'use of himself,' noting that the poet "is more interested in the way we get there, the motion itself. Man is to raise himself, by his bootstraps, to action" (144). Noting that the poem concerns space, Von Hallberg's reading primarily emphasizes loss, "The ideal relationship between man and his environment is nutritive: space like a mother could feed man through her starry teats, were she arched around him the way the Egyptian sky-goddess Nut bent over her earth-god brother and lover Geb . . . But that animistic vision is denied man now" (145) Von Hallberg also fixates on this notion of loss, and also concludes that the poem is primarily meant to "reveal an urgent mind, one hungry for useful general truths" (150). Where Von Hallberg is attentive to the noumenal qualities that Olson perceives as lacking, he is less attentive to Olson's depiction of space as measurable. Though quantifiability is posed by Von Hallberg as the enemy of the poem, it is more ambivalent. Olson is embracing measure, but a measure along the lines of actual interaction. This is the basis of information, where cybernetic analogy is not an abstract comparison of systems but the exchange of information between interacting parts - the human and the environment. Or better, between the human and the tools of making and shaping.

As we read through the poem, we ourselves find that that despite the poem's voice being distraught, it comes to a conclusion that bridges the poem's earlier concerns with history with Olson's later discoveries relating to information. We will see how this echoes through the poem, which founds self-knowledge as the response

to a crisis that also has historical overtones. These historical terms, while less vivid than other poems, are more pointedly laid out. Olson writes,

> All things are made bitter, words even
> are made to taste like paper, wars get tossed up
> like lead soldiers used to be
> (in a child's attic) lined up
> to be knocked down (182)

Later, Olson laments that humans are "merely / something to be wrought, to be shaped, to be carved, for use, for / others" (186). Though Olson is expressly not a humanist, part of what he diagnoses as the ills of contemporary culture can be found in the ways that humanity is undermined by losing their self-determination. Rather than finding their ways and practices in self-understanding, they are "tossed up / like lead soldiers … / to be knocked down." They exist, as Heidegger would put it, "for orderable destruction," to be used and shaped and thrown away.

These conditions give, as we have seen, a historical exigency to how we understand ourselves, changing the nature of the struggle. As we've seen above, defining oneself becomes a key term in one's relation to history. Olson writes, "ya, selva oscura, but hell now / is not exterior, is not to be got out of, is / the coat of your own self" (185). Continuing, "it is simple, what the difference is-- / that a man, men, are now their own wood / and thus their own hell and paradise" (186). Olson terms things as what is necessary "now," a temporal aspect that cannot be elided. What is

emphasized by this now is the historicity of an acute need to know things in a new way.

What "In Cold Hell, In Thicket" adds to the mix are hints at what would become a defining interest for Olson—quantity as a measure spanning verbal arts and technology. The themes here are still emerging, and appear inseparable from other problems, as we see in this early stanza:

> What has he to say?
> In hell it is not easy
> to know the traceries, the markings
> (the canals, the pits, the mountings by which space
> declares herself, arched, as she is, the sister,
> awkward stars drawn for teats to pleasure him, the brother
> who lies in stasis under her, at ease as any monarch or
> a happy man (182-183)

The third, fourth and fifth lines of this stanza connect Olson's signature interest in space with explicit references to measure: "traceries" and "markings," and more abstractly "canals," "pits" and "mountings." Measure here appears in a physical form, marks made for the purpose of human crafting. Further, these markings are those "by which space / declares herself," making the dual move of elaborating space as given in measurement and also feminizing it. The speaker finds it difficult, in this hell, to "trace and arch again the necessary goddess."

The poem is saved by the will, in a way resonating with the earlier prose extract, "it must be used with an assurance of will, yet that very assurance leads to an assumption of self as power, and the confusion of the self with the truth." Like "The Kingfishers," the matter is codified by law, this time "a law" being found in maintaining one's will without wavering, as the poem's inconclusive ending shows:

as even the snow-flakes waver in the light's eye

as even forever wavers (gutters
in the wind of loss)

even as he will forever waver

precise as hell is, precise
as any words, or wagon,
can be made (187)

It should be noted that the ending of the poem emphasizes the problem at hand, that of measuring and making, whether it be "words, or wagon." The crisis is of getting a sense of measure of a problem so that it may be put to use. The problem, containing its own resolution, is that this measure is grounded in oneself as its measure. This makes any action subject to the wavering of the will, a wavering that shifts from perception ("as even the snow-flakes waver in the light's eye") to abstract nature ("as even forever wavers") to one's place in between ("even as he will forever waver").

This wavering is both "precise as hell is" and "precise / as any words, or wagon, / can be made." That this may be precise shares an echo in "The Kingfishers," where the found language of cybernetics is preceded by "We can be precise" (171). The precise nature of the wavering can be understood, as ultimately oneself can. The ending of this poem, unlike that of "The Kingfishers," is much more uncertain, but an uncertainty that is grounded in the task itself, which we understand much more clearly to be motivated by questions related to measure, which seems to engage both linguistic and material matters.

Measure is one of the more significant themes of Olson's research. Related to Olson's interest in "quantity," which he defined as "technology," and as "machine extending individual's powers of production," measure connects poetry, information and technology as a common feature of human making (305, "Bibliography on America for Ed Dorn, *Collected Prose*). In *The Poetics of the Common Knowledge*, Byrd reminds us that information, in the latter kinetic sense prized by Olson, is bound up with Olson's conception of measure. He writes, "Measure is *some* means for marking differences. Events are what is marked. Time is the medium of the difference in which events occur" (284). As we recall, "In Cold Hell, In Thicket" was precisely engaged with such "traceries" and "markings." Markings are the physical instantiation of information.

Some of the strongest moments of William Spanos' analysis are on precisely this point. Examining the figure of the mapmaker in Olson's writing, Spanos independently of Byrd identifies measure's role in Olson's epistemology. Spanos emphasizes Olson's interest in "the ancient Phoenician cartographers, who made their maps in the process of exploration," an engaged and localized epistemology at odds

with the panoptic specularity of “modern map makers, sitting dis-engaged at a desk” (138). We will see that this fundamentally hinges on questions of measure. Spanos emphasizes that this knowledge is “the interpretive *process* understood as the ontological priority of temporality over Being: the process of opening out into depth, of dis-covering” (139). Mapmaking, in this way, is the literal tracing out of a space through experience. The result is “A poetry that is the measure of its occasions” (142). This notion of measure joins experience to language, drawing on the measures of prosodic speech to give shape and meaning to events in space and time. Measure itself is both spatial and temporal, and for Olson is centered in the local, and in the self.

Don Byrd’s early essay, “The Possibility of Measure in Olson’s *Maximus*,” echoes many of these points, while extending their implications deeper into Olson’s poetics. Though not citing any cybernetics texts, it leaves open a space for Olson’s treatment of information. Echoing Spanos, Byrd writes, "Olson's achievement is to discover a poetic which is so completely spatial that he can say simply, 'metric is mapping.' Maximus is not only local to the actual geography of Gloucester but also to history" (52). Byrd defines Olson’s notion of measure as the inherent, experiential mapping out of lived bodily experience. Like Spanos, it takes place in a spatial and temporal register, but Byrd takes it further into history itself. It is because information is evental. As *The Maximus Poems* progress Byrd notes that "Maximus is two synchronous events. He remains a perfectly integrated organism, the form of which cannot be separated from his own content, shaping space to his form. At the same time, however, he is also the form which he gives to space-time or history." Byrd’s treatment activates the kinetic notion of information as evental, dynamic. To measure

is something like the analog machines of Norbert Wiener, measurement is relational, the hidden core of Wiener's understanding of the time series.

We find that Olson's basis of knowledge is recursively defined by the self as the measure of oneself. This is a structural form that, as we see in the unpublished notes for "The Kingfishers," exists parallel to a historical reinvestment in an ontology of change, perhaps superseding it in importance. This principle is not exhausted by a retreat into subjectivity, spirituality, the 'qualitative,' as the emphasis should be placed primarily on "measure." Olson's method, from its syntax to its historical-material subject matter, is quantitative at its core. We should understand self here not in terms of a unified point with a pre-determined structure, but rather in terms of a tropos—a twist or turn into and out of itself. Self as the measure of oneself underlies Olson's interest in mathematics, beginning as early as "The Moebius Strip," and informing the "law" of historical feedback in "The Kingfishers."

The overtly spiritual and occult elements cannot be denied, however, as they clearly inform a strain of anti-scientism that underlies Charles Olson's poetics. The post-war interest in myth, coming from the new rigors of anthropology and archeology and exemplified earlier in the writings of Carl Jung, serve Olson's covert primitivism as they do the work of many other poets and artists. This chapter will leave Olson at this juncture, with most of the key questions unresolved—can feedback, the hallmark formal principle of cybernetics, be "the law" of one's historical agency, while also largely abandoned for more 'nativist' concerns? We will see later that Olson's interests in the "sciences of man" are informed by scientific investments in deep conversation with cybernetics, and more broadly the possibility that the

structures of myth and ritual might correspond to the deepest, most eccentric and most radical hypotheses of information theory.

It is in this light that we should interpret Olson's turning, like Heidegger, back to the problems of the late 1940s two decades later, when popular cybernetics discourse was at its strongest and its scientific influence was beginning to be eclipsed. Olson was at the end of his life and writing the third volume of *The Maximus Poems* in relative solitude, punctuated by the disastrous 1969 *Paris Review* "Art of Poetry" interview, whose posthumous publication cemented the reputation he struggled against—that his writing was obscure and inaccessible. Even in 1966 we find an Olson caught in the "natural narrows" again, struggling to hold his vision in place. Olson returns not merely to the cybernetic themes of "The Kingfishers," but also the exact quotations. In the late poem, "the Mountain of no difference…" Olson is haunted still by the problem of measure, contrasting "modulus precise finite segments" with "the modus" that Olson finds "in perfect measure of rhyme and Truth" (501, *The Maximus Poems*). Byrd's reading observes that "Olson had withdrawn his first assessment of the input-output machine," recognizing the dangers of entropy and cybernetic manipulation (369). In this poem, however, we find a less clear answer than in others. The discreteness of the modulus, the ablative declension of the Latin "modus" (measure), is making a subtle distinction between the fluctuating, continuous and recursive modus of Olson's methodical self-knowing with the rational, discrete and segmented modulus of number theory. The poem is inconclusive, finding information's measure incontestable yet attesting to the "modus," "this measure," an alternative, insisted upon "as a Prayer" (502). The purpose remains, but the clarity is gone, as Olson slips back into the despair he

triumphantly defeated in “The Kingfishers” and “In Cold Hell, In Thicket.” Where Olson’s 1949 poem would situate passages from *Cybernetics* alongside Heraclitus to indicate the suspended temporality of the historical moment, finding strength in a science that appeared to confirm it, here the very same passages are placed again in an unmistakable tone of disquiet. Olson writes,

> -- “There are no infinitesimals”
>
> all does rhyme like is the measure of
>
> producing like, the Guardian
>
> does dictate correctly the message
>
> is a discrete & continuous conduction
>
> of the life from a sequence of events measurable
>
> in time none of this is contestable,
>
> there is no measure without it or
>
> with anything but this measure (501-502).

Earlier poems confronted the paradoxical difficulty of engaging an indeterminate world by making recourse to methodical self-knowing. Here, Olson appears to be relinquishing mastery entirely; truth-statements repeatedly place weight on monosyllabic verbs: "all does," "like is," "the Guardian / does"; ending by underscoring "is" twice. Whatever Olson may be contesting, he is allowing it some truth, that "there is no measure without it or / with anything but this measure." The primacy of measure for Olson cannot be understated; where things become difficult is not in measure as such, but rather in the ways that it's realized. Cybernetics, in this passage, is now something struggles against. As Olson does in 'The Kingfishers," the definition of information as a "discrete and continuous sequence of events distributed in time" also interrupts the grammar of the poetic statement, appearing as a third component that turns the object of an utterance into the subject of another. The citation is somewhat altered, but the manner of citation is the same. The basic truth that messages, as time series emerging from the distributed behavior of indeterminate phenomena, are a part of the workings of the world, is something that Olson will not deny. And yet, Olson now identifies it as something to confront. Has Olson given up? Has he perhaps found another horizon by which to define measure? Is feedback still "the law"?

Olson, though himself borrowing from feedback and information principles in ways that the second-generation cyberneticians would undoubtedly approve of, has an unease with cybernetics that prevents it from fully undergirding his poetics. The answer to this ambivalence will emerge, once we've considered what a cybernetic poetics might be. First, we must engage Heidegger's phenomenological critique of technology, in order to all the more firmly place cybernetics on a historical ground.

We will find, on reading Heidegger, that the reason for Olson's ambivalence echoes the concluding words of Bové's text (but in a more ominous sense than intended by the critic), "a realm of greater uncertainty where the act of reading is defined by its instability and risk" (281). This character of instability is only partially what Olson named pejorocracy. Examining Heidegger's critique of technology in the chapter to follow, we will find that this instability and risk is the hidden condition of the cybernetic moment, looming in front of Olson's eyes, regardless of his (in)ability to bring it to measure.

Chapter 3. Bringing Heidegger to Measure: Technology, Ontology, Temporality

Thus far, we have examined the immediate post-war period for its concerns over the ontological necessity of change, informed especially by the traumas of the Holocaust and the use of the atomic bomb. We have observed Olson, in attempting to articulate this "will to change" in "The Kingfishers," turn to cybernetics as a science of change and instability, and implicitly suggest that feedback and information speak to truths as old as the pre-Socratics. However, cybernetics' standing as a future science of change has not been examined from its historical or ontological ground, an analysis hinted at but never explicated by Heidegger. We have observed, in Charles Olson, a response to the historical moment that defined the age in terms of cybernetics, utilizing passages from Norbert Wiener to situate oneself in history and create a poetic framework for the future. As we will observe in later chapters, this helped set the stage for later poetry, and is an arguable birthplace of postmodern poetry. However, cybernetics also entered intellectual history through philosophy.

In the following chapter, we will examine Heidegger's critical remarks on cybernetics, showing how they are an extension of his mature conception of technology inaugurated in 1949 with his lecture cycle, *Insight Into That Which Is*. Sharp criticism of cybernetics, which appears in Heidegger's work in the 1960s, is frequently connected back to his earlier comments on technology in general, suggesting that cybernetics becomes an exemplary feature of technology as a whole, if not its essence outright. Further, that the latent social and political questions raised by Heidegger's critique of technology become manifest in his remarks on cybernetics. Cybernetics becomes a fulcrum by which to critique technology, while still remaining

indebted to a sense of its historical inevitability and fateful character. We will place this conception against the backdrop of continental philosophy's response to cybernetics, showing that many key comments remain under the shadow of Heidegger.

I will investigate Heidegger's critical comments on cybernetics, situating them in his broader philosophy of technology's essence in "positionality." Focusing on the temporality of his remarks, we will find Heidegger proposing cybernetics as a rupture or event in the historical unfolding of metaphysics. This evental sense, as we will find in Norbert Wiener's writings, is essential to cybernetics, suggesting by its internal logic a looming sense of impending catastrophe or crisis. These overtones will appear in many thinkers of cybernetics and politics after Heidegger, echoing the philosopher's main points knowingly or otherwise. That this connection exists is one of the central claims of this project. After this, I will show how these political questions are also raised by Humberto Maturana and Francisco Varela's concept of "autopoiesis," as well as the media theory of Marshall McLuhan, which offers a means of restaging the critique of cybernetics on more productive grounds. We will then return to Heidegger, examining his remarks on information and language, drawing out the tensions of a cybernetic poetics. Identifying the issues Heidegger raises in trying to keep information and language separate, we will find that Heidegger himself furnishes the resources to join the two, in the event of unconcealment hinted by the poetic saying.

Poetry is frequently understood as redemptive and opposed to the machinations of technology. Where science can only measure language, poetry supposedly grasps what cannot be measured. In this chapter we will attempt to bypass

that question, by emphasizing instead why poetry is significant in the first place. Assuming at the outset that poetry has been, is and will be important, we look instead at what makes poetry a charged subject in the time of cybernetics; that it shares space with information, concerning as it does the exploration, measurement and operationalization of language as *communication*.

Paradoxically, I will spend comparatively little time on Heidegger's writings on poetry and art proper. This is mostly because doing so would increase the scale of this study by an order of magnitude; Heidegger's readings of poets are too detailed, too rooted in additional concerns exceeding the scope of this project (especially their proximity to Heidegger's involvement with National Socialism), and too removed from the American context to adequately assimilate to the materials we will treat in later chapters. Rather than solder the entirety of Heidegger's project to cybernetics, I will make the initial preparations for such a task by discovering the terms of their engagement in the first place. I hope the result, which links Heidegger's conception of the poetic saying with information on the terms set by his writings on technology, will be a sufficient starting point for future engagement.

Heidegger's critique of cybernetics takes many forms that open conversation with many of his earlier engagements with science as a whole. Among the more important points are that cybernetics' mathematical definition of information misunderstands the unique importance of language in defining what it is to be human, and with that (like metaphysics in general) the human is improperly devalued. However, Heidegger's major and most influential point of contention is that cybernetics, as the fulfillment of the essence of technology, is itself shaping social life in its wake, without escape. Heidegger further suggests that the revelation of this is

the unique character of the postwar historical moment, as an apparent climax in the evolution of the impersonal forces of technology, from Greek metaphysics to cybernetics.

We will now examine Heidegger's critical remarks on cybernetics, which reveal the historical unfolding of metaphysics as technological. Heidegger's critique of cybernetics is deceptively late, most famously dating to a 1964 lecture titled "The End of Philosophy and the Task of Thinking." In the lecture, Heidegger prophesizes not merely the end of metaphysics, a long-standing concern of his work, but of philosophy in general. The culprit here is cybernetics, understood as displacing philosophy, and it is important to understand why. Heidegger engages with cybernetics at varying degrees of technical precision, but it is his vaguest pronouncements that are in fact most productive.

In this lecture, Heidegger treats the end of philosophy and the historical forces that condition it. By "end," Heidegger is not acting in defense of a philosophy under threat, but rather treating the basic role of philosophy as something that as come to fruition, demanding philosophy of a new type. Heidegger is quick to clarify what this "end" means, situating it in the language of his later work. He writes, "We understand the end of something all too easily in the negative sense as a mere stopping, as the lack of continuation, perhaps even as decline and impotence. In contrast, what we say about the end of philosophy means the completion of metaphysics" (56). Metaphysics, which for Heidegger is too focused on what can be measured in a measured and treated as a mechanism, is not simply an understanding of the world, but a conditioned tendency in the history of thought with a particular trajectory.

Metaphysics has come to complete fruition not only in technology, but in the

host of techno-scientific discourses that are bound up in it. These discourses have absorbed philosophy as we know it, calling for a renewed understanding of the task of thinking. As the fundamental character of Western philosophy, a metaphysics that assigns means to ends and imposes a rational grid on the world is what has come to an end, reaching a point of completion characterized as a "gathering into the most extreme possibilities" (57) All the multiple streams of metaphysics converge forcefully into a culminating point for philosophy. What might this look like? Heidegger does not look within philosophy. Instead, he turns to its social character. He writes:

> No prophecy is necessary to recognize that the sciences now establishing themselves will soon be determined and guided by the new fundamental science which is called cybernetics.
>
> This science corresponds to the determination of man as an acting social being. For it is the theory of the steering of the possible planning and arrangement of human labor. Cybernetics transforms language into an exchange of news. The arts become regulated-regulating instruments of information (58).

The most important aspects of the reception of cybernetics are to be found here. The first thing worth noting is that humans are not the subject of any of the sentences in this passage. The "sciences now establishing themselves," "This science," "the theory," "cybernetics" are the only active subjects. No humans are necessary. Indeed, "the sciences" are "now establishing themselves." The human is a grammatical add-on to these remarks; Heidegger is interested in the "*determination* of man" and the "*arrangement* of human labor," with the role of the human deliberately left out of the picture.

Heidegger's remarks are deceptively vague, and give the appearance of not having the familiarity with cybernetics that he actually has. He does not critique a particular text or concept, but rather names cybernetics as he understands it in the world, turning toward its social character. Cybernetics' behaviorist formalism, when turned to man, sees only "an acting social being." The etymological root of cybernetics in *kybernetes*, or "steersman," is identified as the "steering of the possible planning and arrangement of human labor." This steering of a minimally defined socially acting human translates into their technological manipulation, or regulation. Heidegger singles out cybernetics for its social impact, a technological ordering that results in the lack of agency we have observed.

What also persists in these comments is Heidegger's employment of the word "steering." Heidegger is turning the language of cybernetics against itself; the art of the *kybernetes*, or governor, becomes the "steering" of cybernetic social planning for Heidegger. What is significant is that steering is identical to positioning, which Heidegger identifies as the essence of technology. To understand cybernetics as the essence of technology, which Heidegger shares with the cyberneticians, is to make a claim about intellectual history. This claim has three significant features: it is suggesting a link between science and a rigorous philosophical ontology, it is an idealized and anachronistic misinterpretation of the key features (and dangers) of Cold War technoscience, and relevant to the second feature it is a positive scientific claim with great descriptive potential for technologies outside of normative definition of technology.

Further, Heidegger has special scorn for attempts to identify information with language, merely "an exchange of news," which we will find does not satisfy

Heidegger as possessing the radical disclosive character of language proper. Most notably for our purposes, once the arts become "instruments of information," their function is reduced to a form of social regulation. Heidegger's concern for the reduction of the arts is longstanding. Earlier, Heidegger's "The Origin of the Work of Art" examined how art becomes "familiar to everyone," on public display for all to see, and in the process treated like "things." Heidegger observes how a painting "hangs on the wall like a rifle or a hat," or more cuttingly, how artworks "are shipped like coal from the Ruhr and logs from the Black Forest" (18-19). Now, however, Heidegger signals that art has been reduced not to a thing but to information. Heidegger would use similar phrasing elsewhere. In *The Principle of Reason*, Heidegger would argue that information "means, on the one hand, the instant news and reporting that, on the other hand and at the same time, have taken over the ceaseless molding (forming) of the reader and listener" (29). To reduce something to information, for Heidegger, is to instrumentalize it and make it a relentlessly present and human shaping force. The next chapter, on cybernetic aesthetics, will bear out this impression in part. 1950s and 60s computer artists not only apply the measurability of information to formal art principles, but also operationalize the artwork's role in society. Here, Heidegger is emphasizing that cybernetics is a totalizing science that folds all human activities - art and science alike - into its domain.

Heidegger's chooses to emphasize the role cybernetics was predicted to play in social planning, folding all discourses, including the arts, into cybernetic society in their now "regulated-regulating" function. Heidegger touches on two problematics: the technological manipulation of the human, and the significance of thinking of language in terms of information. These two themes are at the core of Heidegger's

engagement with cybernetics. Here, Heidegger is diagnosing how cybernetics is contributing to a new organization of scientific discourse and social planning. Both of these are seen as merely a continuation of the historical transformation of technology in the modern age, setting all beings into place as manipulable, replaceable. Heidegger continues:

> Philosophy is ending in the present age. It has *found its place* in the scientific attitude of socially active humanity. But the fundamental characteristic of this scientific attitude is its *cybernetic, that is, technological* character. The need to ask about modern technology is presumably dying out to the same extent that technology more definitely *characterizes and regulates* the appearance of the totality of the world and the *position* of man in it (58, emphasis added).

The claim that philosophy is "ending" is startling, but its resemblance to traditional antinomies between the humanities and the sciences is misleading. Rather, Heidegger is examining philosophy as if it itself is a thing. Philosophy, as a thing, is ending not because it has been destroyed or threatened, but that it has "found its place in the scientific attitude of socially active humanity." The change is one of position and role; indeed, the conditions Heidegger have nothing to the amount of philosophy being pursued, but with the overall purpose to which it is put. Heidegger's language is fine-tuned and carefully put. His terminology builds on previously elaborated concepts, an understanding of which will help interpret the striking claims of this passage. His use of the phrase "found its place," with "the position of man," the earlier-cited "determined and guided" and "steering." Heidegger is placing emphasis on the role of cybernetics in putting philosophy, the arts, the sciences and man into 'position' or 'place.' This notion, in conjunction with another, assist us in further analysis of this passage. The "cybernetic" character is also a "technological"

character; the two are implied to be if not synonymous, than in the very least the latter implying or entailing the other. Heidegger's aligning cybernetics with technology, and its effects with varying forms of positioning, indicate that Heidegger is using language developed over a decade earlier, when he named the essence of technology in his 1949 lecture cycle, *Insight Into That Which Is*.

In this lecture cycle, Heidegger introduced the themes that would define his later career: the theory of technology as "das Ge-Stell," initially translated as "enframing" and more recently as "positionality," and the poetic ontology of the "fourfold" as a new phenomenological thinking of things. Heidegger named technology as a force outside of human agency, developing of its own accord rendering all things replaceable. The essence of technology is the increasing requisitioning of things as replaceable parts of a larger system whose terms are not set by humans, but are in fact merely another replaceable part of it, orienting their own horizon of thinking toward usefulness within this technoscientific regime. The phrase for this replaceability, "the standing reserve," is the condition of things in the technological epoch. Things become detached, or "unguarded," with the danger lying in all things being torn from their context to be destroyed and replaced in an endless cycle. The end point is destruction. Technology's essence, for Heidegger, is a putting into position as a replaceable part of the standing reserve. His famous example, appearing in the essay version of the lecture, is the Rhine becoming a positioned by a hydroelectric dam, no a piece of the standing reserve for the production of electricity.

Insight Into That Which Is sets the terms for this new theory of technology, appearing at the same time as the birth of cybernetics and eventually becoming the means by which Heidegger critiques it. These 1949 lectures furnish a theory of

technology that identifies communications media, and by implication mathematical considerations of communications, as a part of this emerging form of technological control. *Insight Into That Which Is* allows a strong critique of both information and feedback, which Heidegger draws upon an only intermittently makes explicit.

They begin by characterizing the technological age as "distanceless" - now connected by enhanced travel and communications technology, all is equally accessible at the cost of an apprehension of real distance and nearness (3). Heidegger then brings our attention to the thing, not as an objective representation but as it is. Heidegger introduces the notion of the "fourfold" to characterize the thing; the mirror-play of earth, sky, mortals and divinities. This mysterious phrasing, situated in an already densely poetic text, develops largely based on a terminology developed over the course of a decade of reading and systematizing the works of Friedrich Hölderlin. Though these terms merit closer attention than we can provide, they are Heidegger's response to our main focus, the all-encompassing nature of technology. For now, we can hold onto an understanding of the thing as only partially present, giving its own space and time, accessible only in the announcement of the poetic utterance. After announcing this alternative, Heidegger devotes the rest of the lecture cycle to what appears to threaten it in the unfolding of technology. After examining technology's essence as positioning, abstracted as a *thesis* that we will spend some time on, he contrasts it with its correlate in nature, or *physis*, only to show how Being is not opposed to either, but manifests in the unfolding of the technological as a significant feature of the history of Being. The technological is a part of Being in its historical unfolding, and its danger serves as the condition of renewal, in the "insight

into that which is." This insight only appears in a flash, and serves as the point where a possible poetics may appear.

What makes *Insight Into That Which Is* significant is its joining of developments in thought with events in taking place in the world. Positionality is, despite the abstraction and impersonality of the description, fundamentally a material process operating in history. It is a firmly-articulated notion of technology that joins the historical and material with the intellectual. Positionality straddles both of these lines, as we will see. Most significantly, the phenomenological critique of rational, mechanistic and *causal* thinking is implicated in the workings of this unfolding of technology. To think causally, or in terms of means and ends, is to participate in this positioning at the heart of technology. Further, it is considered by Heidegger to be an "assault" on the thing, by placing it in the "standing reserve" of circular replaceability. What does this mean? Heidegger writes:

> The standing reserve persists. It persists insofar as it is imposed upon for a requisitioning. Directed into requisitioning, it is placed into application. Application positions everything in advance in such a manner that what is positioned follows upon a result. So placed, everything is: in consequence of. . . . The consequence, however, is ordered in advance as a success. A success is that type of consequence that itself remains assigned to the yielding of further consequences (25).

Heidegger is directly linking causal thinking with the supply chains of modern industry; they are inseparable. The very act of determining one process as following from another allows it to be repeated, using comparable elements. Causal thinking depends on the repeatability of the process in order to be intelligible. Heidegger elaborates this point in *The Principle of Reason*, where he argues that the principle insists that “every being necessarily has a reason” (9). Though itself innocuous, it

creates creates the conditions under which "something 'is' only insofar as a founded cognition has secured it for itself as its object" (27). Heidegger is suggesting that our desire to find an absolute ground or reason for things leads only to their objectification, embedding them in causal processes that lead only to the requisitioning of industry. To use an analogy, suppose we were dropping stones from a tower to study gravity. To form a hypothesis and ultimately prove it requires experimentation; a supply of stones is needed. Stones become available and replaceable for dropping. From there, it is only a step away from utilizing such a supply for technological processes. Heidegger is suggesting that this implication of causality underlies the increasing coordination of industrial production, where things become raw material that can be used and replaced, *put into position* for this or that purpose. This is the character of the standing reserve, and Heidegger sees it engulfing everything, including the human.

Underlying the standing reserve is a danger, laced with threats of a collapse or disaster. Heidegger begins by identifying the present moment as “distanceless” (3). Distanceless, the condition of things being neither near nor far, but relationless, is a problem precisely because all things are made present to one another by technologically enhanced communications, travel, and recording. What makes things present to one another neither makes them closer nor preserves their remoteness, but merely brings them into the domain of the “uniformly distanceless.” Something in the character of beings in their immediate, distanceless presence to us is an index for Heidegger of the ways that everything now as its standing as a piece in the “standing reserve.” That is to say, if technology has made everything uniformly present, we should understand this presence as the effect of a positioning.

There's a great deal that Heidegger's writings on technology are doing, not the least of which is to challenge our notion of technology as a product of human will or agency. Likewise, that technology is limited to the domain of the actual that it circumscribes. Rather, technology is an historical juncture, whose essence joins the history of metaphysics with material practices. The most concise definition appears as follows, "According to its essence, technology, reigning of its own accord, is the gathering of positioning in the sense of a requisitioning into standing reserve of all that presences" (63). To walk backwards through this, what comes to presence is taken, used, placed into the standing reserve. The standing reserve is the character of circular replaceability of things put to the service of technology. The famous example given in "The Question Concerning Technology" is the Rhine which, once set into position by the hydroelectric dam, becomes a standing reserve for energy. But this setting into position, as the abstracted essence of technology, presents a danger that Heidegger identifies in the "unguarding" of the thing. The conditions of nearness and distance that are erased are precisely what gives a thing its place, its environment that allows its security. The distancelessness, that is the character of the standing reserve, has for Heidegger certain implications that are quite startling, as Heidegger remarks:

> Through such requisitioning the land becomes a coal reserve, the soil an ore depository. This requisitioning is already of a different sort from that whereby the peasant had previously tended his field. Peasant activity does not challenge the farmland; rather it leaves the crops to the discretion of the growing forces; it protects them in their thriving. In the meantime, however, even the tending of the fields has gone over to the same requisitioning that imposes upon the air for nitrogen, the soil for coal and ore, the ore for uranium, the uranium for atomic energy, and the latter for orderable destruction. Agriculture is now a mechanized food industry, in essence the same as the production of corpses in the gas chambers and extermination camps, the same as the blockading and

> starving of countries, the same as the production of hydrogen bombs (27).

This is the character of the standing reserve, the violence and danger underlying this framework of technology. Technology's positioning of things is not just an analogy between different things humans do – factory farming, mining, mechanized warfare and genocide – but rather a condition that has also set us into position such that these all become possible. This is what Heidegger calls "the danger," and at its darkest it appears as this "orderable destruction." In these terms, technology "unguards" the thing, removes it from its protection and leaves it exposed. I think of the ways fossil fuels accelerate technological advancement, which call for more fossil fuels, in a positive feedback loop that also effects a great dismantling of the biosphere as we know it. All of these are held in place by the same conceptual joint. In Heidegger's diagnosis of this danger, the essence of technology becomes formalized as a positioning and, furthermore, a dismantling. It is a fundamentally entropic view, as things become increasingly unmoored, vulnerable in the face of potential use and destruction, as a process not in the control of humans but following its own logic.

Heidegger's most incisive comments on cybernetics focus not on the content of its claims, but on its social and historical function. Cybernetics is not simply a body of scientific principles, but the culmination of a tendency in the history of thought toward technological positioning. This technological determination obeys a logic outside of human agency, and its workings correspond to a looming danger facing humanity. Cybernetics is more of a historical force than an idea, sweeping everything up in its wake. Heidegger would find nobody in greater agreement than the founder of cybernetics, Norbert Wiener.

Norbert Wiener shows an interest in irreversible, historical processes that joins his purely scientific thought with his musings on the impact of cybernetics on society. Through his thinking of temporality, we find that Wiener inadvertently comes to the same conclusions as Heidegger. The first chapter of Norbert Wiener's *Cybernetics* describes the difference between a "Newtonian" and a "Bergsonian" conception of time. In the Newtonian version, time is reversible because physical interactions are idealized. A pendulum swing is symmetrical because its movements are reversible under ideal conditions. Wiener is gently taking to task a vision of the universe like Laplace's, in which its future and its past can in theory be knowable given awareness of the position, velocity and mass of all of its parts. For Wiener, this conception of the universe is untenable, and cannot account for most complex processes, including life. Instead, Wiener turns to a notion of irreversible time that he attributes to Henri Bergson. Pointing to both meteorology and evolutionary history as scientific objects whose processes cannot be knowable in reverse, Wiener attributes to both "a mechanism by means of which a fortuitous variability . . . is converted by a dynamical process into a pattern of development which reads in one direction" (37, "Newtonian and Bergsonian Time"). This is Wiener's attempt to define communication, applying the statistical nature of information theory to all physical processes. And it depends, crucially, on a special redefinition of time. In this understanding of time, all potential variations and states of a system are decided as if by a wager. An answer yes, or no, the random motion of a particle going this way or that. A dice throw. To cast one's lot in this conception of time is to break from history in an all-deciding instant.

Wiener's remarks on cybernetics in relation to time are not mere preface, but indicate an orientation to his own work that will stall his ability to continue. We

observed in the first chapter that Wiener was concerned about the place of cybernetics in history, straddling the line between popularizing cybernetic futurist and a politics of melancholy and refusal. Wiener's self-appointed role as custodian of the public reception of cybernetics was not motivated by confidence in the universal value of his project. Wiener found his own creation, like the legendary Golem he frequently invoked, to be terrifying. Rather than the peaceful, rationally automated and perfected cybernetic society often promised, Wiener saw cybernetic research as an endless drive to create more weapons. He writes,

> The effect of these weapons must be to increase the entropy of this planet, until all distinctions of hot and cold, good and bad, man and matter have vanished in the formation of the white furnace of a new star. … Like so many Gadarene swine, we have taken unto us the devils of the age, and the compulsion of scientific warfare is driving us pell-mell, head over heals into the ocean of our own destruction (129, *The Human Use of Human Beings*).

Wiener invokes entropy as the driving force of this process. Paradoxically, that very process which formally defines information, organizes cybernetic systems, and is utilized by humans for technological revolution erases the distinctions information rests on, leads to disorder, and is at bottom out of the control of humanity. Wiener's mixed metaphors - the nuclear fusion of stars and bombs with the "ocean of our own destruction" - suggestively implies the danger that Heidegger pointed to. Wiener's use of the word, "ocean," does not appear incidental in this light; the "steersman" of cybernetics is based on the metaphor of the ocean for entropy. But now, according to Wiener's apocalyptic vision, the entropy of the ocean characterizes everyday life, haunted by the specter of total destruction.

Norbert Wiener's self-reflexivity can be attributed to what we know of his complex persona, though we may also attribute it to a self-reflexivity inherent in cybernetics itself. Feedback, the principle of self-correction by making the output of a system its input, is a notably slippery concept, quickly scaling reflexive layers. Feedback is an attempt to scientifically define that which we increasingly refer to as "meta," inviting a turn back on itself. The later cybernetics scholars, especially those interested in autopoiesis, deliberately link ontological circularity with feedback, arguing that self-reference is essential to living systems.

What makes Wiener's introspective turn more interesting is that he restores material phenomena to cybernetics in a nontrivial way, furnishing the resources of cybernetics for thought, as well as the tools to critique it. In thinking of society itself as cybernetic system, Wiener and Heidegger reveal something perhaps systemic in how we think about cybernetics. Attentiveness to Wiener's remarks on time indicate a broader concern with the temporality of cybernetics. Though Heidegger remarked, as we observed above, that "No prophecy is needed" to see the implications of a cybernetic future, the force of Heidegger's language is rooted in prophecy. Indeed, there is a general tendency for cybernetics to take hold of our thinking of the future.

Thinking about cybernetics is often fixated on its own temporality, and it takes a peculiar form. In its more positive valences, often taken up by those most enthusiastic about the project, the constant and irreversibly changing nature of things is taken to be an overall boon for an ontology (and scientific project) free of Newtonian and metaphysical presuppositions. But in reflecting on the moment of the purported historical shift to such awareness, temporal considerations take a different

character. It is bookended by a past that is now and forever impossibly remote, and by a future that cannot be determined.

The 'moment' in which cybernetic ideas begin to impact society and history becomes an ambiguous but powerful event. Wiener's writings on cybernetics and society indicate that this event, as irreversible as thermodynamic processes, is one of *crisis*. The etymology of crisis suggests a turning point, a separation, a decision, and in this regard any reflection on cybernetics faces the question of such a crisis ("Crisis," *Online Etymology Dictionary*). We will soon find that many thinkers of cybernetics and politics will engage this temporality of crisis as a direct inheritance of Heidegger's writings on technology. Analysis of this crisis would shift from the inhuman workings of technology itself to that of political regimes either directly or indirectly built on the cybernetic apparatus. In the concrete, political sense, it is in neoliberal globalization, which is marked by an automation of finance and governance, the use of communications media for state surveillance, and the precarity of lived experience that people are subjected to.

Political writings on cybernetics are widely divergent. And yet, I want to suggest that there is a common denominator in a strong indebtedness to Heidegger's writings on technology. Though many works in the 20th-century continental tradition have either utilized cybernetics principles with great productivity, or elaborated on its risks and limitations, none show evidence of having escaped the particular historical contingency that made cybernetics appear inevitable.

Bernard Geoghegan's enormously helpful essay, "From Information Theory to French Theory: Jakobson, Lévi-Strauss, and the Cybernetic Apparatus," provides a historical narrative of the reception of cybernetics in 20th-century French thought.

Geoghegan Compellingly argues for theory's indebtedness to the proliferation of cybernetics concepts in structuralist writings by Roman Jakobson and Claude Lévi-Strauss. The two thinkers helped bolster the structuralist program by aligning with information theory principles, enjoying funding from the Rockefeller Foundation's support for cybernetic approaches to the humanities and social sciences (110-116). Jakobson and Lévi-Strauss distributed copies of Shannon and Weave's *The Mathematical Theory of Communication* to Jacques Lacan, Louis Hjelmslev and other prominent linguists (111-112), as well as securing funds for a conference on cybernetics in Paris, with Lacan, Émile Benveniste, and Jean Piaget in attendance (119).

Along with the robust support for such research on an institutional level, Geoghegan traces the impact on how theory was written. He observes that after Lévi-Strauss' funding plateaued, his writing picked up the slack, becoming what Geoghegan calls "an innovative poetics that itself comprised a mode of cybernetic experimentation and analysis" (19). This poetics, which Geoghegan sees culminating in *The Savage Mind*, shifts from the precise mathematics of information theory to a suggestive "interpretation of cultures as dynamic systems of communication in which language, women, plants, hunting procedures, and economic practices circulated among one another" (123). Cybernetics becomes a body of metaphors and tropes, rather than fixed structures, using information in particular to describe the world with greater dynamism and nuance. This "poetics" would lead, after a synthesis with Marxian critiques of cybernetics, to the broader employment of information and coding metaphors in post-structuralism that Geoghegan then dispatches with somewhat hastily. Pointing especially to Derrida, Lyotard and Deleuze, these later

thinkers fashioned a "mode of writing that deployed cybernetic tropes and problematics to thematize the historical and political frameworks of communications and science" (124). Geoghegan's essay, which is an indispensable reconstruction of the legacy of cybernetics in French thought, stops here with this restaging of cybernetic principles to upend the scientific project, and to advance new lines of political struggle.

However, the key figure that is missing here is Heidegger's discussions of technology as they are applied to cybernetics. Though Geoghegan treats the use of cybernetics in its political valences, an understanding of how political thought engaged the discipline in impoverished without including Heidegger's contributions. The analysis foregrounds the optimism of cybernetics in bolstering a global liberal project, while downplaying the temporality of crisis that pervades the entire discourse. To varying degrees, this would also shape political assessments of cybernetics. Elaborating this more fully is to find that nearly all discussion of technology after Heidegger is to engage the parallels between the purported culmination of metaphysics and the rise of a global political order based on the hidden workings of technology.

By the time Derrida was writing *Of Grammatology*, much of which was devoted to critiquing Lévi-Strauss, cybernetics was on the wane, though still playing prominent role in the human sciences. He argues that his "historico-metaphysical epoch *must* finally determine as language the totality of its problematic horizon," a horizon unifying "the most diverse researches and the most heterogeneous discourses" (6). This prominent role afforded to language is none other than information, which he traces through "the contemporary biologist [who] speaks of writing and *pro-gram*

in relation to the most elementary processes of information within the living cell" (9), and "the development of the*practical methods* of information retrieval [that] extends the possibilities of the 'message' vastly" (10). The very application of cybernetics to the human sciences that bolstered Lévi-Strauss' reputation was, for Derrida, a "nonfortuitous conjunction" that degraded language, failing to properly understand the primacy of writing in their mathematical understanding of communication. Derrida found questions of writing, and their attendant relation with the history of metaphysics (our primary concern here),

> And finally, whether it has essential limits or not, the entire field covered by the cybernetic *program* would be the field of writing. If the theory of cybernetics is by itself to oust all metaphysical concepts … which until recently served to separate the machine from man, it must conserve the notion of writing, trace, *grammé*, or grapheme, until its own historico-metaphysical character is also exposed (9).

It is evident that cybernetics remains within view as a stand-in for technology, as it does for Heidegger. The cybernetics in Derrida's text is a figure with a "historico-metaphysical character" rather than a set of scientific concepts. It is specifically a figure so recognizable that simply naming it would be sufficient. It is recognizable in just the same way that Heidegger's references in "The End of Philosophy and the Task of Thinking" are, and indeed, Derrida appears to pick up where Heidegger left off. What remains to be "exposed" is its "historico-metaphysical character," its standing in the historical unfolding of metaphysics, or technology. Derrida is explicitly echoing Heidegger in this respect; cybernetics is a juncture in the history of a technological ontology. This juncture is in "the history that has associated technics and logocentric metaphysics" that "now seems to be approaching what is

really it's own *exhaustion*" (8). Derrida explicitly evokes the completion of metaphysics in cybernetics as the end of philosophy.

Following Derrida, Jean-Luc Nancy's *The Creation of the World or Globalization* underscores the historical trajectory of metaphysics-technology as coming to a close, resulting in none other than globalization. And further, that this result has its own temporality of crisis. He writes,

> If metaphysics, as such, itself essentially historical, accomplishes itself in the form of technology, and if technology must be understood as the planetary domination of the absence of beginning and end, . . . how can one conceive of this process and thus conceive of history except according to the exhausted themes of progress and/or of decline, of the fortunate and/or unfortunate accident? (81)

Heidegger's notion of "the end of philosophy" looms over these pages, and the strange temporality of the cybernetic moment shapes Nancy's conception of this "process." Like Heidegger, it hovers between the abstract and concrete, emphasizing the "planetary domination" that characterizes cybernetics' contribution to globalization, while this domination takes place not through any active agent but by "the absence of beginning and end." Cybernetics does not figure in this text, but its outline - the culmination of metaphysics in technocratic globalization - does. He continues, observing that the joining of metaphysics and history assumes "the possibility that a process would complete the realization of a reason, of a ground, and of a rationality. It is thus the possibility that the historical process functions as a natural process." But metaphysics cannot assure this ground, introducing a fundamental rupture in the history it guides. The result is a temporality of crisis that cannot be named by "the exhausted themes" metaphysics uses to understand itself in history.

The joining of cybernetics and metaphysics is peculiar - it introduces two movements, one that totalizes thought by seeking increasingly absolute rationality for things, and totalizes the world by coordinating human and nonhuman activities under a single cybernetic regime. As a process, it is uniquely self-directed, in no way representing human will or providing means to a human end. For, Nancy metaphysics is "the flight into a verifying autonomy of technology," which "repeats in an infinite abyss, all of the constitutive aporias of the *auto-* in general (89). Thinking of this as bound to cybernetics, we find in the cybernetic moment a body of forces working independently and self-directed, our participation in which risks leading to an infinite regress of verification that occludes an actual understanding of what is happening in the world.

If Nancy's understanding of technology rests primarily on a more abstract notion of metaphysics' unfolding through history, Bernard Stiegler's *Technics and Time* places emphasis back on technology itself. He, too, is keyed into its autonomy. De-emphasizing the political and abyssal nature in favor of an attentiveness to technology in its own right, Stiegler is attentive to its autonomous unfolding. Stiegler identifies this autonomy and systematicity of technological change as "what absolutely distinguishes modern technics from any other epoch." Stiegler, much more invested in anthropological questions of the human, finds the cleaving point is in the shift of agency from the human to technology itself, which "commands (*kubernaô*, the *etymon* of cybernetics) nature. Before, nature commanded technics. Nature is consigned by technics in this sense: nature has become the assistant the auxiliary; in similar fashion, it is exploited by technics, which has become the master." (24). Stiegler, attentive to the etymology of cybernetics, identifies part of its workings to

these evolving forces. And yet, like Heidegger, he is emphasizing something other than cybernetics principles proper; rather, he is turning to their steering as an almost meta-technological principle, defined as a relation of command rather than as the science of dynamic organization that it is understood to be by its practitioners. He is also attentive to the "veritable collapse of technocratic euphoria" in a host of symptoms outlined at length, emphasizing the increasing vulnerability and instability of communications technology (85-86).

The above thinkers - Derrida, Nancy and Stiegler - are more or less direct readers of Heidegger, so their attentiveness to the aporetic historical character of cybernetics is perhaps unsurprising. More compelling are the ways other thinkers echo similar points. Jean-Francois Lyotard's writings on postmodernity opt for a sober, if occasionally sardonic view that productively employs Heidegger to more explicitly political ends, connecting cybernetics to problems of capital. Lyotard's seminal *The Postmodern Condition* diagnoses postmodernity as a period of computerization and automation of knowledge practices in the form of information transmission. In the introduction, "The Field: Knowledge in Computerized Societies," Lyotard traces the influence of cybernetics across disciplines, with its emphasis on streamlined and scientifically rationalized communication. Cybernetic visions of a rationalized and self-regulating society, beginning with Talcott Parsons and taken up in Luhmann's theory of social systems, is observed by Lyotard to have received the tacit approval of the "technocrats." Lyotard notes a corresponding shift in the nature of political engagement and critique, writing,

> But this realism of systemic self-regulation , and this perfectly sealed circle of facts and interpretations, can be judged paranoid only if one has, or claims to have, at one's disposal a viewpoint that is in principle

> immune from their allure . This is the function of the principle of class struggle in theories of society based on the work of Marx. 'Traditional' theory is always in danger of being incorporated into the programming of the social whole as a simple tool for the optimization of its performance; this is because its desire for a unitary and totalizing truth lends itself to the unitary and totalizing practice of the system's managers (12).

Lyotard is arguing that with the onset of cybernetic society, critique itself becomes a part of the operations of a self-regulating social sphere, allowing capital to perpetuate itself. A cybernetic logic is not a liberatory one, but rather one that continues to absorb all potential variation into itself. This is essentially the workings of Heidegger's Gestell, as we will see Lyotard making explicit in later writings. The novelty, other than its hard-nosed and detailed focus on existing knowledge practices, and play of information against his notion of social interactions as "language games," is the alignment of cybernetics with capital. A cybernetic society, exerting control over its subjects, is economic and ideological, a shift from Heidegger's emphasis on ontology. Lyotard's observations are novel, but they ultimately build on an intellectual architecture constructed by Heidegger. The difference is terms, as capital is described in ways that are almost synonymous with technology.

Where *The Postmodern Condition* is marked by a restraint, given the cross-disciplinary audience Lyotard was asked to write for, in other writings he is able to make the connection between Heidegger, cybernetics and capital much more explicit. The essay, "Time Today," makes his debt to Heidegger's Gestell, playfully termed the "most perfect monad," explicit. The tropes remain present: that cybernetics is inherently tied to technoscience and threatens to absorb human agency into its operations. The difference is that Lyotard writes about "the techno-scientific apparatus which Heidegger calls the Gestell" as interchangeable with capital. He

writes, "Capital is not an economic and social phenomenon. It is the shadow cast by the principle of reason on human relations" (69, "Time Today," *The Inhuman: Reflections on Time*). If Heidegger appears to join the unfolding of metaphysics with its historical actuality in cybernetics, Lyotard turns technocapital back to metaphysics and the principle of reason. The reason, for Lyotard, is not only a critique of capital or of technology, but a broader concern with temporal questions related to technology. Mulling over the philosophical implications of the distant but eventual collapse of earthly life due to the death of the sun, Lyotard turns his joining of capital, technology and metaphysics toward a meditation on entropy and historical inevitability:

> As is clearly shown by the development of the techno-scientific system, technology and the culture associated with it are under a necessity to pursue their rise, and this necessity must be referred to the process of complexification (of neg-entropy) which takes place in the area of the cosmos inhabited by humanity. The human race is, so to speak, 'pulled forward' by this process without possessing the slightest capacity for mastering it (64).

Lyotard deftly manages to echo echoes Norbert Wiener's frantic anxiety in his assessment of cybernetics, and Heidegger's analysis of technology, in a single move. The subsumption of "technology and the culture associated with it" with the "techno-scientific system" indicates that technology's changes generally follow the outline provided by Heidegger, continually challenged forth, all-encompassing and inevitable. By describing these operations as a "process of complexification (of neg-entropy)" he is making clear an indebtedness to, if not an outright reading of, Wiener's understanding of life and society as an island of negative entropy against a backdrop of entropy. The difference is that there is little space for the human's "capacity for mastering it." Where Wiener's anguish represents that of a tragic figure

attempting to constrain the forces he'd unleashed, Lyotard has already moved forward to a thinking of conditions after the foreclosure of human agency.

In remarks such as these, we find it not merely possible but almost necessary to join Heidegger's understanding in technology to a political framework. As a result, the workings of technology become either inseparable or indistinguishable from capital. The result is an analysis voided of traditional Marxian analysis of class, the state, or ideology; given that capital is a self-propelled outside of human agency. Perhaps this relationship is taken to be self-evident. But it is in part an artifact of the reception of Heidegger. The question I raise here is whether this captures in essence what took place in the cybernetic moment.

The result is a line of analysis and critique that treats cybernetic governance not as something that can be used either properly or not, but rather as the raw exercise of power in its contemporary shape. On the eve of the Occupy movement, Bifo Berardi wrote *The Uprising: Poetry and Finance*, which argues for poetry as a counter to the dominance of technocapital. Diagnosing the conditions by which individuals and entire nations become shackled to unpayable debt, the significant factor is the automation of language according to the rules of finance. Berardi writes, "Governance is a keyword in the process of the financialization of the world. Pure functionality without meaning. Automation of thought and will. The embedding of abstract connections in the relation between living organisms" (28-29). Berardi, writing in 2011, is primarily concerned with finance, though the cybernetic themes are evident. Here, finance is the steersman and primary automating force. What makes Berardi a notable turning point is his faith that poetry can restore what cybernetic finance has taken from us, which we will examine later in this chapter.

The significance of governance is best explored by Giorgio Agamben, who finds cybernetics playing a significant role in the contemporary liberal state. Building on Michel Foucault's writings on neoliberalism, in which the earlier author investigated "how liberal governmentality is currently programming itself" (78), as a " transition to a new form of rationality to which the regulation of government is pegged" (312, *The Birth of Biopolitics*), Agamben goes where Foucault does not: exploring the cybernetic roots of this governance. In his essay, "For a theory of destituent power," Agamben traces cybernetic governance to what he identifies as its culminating point: contemporary neoliberal governance. Writing on the mercantilist "physiocratic" economics of François Quesnay, Agamben identifies cybernetic approaches to famine and other catastrophes. He writes,

> instead of trying to prevent famines, [Quesnay] decided to let them happen and to be able to govern them once they occurred, liberalizing both internal and foreign exchanges. 'To govern' retains here its etymological cybernetical meaning: a good kybernes, a good pilot can't avoid tempests, but, if a tempest occurs, he must be able to govern his boat, using the force of waves and winds for the navigation. This is the meaning of the famous motto "laisser faire, laissez passer": it is not only the catchword of economic liberalism: it is a paradigm of government.

Agamben describes a process whereby governance shifts focus to management, rather than prevention, of crisis. Likening crisis to the waves of the sea, the ship of state's new aim is to survive the storm. The shift is to a model of governance that assumes control over the effects rather than the causes. In this view, cybernetics first institutes a disruptive, precarious world, then oversees everything under its purview to manage that precarity. This managing does not eliminate the precarity, but rather minimizes its effects through feedback. This feedback is not strictly benevolent, but rather, operates as part of the self-preservation of the system itself. To clarify, this is an abstract

model of a host of human and non-human agents in a public sphere; to speak of cybernetics as the single agential host of this political development is not necessarily a good thing. But rather, this is the logical end point of cybernetic society as it is envisioned. Agamben writes further, "If government aims to the effects and not to the causes, it will be obliged to extend and multiply controls. Causes demand to be known, while effects can only be checked and controlled." The result is a paradoxical joining of economic liberalism, social disorder and increasingly heightened programs of surveillance.

Agamben suggests that cybernetics' impact as a social and ontological danger lies in the following: the institution of regimes of governmentality, and the imposition of an ontological frame that conceives of living things not in terms of their own life, but a minimal and mechanized definition that is easy to control and to sacrifice. This can be connected to the making-information of all things, as the noise that serves as the vital well-spring of information is also a making-chaotic of the world.

There is a fundamental ambiguity in these considerations. Because the unfolding of technology, and with it technocapital, has become an ontological matter, the effect is a depoliticizing removal of an agent, displacing it onto forces best identified with the world as such. As a result, any notion of public discourse and collective decisionmaking finds itself in opposition to a cybernetic society. And yet, the description Heidegger provides, then lending coherence to later political thinkers, outlines the political stakes. In the rest of this discussion, we will avoid any attempt to resolve these questions. Rather, we will examine only how certain thinkers themselves appear to have responded to them.

The "unguardedness" of the thing as a piece of the standing reserve remains a political question. In this regard, it is not in error that Heidegger's conception of technology is connected to anticapitalist politics. The language of the Invisible Committee and Berardi inherit a suspicion of a cybernetic future that is at its heart Heideggerian. To square the circle, it is because to be a part of the standing reserve, to be abandoned to the danger, is to be conceived of as information: decontextualized and infinitely recombinable. To do so, as the Invisible Committee especially reminds us, is to reimagine the world as a vulnerability to which one is forcibly exposed, reducing life to "bare life," and thus haunting life with the specter of death. Where Marxist analysis of early modern primitive accumulation emphasizes the closure of the commons, these interpretations of cybernetics suggest that a similar process is taking place at the level of life itself. The evental temporality by which cybernetics is discussed is the temporality of crisis.

What is our response to such a crisis? Is technology to be opposed? It is worth recalling that from the perspective of cyberneticians themselves, cybernetics was a radical epistemological break allowing new conceptions of what cybernetics would mean. We can see that, by turning to the second-generation cyberneticians, especially Maturana and Varela, there appears a theory of mechanism that can perhaps adequately respond to Heidegger, thinking something like positionality with a comparable level of depth. It should be noted that, while the second cyberneticians were certainly participating in the same military-funded research as their earlier forebears, they jumped all the more quickly into private research, valuing the autonomy of systems just as much as the earlier cyberneticians sought to connect them. Andrew Pickering explicitly draws on Heidegger's concept of positionality, in

his text appearing as "enframing," suggesting that the British cyberneticians (Ashby, Walter, Pask and Beer, among others) were engaging an altogether different approach to scientific inquiry. He writes,

> The history of British cybernetics offers us a different form of science and engineering, one that does not seek to dominate nature through knowledge. I want to say that one can distinguish *two different paradigms* in the history of science and technology: the one that Heidegger despised, which we could call the Modern paradigm, and another, cybernetic, nonModern, paradigm that he might have approved of (470).

Pickering proceeds to describe the British cyberneticians, namely Pask and Beer, whose attempts to biologically automate factories were based, at least in theory, on the fundamental autonomy of the pond ecosystems they attempted to use. Pickering is using Heidegger with full sincerity as a rejoinder against exploitative science. He draws from the second-generation cyberneticians a sense that science can be conducted otherwise, that science need not depend on a mastery or domination of the materials at hand. However, we've seen that in Heidegger, positionality is not simply a scientific or technological practice, but rather is the gathering of positioning as such. Or, to put it more simply, all things are undeniably part of the standing reserve, which can't be changed through any willful action. The way forward is to identify the technological as firmly entangled in the natural, and to look toward what destabilizes it from within.

Maturana and Varela, in their elaboration of autopoiesis, come to an understanding of technology with at least a partial attunement to the nuances of Heidegger's understanding of technology. Indeed, we can perhaps read autopoiesis as only possible as a concept *after* Heidegger, or beyond him. In their jointly-written

essay, "Autopoiesis: the organization of the living," Maturana and Varela offer a radically extended notion of machinery; rather than being limited to strictly causal effects, autopoiesis defines a living organism as a machine that manufactures not components for another system, but for itself. Further, an autopoietic machine maintains the relations of production of the means of self-production. This circular vision absolutely follows the terms of Heidegger's circular replaceability of the standing reserve; the difference is that these systems are limited rather than being the all-encompassing world technicity that Heidegger paints so grimly.

Maturana and Varela distinguish between systems who define their own terms of self-production, and systems whose production only serves another system. In doing so, they not only echo Heidegger, but also offer points of extension. They write,

> Machines are usually viewed as concrete hardware systems, defined by the nature of their components and by the purpose that they fulfill in their operations as man-made artifacts. This view however is obviously naive because it says nothing about how they are constituted (77).

They continue to elaborate the theoretical principles of these machines' constitution, but it is worth lingering here. They are precisely calling attention to the same misunderstandings of technology as Heidegger, with a subtle shift of emphasis. The popular understanding of machinery (or, substitute "the essence of technology") indicates present machine parts, without factoring in broader system in which they are situated. This is precisely where Heidegger intervenes, making recourse instead to the ways that we think of means and ends, and the broader context of industrial production, as a sign that technicity is a force setting its own terms and putting the human into position. Maturana and Varela utilize this logic, but with the formal principle that all systems emerge as a function of their distinction from their

environment. The role that environmentality plays in autopoiesis cannot be underestimated; relationships between system and environment serve as the dialectical underpinning behind all systemic interactions.

Further, they distinguish between autopoietic (self-making) and "allopoeitic" machines, whose components "are produced by other processes which are independent of the organization of the car and its operation" (79). This describes positionality in a different register, not by separating the "real" autopoietic machines from the others, but to indicate where our attentions should lie. An allopoietic machine's components are produced by a system that includes it, indicating that the self-organizing system is, like Heidegger's concept of positionality, bigger than a single machine. What this allows is a revision of Heidegger's concept which, while still possibly working at a global and historical scale, need not be singular and all-encompassing. The point is that it cannot be made, but allowed to emerge. An autopoietic system subsists. Is this all the more caught up in positionality? Perhaps, but we can also read it as an engagement with a firm epistemo-ethical horizon.

But as we have seen, the profound questions raised by cybernetic governmentality suggest that autopoiesis and crisis are not mutually exclusive. Heidegger’s theory of positionality, which lends credence to a theory of neoliberal power structures as being autopoetic, suggests that the claims to epistemological radicality on the part of the second-generation cyberneticians is potentially a mere palliative. Where the responses above to cybernetics have been strongly deterministic and very much in the stamp of Heidegger, there is an engagement that shares the determinism but does not concern itself with thinking about technology in such an apocalyptic way. Instead, it opts to describe society in cybernetic terms, in ways that

are coldly neutral. It is the media theory of Marshall McLuhan, which joins considerations of media and technology to think of information as operative in the world.

McLuhan, an avid reader of cybernetics, provides a picture of cybernetic society that resonates with the ontological claims about technology in history that we see in these other thinkers. McLuhan's major argument - that media are extensions of the senses, is fundamentally an argument about positioning. They also raise related questions of the temporality of technology, from a vantage point that allows us to engage the contradictions of cybernetic principles and cybernetic society.

McLuhan's writings are both praised and dismissed for their tendency to treat media in a generalized, cross-historical manner. McLuhan identifies any medium as an extension of a sense, and that electronic communications represents the "extension of consciousness" (19). McLuhan understands 'extension' as an acceleration, positioning, and communication, writing that "the 'message of any medium is the change of scale or pace or pattern that it introduces into human affairs" (24). This conception treats information along Wiener's lines, as communication's effects along with its structure. In doing so, McLuhan thinks of technology and communication as joined, functioning like feedback and information in a cybernetic system.

One of McLuhan's most productive ideas is in his distinction between "hot" and "cool" media. Self-consciously drawing on youth slang, the two terms provide the basis for thinking of the kinds of effects media have, with hot media being "linear" and "fragmenting" and cool media being "participatory" and unifying. With seeming effortlessness McLuhan distinguishes between cinema (hot) and television (cool), the Charleston (hot) and the Twist (cool), industrial machinery (hot) and information

technology (cool), and so on. McLuhan even proposes using these ideas for social planning, suggesting that societies may be "hotted up" or "cooled" by sanctioning different media at different times (41). This tendency to impose this division on media will result in contradictions and ambiguities that McLuhan ultimately struggles to resolve. What is important is that his two categories are conceived in terms of information. A hot medium is in "high definition" and "well filled with data," while a cool medium has "a meager amount of information," which must be "filled in or completed by the audience" (36). McLuhan's conception of cool media describes the attitudes and behaviors of the cybernetic moment: improvisation and interaction along the lines of a feedback model. Though the hot/cool schema does not correspond to any strict cybernetic theory, its attempt to formalize interaction along the lines of information structures brings it firmly in line with the cybernetic project as a whole.

More compellingly, McLuhan uses his hot and cool distinction to make broader claims about intellectual history. For McLuhan, the print media lend themselves to societies that are fragmented, logical and linear, and as such the dominant philosophical trends are reduced to those terms. Something resembling a critique of Western metaphysics appears when McLuhan describes changes in print technology:

> After three thousand years of specialist explosion and of increasing specialism and alienation in the technological extension and alienation in the technological extensions of our bodies, our world has become compressional by dramatic reversal. As electrically contracted, the globe is no more than a village. Electric speed in bringing all social and political functions together in a sudden implosion has heightened human awareness of responsibility to an intense degree (20).

McLuhan's primary forebear, other than Harold Innis, was Eric Havelock's landmark study, *Preface to Plato*, which described the rise of Socratic philosophy as charting the changes in consciousness caused by writing. In his unique model of technological determinism, it is the changes in technology and media that result in societal and cultural shifts. Electronic media is understood as a rupture taking a similar shape to the end of metaphysics, but with a different valuation. Though McLuhan's notion of the "global village" has received scrutiny for its remnants of modernist primitivism and hippie overtones, it is fundamentally describing an increasingly global awareness created by electronic media. Contrary to what McLuhan sees as the isolating and fragmenting nature of written media, to which he rightly or wrongly attributes the rise of nationalism and intellectual specialization, electronic media simultaneously coordinates and decentralizes, joining social forces in a global network without a center. Media theorist that he is, these shifts do not simply change the external social structure, but also shape the our fundamental experience of the world. The scientific rationalism of the print age gives way to to a revival of "mythic consciousness" (46).

The most significant weakness of McLuhan's work is its very hipness; the author is frequently so glib and associative in his logic (itself supposedly in the service of the ideas he presents) that McLuhan's schemas often multiply distinctions unnecessarily. For example, McLuhan's hot/cool schema often makes it difficult to place the historical division point. On the one hand, the break from print ruptures "three thousand years" of hot media, while at other points better describes the distinction between modernism and postmodernism. For example, modernism is treated as a hallmark of the mechanical age. Cinema and radio, which with newspapers were the primary media of modernism, are frequently contrasted with the

coolness of television (40-41). That cinema and radio were non-print electronic technologies, and thus an essential part of the extension of consciousness through telecommunications, is gently elided. Likewise, the general aesthetic horizon of *Understanding Media* is shaped by modernism: James Joyce, Ezra Pound and Pablo Picasso are understood as anticipating the character of the cybernetic society McLuhan was describing. It is this modern/postmodern distinction that McLuhan attempts to negotiate in his extremely webbed analysis of "hot" and "cool" media, respectively understood as linear/single-channeled and nonlinear/multichanneled, shaping consciousness in distinct ways. McLuhan attempts to apply this as a distinction between historical epochs with two potentially contradictory frames. The first, on a longer time scale, is between the Cartesian rationalism of a print-driven post-Gutenberg western society and the new communal consciousness of electronic media. The second, focusing on the 20th century, argues for a similar shift from hot to cool along historical lines that line up directly with modernism and postmodernism. The fulcrum, if McLuhan's metaphors are any indicator, is cybernetic. All the buzzwords of cybernetic society - automation, interactivity, decentralization, information - are used to describe cool media.

Though one may be tempted to read the incongruities as a failure of McLuhan's analysis of media, with its tension between structural and historical interpretations, smoothed over by a glib and self-satisfied presentation, what remains is a general interpretive body of characteristics associated with the cybernetic age, and still present interpretive value relative to our above considerations of Heidegger and technology. McLuhan's media theory presents an understanding technology's essence as medial, shaping human experience in ways that can be understood historically.

Further, that the advent of electronic communications is a globalizing shift, with particular ethical and political stakes, that threatens the rupture of long-established intellectual traditions. Without being so facile as to make a direct analogy between the two, Heidegger (with his interlocutors) and McLuhan respond to similar stakes of the cybernetic moment, attentive its social/historical impact, the general outline of its effects, and the temporal questions raised by technological change.

If McLuhan and Heidegger appear to be responding to the same historical phenomenon, at least in rough outlines, one point of differentiation is in the thinkers' respective attitudes toward technology in general. Despite the nuances of both thinkers, it seems inescapable to think of them as being fundamentally opposed, with Heidegger taking a conservative view of technological change, and McLuhan embodying the optimism and cultural caché of the cybernetic moment. We will treat this problem in greater detail when we return to Heidegger in our discussion of poetry. But for McLuhan, it is worth engaging an under-explored subtext of his work, in which he critically engages how we think about technology and history. It will come to deepen McLuhan's potential for rich conversation with Heidegger, while raising a questions the philosopher does not.

A hidden subtext of *Understanding Media* is the "narcotic" effect of media, which he attributed not to media itself, but to the ways one attempts to understand it. McLuhan sharply critiques remarks by media mogul David Sarnoff, who argued that "The products of modern science are not in themselves good or bad; it is the way they are used that determines their value." McLuhan's reply is blunt. "This is the voice of the current somnambulism. . . . it ignores the nature of the medium, of any and all media, in the true Narcissus style of one hypnotized by the amputation and extension

of his own being in a new technological form" (26). This somnambulism, used interchangeably with "narcosis" and the "narcotic" effect of media, is not attempting to make general claims about how media effects people; he is not saying that everyone is dulled by media, or some related claim. Rather, he is outlining a peril in the very reflexivity in thinking about media. Echoing Heidegger, McLuhan bypasses questions of the valuation of technology in favor of a neutral description of its effects. Reflecting on media is itself mediated, and as such raises questions for how to approach it. McLuhan creates a cybernetic conception of it his deployment of Narcissus, in which reflection on media becomes a feedback loop reinforcing the abstracted self-image rather than the medium itself. A medium is an extension of oneself; beholding that extension is an amputation and separation, negatively interrupting the medial configuration of sensation. In McLuhan's least optimistic passages, the media scholar imagines the cybernetic mechanism behind the narcotic effect of media:

> It is this continuous embrace of our own technology in daily use that puts us in the Narcissus role of subliminal awareness and numbness in relation to these images of ourselves. By continuously embracing technologies, we relate ourselves to them as servomechanisms. That is why we must, to use them at all, serve these objects, these extensions of ourselves as gods or minor religions. An Indian is the servomechanism of his canoe, as the cowboy of his horse or the executive of his clock (55).

Like Heidegger, it introduces the link between technology, cybernetics and the human, in a way that assumes a displacement of the human – as the subject beholding its object, as the creater of a thing for its use as means to an end, and whose creations progress linearly in increasing levels of sophistication and complexity. These technologies, whether they are tools, companion animals or mechanical devices,

confront us with our own likeness and put us, spellbound, into their service. As servomechanisms, we become the adaptive devices of our technologies, in a relation of circular feedback that regulates them, but never absolutely determines them in the traditional sense. This subject-object relationship of human and technology becomes triangulated by cybernetics. If we take McLuhan's remarks on the narcotic, anesthetizing effects of media, we may at least find the resources understand the reception of Heidegger's critique of cybernetics. This is not to reject these polemics, as McLuhan can easily be accused of a similar myopia with regard to the his statements about the cybernetic moment. Perhaps the robust knowledge and cultural production of this time depended on the narcissus effect. On this matter, I choose only to place them on a different register, in order to understand them better.

Returning to Heidegger, we find that we are confronted with a range of problems with taking on his critique of cybernetics. I find that the simplest option is to understand the case as follows: the introduction of cybernetic principles into society, with the broader scientific, political, philosophical and cultural context that gave them support, led to society in part being amenable to reshaping on cybernetic grounds. This, of course, is supported by the not inconsequential conceptual overlap between cybernetics and governance, communication/control and the expansion of telecommunications with the automation of industry and finance.

Heidegger's critique of technology presages with startling accuracy the particular vulnerabilities and dangers introduced by cybernetic forms of control. The best of those receiving these ideas would expand on that vulnerability, those dangers, with greater analytic precision and sensitivity, while others risk falling prey to the totalizing structures and entropic evental temporality that is at times powerful, and at

other times resembles what McLuhan called the "narcissus" effect of media-enhanced self-reflection. Because information and thermodynamics are frequently conflated, and because thinking in terms of systems is frequently totalizing, it is easy to attribute to cybernetics the irreversible hastening of entropic forces, or the inevitable unleashing of them on humanity.

Synthesizing the figures we have engaged with thus far, we may make the following summary points about the reception of cybernetics. Despite the radicality of the claims of cybernetics, these questions of governance continue to haunt us in a time of crisis. Cybernetics is understood as responsible for a precarious global order, resulting from communications networks. Cybernetics is a conservative principle, describing how integrated communications networks can employ recursive feedback to stabilize systems: social, biological or otherwise. It follows that entities with some degree of power -- states, corporations, militaries, financial institutions -- will utilize this as a matter of autopoietic self-preservation.

Humans are not necessarily the agents of this self-preservation, though they experience its effects. Because humans are increasingly connected through cybernetic globalization, they are also governed by it. Governance determines the bounds of possible free decisions. More importantly, the self-preservation of conservative institutions does not simply mean this sort of control, but also the distribution of effects. The probabilistic nature of cybernetic control leads invariably to the seat of power being in the distribution of likelihood of potential adverse outcomes; environmental catastrophe, financial failure, infrastructural breakdown would be increasingly leveraged against the commons. This is precarity, the meaning of the

standing reserve. It is a general condition of society being integrated by communications networks.

Cybernetics raises profound questions of human agency. Some choose to understand power in terms of the human actors who do or do not hold a stake in it; others choose to understand power in terms of nonhuman actors like technology or global capital. Regardless of one's overall outlook, if one accepts that power is shaped in part by cybernetics, then the self-referential preservation of order against disorder applies first and foremost to power preserving its own means of continuing to exist. In any discussion of cybernetics, the problem of human agency is raised as intractable and aporetic. This aporia stems in part from how we define agency relative to technology. Regardless of the 'real' seat of power, cybernetic technologies are a human artifact in the image of humanity, that is then understood as shaping us in its image.

If we understand the precarity of the standing reserve to be the case, and to be intimately connected to what is called cybernetics, is it necessary to treat the agency of the human as permanently foreclosed? On this point, I am resolutely neutral, for several reasons. First, of course, that it is not within the scope of a work of literary scholarship to decide. Second, that the agential character of technology, media, social systems, capital or the state may be described without subscribing to a complete systematicity of any one of these. Third, and most importantly, that it may in fact be necessary to suspend judgment in order to engage what cybernetics does and means in the 20th and 21st century. If reflection on the nature of cybernetics risks the narcosis of thinking on our medial existence, analysis of this history of cybernetics cannot fall into the patterns set by earlier philosophers and media theorists, which would take the

crisis temporality of cybernetics as the final arbiter of ontological judgment. What is required is another path, which appreciates Heidegger and cybernetics as undertaking a crucial dialogue on technology and the future.

Setting the question of agency aside, we turn now to the question of poetry. Following our previous remarks, we must conclude that information is bound up with the social precarity of technology, regardless of how we conceive of cybernetics' (or humanity's) agency in the matter. What, then, would be the response? In the final lecture of *Insight Into That Which Is*, Heidegger offers a passage from Hölderlin, which reads, "But where the danger is, there grows / also what saves" (68). We will devote more space to this passage below, but it serves as a reminder that poetry would help guide the way past the danger of cybernetics.

Some would proffer language as itself the redeeming factor. Berardi, responding to what many see as the current face of technological positioning, neoliberal financial capital, says many beautiful things about poetry as a means of resistance. Contra information, poetry is deemed to have an intrinsic quality that separates it from information. He writes, "Poetry is the language of nonexchangeability, the return of infinite hermeneutics, and the return of the sensuous body of language" (139-140). This unabashedly romantic picture envisions poetry as having access to limitless meaning, in contrast to the sharply defined measurability of information. Further, it is rooted in "the sensuous body of language," making poetry a matter not of cybernetic devices without feeling, but the physicality of life in the cybernetic moment. Berardi's project of redemption rests on this capacity, and in the process advances some compelling possibilities for the matter of contemporary poetry. He proclaims, "When general intellect will be able to reconstitute its social

and erotic body, capitalist rule will become obsolete" (142). Or shall we say, cybernetics will become obsolete? The strengths, that we will not explore here, are in this model's appreciation of embodiment as the social body, manifest in erotic affects. Part of this is based in the 2010-2011 protests in Europe, the Middle East and North America, including the Occupy movement, and is thus attentive to the strategic mass claiming of public space.

Berardi's conception is romantic but not foolish; it has significant positive suggestions for what poetry can contribute to a global anticapitalist movement. And it is rooted in what Berardi sees as poetry's resistance to cybernetic automation: "Poetry is language's excess: poetry is what in language cannot be reduced to information, and is not exchangeable, but gives way to a new common ground of understanding, of shared meaning: the creation of a new world" (147). Poetry cannot be reduced to information; there is no more succinct way of making this point. If information means the reduction of language to what can be measured, and communication to a set of pre-given decisions, poetry can be understood as not operating in the same register. However, I propose that we cannot make so simple of a claim about information.

Information theory and poetry both measure language by prosody and by bits, and both operationalize language with performance and algorithms. Though there are very worthy reasons to treat them as incompatible, it is still the case that they related, and the source of the controversy in the first place. Thinking of the two non-oppositionally will assist in understanding how they dovetail in the cybernetic moment.

Though one can apply Heidegger's thought to Berardi's view, or even attribute such a view to Heidegger's thought, his thinking on language, poetry and art is doing

fundamentally different work. Heidegger is a thinker of finitude; the notion of poetry as a resource of "infinite hermeneutics" would be a step in the wrong direction, inserting an onto-theological understanding of language. While Heidegger is certainly attentive to the irruptive capacity for language, and poetry's transformative potential, he is also suspicious of any view that would prescribe a functional quality to poetry, even one as exalted as the making obsolete of "capitalist rule." Heidegger is not thinking of poetry and technology as oppositional, nor is he thinking them as the same. As we will see, the transformative process takes place within the technological itself, as the flash of insight that I will term cybernetic poetics.

Before we can arrive at this point, there is no question that Heidegger resisted any comparison between information and language, let alone poetry. The primary objection is that language has a unique character, which information either degrades or does not possess in the first place. Fortunately for us, on this point Heidegger engages the actual texts in much greater detail. He does so, in part, because his attempt to keep information and language separate presents significant challenges.

The texts of the postwar *Zollikon Seminars*, which include seminar remarks delivered before a scientific audience, and related correspondence with seminar organizer Medard Boss, shows that Heidegger read information texts in detail, and provided substantive replies. Throughout the seminars, Heidegger's engagement with science is hostile yet generous, walking his interlocutors through the phenomenological method. But there are moments where his poetic ontology begins to appear. In a letter to Medard Boss, he makes some notable remarks on information theory in relation to his views on language. After receiving an article from Boss in 1966, concerning recent developments in molecular biology, Heidegger zeroes in on

"its strange identification of purely chemical processes with events of linguistic communication," both of which the article identifies as "the processing of information." Heidegger is directly encountering the role that the information paradigm played in the development of modern genetics, and we may see him grappling - in a much more detailed way - with the the full analogical extensions of cybernetics. Heidegger makes the following point:

> Measured against it, the disclosing communication of saying is reduced to a mere series of reciprocal releasing mechanisms. Measured against it, the course of chemical processes is simultaneously elevated to linguistic communications. Both that reduction and that elevation presuppose that the specific and objective character of the two domains (material-energy process and language event) is disregarded. And this is due to the exclusive focus on information. This information is distinguished by the relationship of reciprocal steering mechanism. In this projection, everything is focused on these in order to guarantee an all-pervasive capacity for steering everything. This steering capacity is considered the leading characteristic of all events because by this standard a uniform, universal procedure is secured for all areas of science. Only then is the absolute "victory of method" over science made possible (*Zollikon Seminars*, 277-278).

Heidegger is intervening precisely in what we've identified as a major hypothesis of the cyberneticians, that the mathematics of the time series, by "communicating" the distribution of components of a system. This thesis, which underlies the analogy between the "material-energy process and language event," to use Heidegger's language, is not the only feature of cybernetics but one of its most subtle and widespread components. Here, Heidegger is drawing less on the ties to the time series (of which it is unclear that he was aware) than the analogical flattening that results. This analogical flattening, which characterizes the 1960s systems discourse writ large, is for Heidegger a hallmark of metaphysics. He notes above that the move requires a "reduction" of the language event and an "elevation" of the material-energy process.

Heidegger will invoke the same logic elsewhere in his many accounts of the difference between humans and animals. In his lecture course on Johann Gottfried von Herder's *Treatise on Language*, titled *On The Essence of Language*, Heidegger's notes on the signature importance of language for the human includes some striking comments on the nature of analogy. He identifies in "the analogy, the presupposed correspondence" a situating of the human in "*the regulated economy of all living beings*," that is, a placing of the human in a rationalist, scientific order (7-8, emphasis in the original). Further, Heidegger argues that the analogy between human and animal is a simultaneous "reduction" of one term and "elevation" of the other. In the case of the human-animal distinction, it lowers the human and elevates the animal (23). Heidegger is clearly employing this logic here.

Derrida has observed that Heidegger's thinking on technology often utilizes metaphors of contamination, and in this regard shows a limit in his willingness to engage the potential intersections between information and language. By holding at bay any possibility of information resembling "the disclosing communication of saying," Heidegger can be seen as performing what Derrida calls "thinking of technique *as such* and *as an essence* tries in a classically philosophical manner to shelter the thought and language of essence from contamination" (172). Derrida suggests that Heidegger's turn to think of technology in terms of essence troubles his conception from the start. I argue that it is Heidegger's struggles to separate language from information that lead to a fundamental difficulty in thinking the nature of poetry.

This thinking is apparent in another text, the 1962 lecture, "Traditional Language and Technological Language." Here, as before, Heidegger's engagement with the actual texts of information and cybernetics is much more involved. As

before, Heidegger makes great effort to keep information and language separate. In this lecture, information corrupts language; technological language is "mere information," which is itself "a mere report of signal transmissions" (140-141). Likewise, technological language is aligned with information, without a clear linkage other than information's emphasis on clear pre-defined terms and instrumentalization. Joining the two would suggest that technological language is simultaneously language and information, either by being corrupted or by becoming something altogether different. In the lecture, Heidegger raises probing questions that link information with positionality, outlining the same process as taking place within language itself.

> In how far does what is peculiar to modern technology, which challenges humans forth, i.e. sets them up, into making natural energy available and securing it, come into effect also and precisely in the transformation of language into mere information? In how far does there lie in the essence of language itself the vulnerability and the possibility for its transformation into technological language, i.e., into information? (139)

What parallels can be made between information and positionality? The last of these mostly rhetorical questions hints at where our analysis can take us, but is not satisfactorily resolved. The potential that "the vulnerability and the possibility for its transformation" is in the essence of language itself raises questions as to how deeply Heidegger was thinking technology and information as joined. To do so would require suspending evaluative considerations of information as 'degraded' and 'corrupted' forms of language, in favor of thinking the two together. The standing reserve forces things into presence. Likewise, making language into information imposes a clarity and presence to units of communication themselves. Reading Wiener, Heidegger observes that the cybernetician's operationalized conception of language "is executed on the basis of yes-no decisions for which production machines are set up, whose

flows and breaks in electrical current carry out the schema of abstract signal transmissions and yield the corresponding message." Information is executed on a "basis," and the production in which it participates is "set up" according to a "schema," suggesting that for Heidegger, the abstract grid of metaphysics is in part positioning language itself for these "yes-no decisions." Heidegger continues, "For such a kind of report to be possible each sign must be clearly defined." For positionality to apply to signs involves clear definition. In this context, definition does not only indicate meaning, but position in the cybernetic apparatus in which the communication's effect is guaranteed. To this characteristic of language, Heidegger would oppose the uniquely revelatory mode of poetic language. This language is a "saying showing," which for Heidegger is distinct from technical language in its allowing "what has not yet been shown, has not yet come into appearance." Heidegger offers an inviting place of restoration of the capacity of language to information. He writes, "What is decisive for our reflection lies in the fact that it is from the technological possibilities of the machine that the instruction is set out as to how language can and shall still be language" (140). The potential for information to be language remains tantalizing for the philosopher, despite the caution; the question is in how it "can and shall still be" so. It is a matter of potentiality rather than the present actuality of language as pre-defined by automatic machinery.

We ask Heidegger's question again: what would be the implications of the standing reserve be if it were at the heart of language? What it would require is that language, as information, is itself inseparable from its automation and instrumentality. To take this critique seriously, we will need to see how far the Wiener model can take us. In the hands of the cybernetic poets, will systems speak? Here, we already have

the rudiments of the problem that this book aims to address; thinking of Heidegger's comments on language in relation to the cybernetic definition of communication, and its translation into poetry.

By this logic, we must assume that poetry does not happen as a radical outside to the self-enclosed nature of technology, but that the poetic can take place *within* technological, and within cybernetics. And yet, most philosophers turning to cybernetics in the wake of Heidegger stop here, perhaps caught in the . Cybernetics, in this picture, is an ontological given that increasingly orients a political project. This is not the place to assess this project's value, as it is still relevant and fruitful. Rather, it must still be recognized that this "end of philosophy," as Heidegger himself put it, is a limit that hides certain features of cybernetics' historical and social impact. Heidegger himself points the way to a rethinking of cybernetics, outside of its oppositional character. We start there, to move forward to the fundamental insight.

Heidegger shows the world's increasing subsumption under an increasing technologization from which nothing can escape. Heidegger's next move furthers this folding of the intellectual with the historical and material, by showing the essence of technology at the seat of Western philosophy. In his lecture, "The Danger," Heidegger brings into relation the classical notions of Θέσις, "thesis," and φύσις , "physis," as the ontological underpinnings of his conception of technology, revealing a further play in positionality anchored in the history of philosophy.

The "name for the essence of technology," positionality, is a derivation from the German "stellen," as positioning, placing, setting. The prefix, "Ge-," is a signature late Heidegger construction by which anything may be "gathered." Gathering, for Heidegger, indicates simultaneously a multiplicity, essence and culmination. In much

the same way that a mountain, or Birg, can be gathered into Gebirge, a summit or refuge, stellen as positioning can be gathered into das Ge-Stell, or positionality. This construction, at play also in the fourfold (vier --> Geviert), takes on a key role in his discussion of positionality in relation to nature. Heidegger ties stellen explicitly to the Greek Θέσις, as the positioning that is also recognized by the positing of a central idea, or thesis. As Heidegger does, he makes recourse to thinking Θέσις in an "authentically Greek" manner by opposing it to φύσις, physis, or nature. Heidegger will decisively characterize the relationship between thesis and physis such that the previously elaborated understanding of positionality is turned on its ear. He argues that "we must think positionality [Ge-Stell] as corresponding to growth [Gewächs] and indeed growth as the gathering of what grows [des Wachstums]" (60). Heidegger draws upon the ancient physis-thesis distinction by tying the gathering of positioning with the gathering of growth, in order to link the two. That which positions has its own growth, or emergence, and further that which grows is put into position. The two require one another. Heidegger clarifies this point with the example of a stone staircase:

> For only when there is something present that is brought about by a bringing-here-forth can human positioning, Θέσις, then arrange upon such a presence (i.e., the stone) and out of this presence (stone) now something else that presences (a stone staircase and its steps), here among what is already present (the native rocks and soil). What now presences (the stone staircase) presences in the manner of something that, through human positioning (Θέσις), i.e., production, becomes steady. *What stands here through Θέσις essences otherwise than what is brought here by φύσις*. All the same, it is common to conceive even that which is brought here and brought forth in Θέσις, and thus that which presences, as something standing here. What is brought here forth in φύσις is standing here in unconcealment not through a human production, but rather through a bringing-here-forth of itself from itself (60-61).

We find physis as the condition of possibility of thesis, the stone whose coming to presence, or emergence, on its own terms, must take place for it to be put into position. This seems fairly straightforward – physis as providing the *hyle* that thesis sets upon as *morphe*, puts into place. One can't have a hydroelectric dam without a river. In this regard *thesis*, or technology, still appears as supplementary to an originary *physis*. Which is why the other passage is so important. Here, the same *thesis* that appears to put nature into position is also a fundamental character of nature. Technology, "reigning of its own accord," has its own growth. These remarks are essential, because they serve as the turning point for understanding the danger lurking in technological thinking without conceiving the problem oppositionally. Physis and thesis are in a fundamental interchange. Physis, understood as growth, unconcealment, emergence, is not a purity threatened from without by the impositions of Thesis' technicity. The opposed terms are put into deconstruction; the essence of technology as a gathered positioning takes on, in its globalizing character, the quality of growth, and that which grows is itself given as a positioning.

Such an understanding allows us to read Heidegger as thinking autopoiesis. That which grows, emerges or self-organizes, does so by recourse to an environment that can only ever be seen as the standing reserve. What's the difference? It lies in the ways that the environment of a system is never inert matter, rendered as lifeless "stuff" that can be molded and shaped, but rather a dynamic weave of interpenetrating systems. Though Maturana and Varela rarely make this explicit, their formulation depends on all things being connected, and paradoxically distinct. To bring this to bear on Heidegger, it requires us to think communication as poetic, a disclosive saying, vulnerable at the height of distress. It requires us to think, following a systems

logic, in terms of catastrophe, when the terms of the system's self-organization radically transform, and something else appears. To properly understand Heidegger cybernetically, it requires us to make the most daring leap, taking up precisely what he would refuse in taking the "poiesis" of autopoiesis seriously as a *poetics* of self-organizing systems.

I argue that the fundamental "insight" of the Bremen lectures is the inextricability bound nature of technology and language, realized in information and transforming the world in the process. Heidegger's "insight" is twofold: it is the recognition that the essence of technology is inextricable from nature, and that the disclosive power of language happens within technology, *as* information. Information can be poetry. What are the makings of such an "insight?" It is, for Heidegger, to be found in the unique revelatory mode of poetry. Poetry, as rarefied expression stemming from the uniquely human (at least by Heidegger's logic) capacity for language, allows insight into what is. Where the technical language Heidegger opposes is merely caught up in the workings of technology, poetry offers another truth of being, closer to nature as a principle of growth. This takes place because of Heidegger's observation that the workings of nature, rather than being rationally calculable, appears as an event, or insight. This revelation is given coherence by means of the poetic saying.

The insight takes place in what Heidegger calls a "flash" or "glance, that is, in an instant of unconcealment. This unconcealment is an event. He writes, "The flashing entry of the world in positionality is the flashing entry of the truth of beyng into unguarded being" (69-70). This insight describes a being given over to the vulnerability of technology. In poetry, it is not simply an overcoming of technology,

but a showing of what the world looks like in the image of positionality, simply as it is. It would take the resources of poets, to make use of the deeper significance of information. This happens within language. Heidegger writes, "Language is the inceptual dimension within which the human essence is first capable of corresponding to being and its claim and of belonging to being through this correspondence" (67). As Heidegger stresses, this insight is an opening to being. As technology lies at the heart of being, the inceptual character can be productively read as an insight into a cybernetic ontology, rooted in information.

As McLuhan observed, the global awareness precipitated by "cool" media calls for a responsibility, that in itself may be an awareness of positionality under technological regimes. To speak to this understanding in poetry requires a cybernetic attunement. In the Bremen lectures, Heidegger speculates, "In truth, however, the essence of the human is now ordered to give a hand to the essence of technology" (64). And this, fundamentally, is the beginning point of a cybernetic attunement. It is not a phenomenology of technology or media theory, but a recognition of the shaping of the word by information, and the putting of the word into position such that the insight might take place. Heidegger's notion of attunement evolves from *Being and Time* to his writings on Hölderlin, where the fundamental attunement of the poet entails an openness to such an insight. In Heidegger's lecture course, *Hölderlin's Hymns Germania and The Rhine*, he remarks, "Attunement, as attunement, lets the open manifestness of beings occur" (140). Indeed, the cybernetic 1960s is characterized by such an openness. Where cybernetics defined a world in flux, the artists of the period operationalized that flux, involving themselves in projects whose terms were not explicitly set in advance. They frequently understood this in terms of

chance. Fundamentally, as we shall see, the standing of technique, in aesthetic apparatuses that position the work in order to bring it into being, becomes paramount in the art of the cybernetic moment.

What is the standing of the technical, and of technique, in poetry? One potential response would be to dismiss such a poetry as inauthentic reflections of a technologically driven age. And yet, poetry's intellectual history, from Renaissance scientific treatises in verse to Coleridge's interest in chemistry to modernist fascination with electricity, indicates an exchange between poetry and science that cannot easily be reconciled with Heidegger's striking vision of what poetry can be. Heidegger's account of poetry remains on the whole tied to certain Romantic fixations on nature, immediacy, wholeness, and nationhood that tied the loose ends in his works without resolving the question of poetic technique. For, as we recall, Heidegger is aware that the technical is at the heart of being. Just so with poetry; matters of poetic technique are as urgent for poetry as determining its swiftest, most clear and direct expression. As later chapters will explore, the matter of technique will be redefined with cybernetics, inviting not only an information-based formal structure for poetry's effects, but a fundamental attunement capturing the ethos of the cybernetic moment, that I call a cybernetic attunement.

We need not carry Heidegger's oppositional stance to technology forward with the same urgency as the other features of his project. What we do need to consider is his thinking of poetry. Cutting to the heart of his late thinking, the poetic saying has a fundamental disclosive character that does not impinge upon the thing, but lets it be. Further, the poetic saying commemorates what has passed, and carries hints of what is to come. Can this apply to cybernetics, especially given Wiener's suggestion that

systems have at their core a manner of communication in their operations? In the face of the increasing technologization of the world, what can the languaging power of poetry do? More than a facile belief in the redemptive power of the humanities in the face of big science, poetry for Heidegger was a turning point in being itself, that could rip the fabric of modernity and restore things to their more primal character.

And yet, to ask Heidegger what a "cybernetic poetics" could be is laughable in the face of it. Heidegger's aesthetic choice was quite clear, electing for an essentially conservative, though clearly idiosyncratic, grouping of poets consigned to a lyric vein. Though these poets, with especially Hölderlin as the foundational poet in Heidegger's thoughts, are indeed essential, they also betray Heidegger's limitations as a reader of poetry, as a thinker more broadly, and - much more generously - as a historically bound figure who can be read against the grain. We may turn to another set of poet-thinkers, as "cybernetic poets," who may better answer the question of *where we were going* and *what we were doing* than Heidegger's own selective group. Can this be understood poetically without falling into the somnambulism of media? As we turn to the cybernetic arts, we will encounter technology's pitfalls, where art becomes merely an apparatus of social regulation, as well as the revelation that information, as understood in its generative forms, is a poetry in action.

Chapter 4. Cybernetics and the Arts: A New Aesthetic Program

Marshall McLuhan, in *Understanding Media*, famously declared avant-garde art practices to have an oracular function, writing that "Cubism, by seizing on instant total awareness, suddenly announced that the medium is the message" (13). In doing so, McLuhan was not only suggesting a potential role for experimental art, but enlisting it. On the face of it, there is something agreeable about this notion of the avant-garde anticipating later medial forms. The arts have an irreplaceable social role, a positive content. Media theorist Boris Groys, in *Ontology of Suspicion*, takes McLuhan to task for this, suggesting that aligning modernist art with ontological claims about media is naive. "McLuhan transformed the active, forceful, artistic practice of the avant-garde into a purely interpretive practice that seemed to be sufficient in his eyes to register the anonymous messages of the mass media" (76). An avant-garde understood primarily in terms of media, which Groys criticizes art theorists Ernst Gombrich and Clement Greenberg for, obscures the complex and contradictory social aims and performative strategies of avant-garde works in favor of a mostly abstracted notion of medium and form. Where does this come from? McLuhan is too polyglot to draw from a single source, but close examination reveals that cybernetic approaches to aesthetics have a similarly ambiguous relationship with modernist art practices, abstracting them into questions of form while advancing a puzzling understanding of the social role of the arts in general.

In the 1950s and 60s, at the time of cybernetics' greatest cultural flowering, modern art was increasingly accessible to a perplexed viewing public, a viewing public that included scientists with varying degrees of literacy in the arts. Those scientists who would contribute to early computer art had the privilege of taking for

granted some principles that would be revolutionary for modernism, while also missing key impulses of modernism. What emerged as a result was a cybernetic imitation and augmentation of modern art, which would play a quietly transformative role in the arts as a whole.

In much the same way that cyberneticians saw themselves as laying the groundwork of an ideal, cybernetically controlled and automated society, the aesthetic experiments of the engineers and artists who first developed computer art were motivated by a more ambitious social vision. Early computer artists tasked themselves with creating popular literacy in computing technology, imitating past masterworks in order to improve and eventually surpass them, and making perfect machine-made works available to the general public. Cybernetic aesthetics would take art, the great regulatory (or emancipatory, depending on the predilections of a given artist) feedback loop of art and streamline it. In much the same way that feedback lends itself to application to society as a whole, art would become the instrument of it. And yet, the application of cybernetics principles to art also took place with the spirit of exploration. As Abraham Moles, one of the earliest theorists of cybernetic aesthetics, aptly put it, "Aesthetics is no longer essentially a philosophy of beauty, but an experimental science based on psychology, sociology and the theory of creativity" (62, "Art and Cybernetics in the Supermarket," *Cybernetics, Art and Ideas*, ed. Jasia Reichardt). Cybernetic aesthetics contributed to a period of enormous formal experimentation cutting across genre, in the name of this investigation of new potentials for art offered by the computer.

In this chapter, I will examine this early period in cybernetic aesthetics, arguing that we must appreciate a significant dividing point, between works based on

feedback and automata, and works based on information theory. In the first, we will see feedback devices employed to create works that explore their own apparent capacity for living behavior. This approach finds its best theoretical exponents in New York critic Jack Burnham's "systems esthetic," and United Kingdom artist-pedagogue Roy Ascott's "behavioralist art." Having its greatest impact on sculpture and installation, we will see a feedback-derived cybernetic arts offer conceptual tools to, among others, kinetic sculpture, environmental art and institutional critique. In the second, we will see information employed to explore works of art as messages that are encoded, transmitted and interpreted. This approach finds its best theoretical exponents in Abraham Moles and his student, Max Bense, whose Stuttgart school of computer art advanced a "generative aesthetics." Much more diverse in its influence, but most relevant to two-dimensional art and the composition of literature and music, information theory principles helped shape the development of early computer graphics, machine-generated music and text, concrete poetry, optic or "Op" art, new music and procedural poetry.

This distinction allows us to better understand the intersections of traditional art forms with computer art, and where significant philosophical and disciplinary differences emerge. By considering the competing narratives of the impact of cybernetics on the arts, we can move from seeing concrete poetry (for example) as a *precursor* of new media poetry, as poets Brian Kim Stefans and Kenneth Goldsmith have suggested, to seeing the genre *as* a new media poetry in its own right. Likewise, the development of institutional critique in the 1970s, once seen in parallel with overt systems art works (often practiced by the same artist, as in Hans Haacke), can be understood not merely as echoing social cybernetics in its approach to the entire

milieu of art as a market phenomenon, but as an explicit implementation of cybernetics in the art world. As we have done in previous chapters, we break from identifying cybernetics as a set of facts explaining phenomena at a distance, to the phenomenon itself (in this case, works by artists invested in the cybernetics paradigm) as an implementation of cybernetics principles in a non-scientific setting.

To be clear - just as there is no pure and final separation of information and feedback, this distinction does not imply exclusive influence of one or the other. Artists draw from ideas on their own terms. Indeed, the greater likelihood is that all of these texts were fair game for conceptual borrowing to all artists and theorists involved. Be that as it may, we see the appearance of two different concerns in the cybernetic arts. One concerns interactivity, dynamism, movement using biological metaphors of works of art (and their surrounding context) as living and self-maintaining organisms. The other concerns generativity, chance, pattern, noise and difference utilizing a transmission metaphors of works of art as messages containing information. Though both have equal claim to cybernetics, the outcomes are sufficiently different as to present two alternative directions for the future of cybernetic arts.

In this history, we encounter a paradox. Where information aesthetics enjoys success in the creation of a novel art form that persists to this day - in the form of computer graphics - it is the feedback model that persists in the form of reflexive or self-critical art, despite the relatively dated kinetic works it stems from. This is partly because computer graphics became its own discipline largely independent of the art forms I argue were in conversation with it - namely, concrete poetry, op art, and machine generated texts and music. The history of computer graphics, rightfully so,

becomes one of visualization programs and increasingly sophisticated image-making tools. This is only accelerated in the 1980s with the rise of the personal computer as the place of image creation. Early computer graphics become consigned to the status of draftsmanship, too inert to speak for the buzz and hum of the cybernetic moment. And yet, we will see that it is in information's impact on the arts that a new project for poetry emerges.

In the last few years of the 1960s, there were a handful of exhibitions in the United States and Europe that showcased the potential of computer art. The best known of these was the Jasia Reichardt curated exhibition, "Cybernetic Serendipity," staged in 1968 at the Institute of Contemporary Arts in London to enormous financial and critical success. As Rainer Usselmann reminds us in a 2003 retrospective essay, the exhibition took place during a time of considerable political unrest (a cynical reviewer noted it could not have taken place in Paris without police barricades), while striking a primarily apolitical tone in the spirit of good-natured fun. Its immersive environment was noted for its crossover appeal, with something to offer to scientists, children and "hippies" alike. Many of its costs were underwritten by corporate and industrial interests, and the result was simultaneously a legitimate art show, design expo and pedagogical space aiming to acquaint the public with still-novel computing technologies. (389-390, "The Dilemma of New Media Art: Cybernetic Serendipity at the ICA London," *Leonardo*).

The exhibition, as Reichardt writes in a special issue of *Studio International* concurrent with the show, is arranged into three sections:

1. Computer generated graphics, computer-animated films, computer-composed and -played music, and computer poems and texts

2. Cybernetic devices as works of art, cybernetic environments, remote-controlled robots and painting machines
3. Machines demonstrating the uses of computers and an environment dealing with the history of cybernetics ("Introduction," 5)

As the division indicates, once the pedagogical section is set aside, one can see that Reichardt was driven by some categorization of computer art along polar lines. One pole was defined by works along the lines of automata, while the other was defined by works of many genres created through the state of the art processing power of computers. Because of the demanding nature of the robotics, logistics may have made separate sections advantageous. And yet, the extensive design component of the exhibition as an interactive, pedagogical space, suggests some underlying concept motivating this choice. This division is precisely the one between feedback and information that I follow in this chapter.

Among the most famous works in the exhibition was Gordon Pask's "Colloquy of Mobiles," in which an ensemble of "gender"-differentiated machines move and signal in relation to one another, forming increasingly complex and unpredictable patterns of movement somewhere between dance and mating ritual. It is rightly celebrated as a masterwork of cybernetic art for its seemingly lifelike behavior. Pask is one of the major theoreticians of cybernetics, celebrated for his idealist notion of artificial intelligence as the creation of novel forms of life with humanitarian applications, making him the ideal candidate to represent cybernetics from the ranks of its practitioners. Among the more eccentric of the cyberneticians and a transitional figure between the first and the second cybernetics, he certainly showed greater artistic aptitude than theoreticians of cybernetics like Norbert Wiener. In addition, the most enthusiastic histories of computer arts attest to the value in their

cross-disciplinary nature: engineers finding themselves becoming artists, and artists learning computer science as an extension of their trade. But beyond the unity of opposites implied by these histories is a more significant fact, that the history of cybernetics is not merely a history of evolving and converging principles, but of objects: cybernetic devices that put principles to the test by enacting them in their construction. Some objects had a specific purpose - Vannevar Bush's Differential Analyzer, the ENIAC and ILLIAC were the earliest modern computers, while Wiener's contribution of human-machine feedback to naval fire-control computers had obvious practical value. Others, however, frequently made independently and of less immediate practical use, were essential to the development of cybernetic principles. Examples include Grey Walter's mechanical "tortoises," which employed a simple artificial neural circuit to move in its environment based on light stimuli, and Ross Ashby's Homeostat, arguably the most important mechanical demonstration of principles that would become essential to the second generation of cyberneticians. The Homeostat was comprised of four independently acting electromagnetic devices that, through individual feedbacks in relation to the others, would mutually stabilize. It was an enormously complicated machine with only one real purpose: mimicking the brain's capacity for self-regulation. Specific to the development of the second cybernetics, themes of interrelated but independent subsystems, an increasing emphasis on the relation between system and environment, and the overall closed, internalized nature of the self-regulation were novel developments that were 'proved' in the functioning of the device. The Homeostat was not an industrial tool, and as Pickering suggests in his paper on the application of homeostasis to factory

automation, never really would be. Its purpose was as an enactment of cybernetics itself.

Andrew Pickering's *The Cybernetic Brain: Sketches of Another Future*, is a loving treatment of the cultural and epistemological conditions of this very practice, which he specifically describes as a "nomad science," following the distinction laid out by Deleuze and Guattari. To create cybernetic objects introduces new definitions of invention and knowledge production. It is in this spirit that Pask's Colloquy of Mobiles was created, a spirit cultivated on multiple fronts by Reichardt's exhibition.

Of the two exhibition sections explicitly devoted to art, one is devoted to works themselves that are by nature machines, machines that imitate living beings through feedback. As I hope to demonstrate, this will become a key paradigm for cybernetic theories of art, which increasingly raise questions about how a work of art, or the broader context of its creation, may be understood as a cybernetic system.

The centrality of feedback to a cybernetic vision of the arts is nowhere made more explicit than by Roy Ascott, whose "Behaviourist Art and the Cybernetic Vision" conceived of art - both the artwork and the process of its creation - as a feedback loop through the social world. A practicing artist and teacher, Ascott himself conceived of art, and art pedagogy, along cybernetic lines to great effect. His "Groundcourse" at the Ealing Art College in London pushed his students to interact with the creative process as a living system, subject to change and interacted through feedback. With students including The Who's Pete Townshend and ambient pioneer Brian Eno (who frequently cited cybernetician Stafford Beer as a primary influence), his pedagogy introduced interactivity and improvisation into music studios, making enormous contributions to the experimentation in popular music of the 1960s and

1970s. Indeed, Eno's music production, which used both literal tape loops and conceptual feedback loops in the creative process, extends this influence to another degree.

It is essential to recognize that while Ascott's vision *included* technology in its outlook, it did not depend on computers, but rather "a future shaped by this Cybernetic Vision," that is, both an awareness of the momentousness of cybernetics and an internalization of its principles to revitalize society (97). Cybernetics, for Ascott, was tangible in its practice but ultimately metaphorical - the interactions Ascott cultivated strongly resembled feedback. This was all in keeping with cyberneticians' focus on enacting the truths of cybernetics in material artifacts, whether in machines, artworks, or (as would increasingly happen), conceptual or performance-based works.

Ascott's essay fits modernist art into a cybernetic paradigm. All art is understood as a "message," and modern art, understood as a rupture from an ambiguous past in the generation or two preceding his own, takes on a new purpose for a message. The artwork is conceived of as a message, with earlier works argued to be concerned with clean transmission and representation of its subject matter. Arguing that Modern works of art are "events," Ascott proposes understanding these "messages" as part of a feedback loop, which then enters a circuit of interaction and behavior rather than static reproduction. "The participational, inclusive form of art," he writes, "has as its basic principle 'feedback,' and it is this loop which makes of the triad artist/artwork/observer an integral whole." The understanding of feedback in a work of art takes two forms that may correspond to negative and positive feedback, this time with positive feedback and its destabilizing function taking a revitalizing

quality. Ascott continues, “For art to switch its role from the private, exclusive arena of a rarefied elite to the public, open field of general consciousness, the artist had to create more flexible structures and images offering a greater variety of readings than were needed in art formerly” (98). The feedback loop is employed on dual registers. On the one hand, the work itself becomes a recursive loop folding the viewer into its operations, manifesting in a flexibility of interpretations. Utilizing a multiplicity of interpretations to be completed by the reader is a touchstone of postmodernity from McLuhan to Barthes, and it is here articulated on firmly cybernetic lines using the metaphor of feedback. On the other hand, the work is not only a feedback loop, but a different type - a positive feedback loop that challenges and disrupts society. Ascott’s model conceives of art as a public integrator that adds complexity to the world, and enlivens space, rather than being merely a negative feedback loop preserving a body of references for a closed community. More to the point, for art to serve as feedback can exist in either closed or open systems, with the liberatory potential being in a work that opens society.

Roy Ascott’s notion of “behavioral” works of art attempts a synthetic approach that includes not only automata, but many other plastic works breaking from conventional representation. The dynamism of these works is understood, using a term popular in cybernetics language, as the “behavior” of a work. An artwork, like a black box, is understood in terms of what it does. A work of art is understood as a cybernetic device. His conception notably folds *all* of these under the same behavioral heading, implying that an abstract painting is itself akin to an organism, a cybernetic circuit, a kinetic sculpture. In this essay, Ascott aligns cybernetic art with radical transformation, while simultaneously reinterpreting traditionalist art as itself

cybernetic, just with a different kind of feedback. Ascott's utopian optimism prevents him from asking whether a conservative, regulatory feedback may also be a part of "cybernetic vision." It is only in turning to Burnham that we find it.

Where Ascott's primary transmission of influence was pedagogical, in the world of art criticism proper, Jack Burnham is the most significant exponent cybernetic paradigm for understanding art. Originally a sculptor, Burnham was an art critic and curator who advanced a "systems esthetic" as cybernetic update of the earlier formalist criticism of the likes of Clement Greenberg. Burnham's system esthetic also employed a feedback loop through the social, treating the art world itself as a self-organizing system.

The peak of his influence was in the midst of the so-called "six years," to use Lucy Lippard's famous coinage, in which avant-garde practices de-emphasized conventional art objects in favor of experiments in performance and installation with the rise of conceptual art. Though never a central figure in this moment, Burnham is significant for conceiving of this tendency on formalist lines that read the "dematerialization of the art object" as a revelation of the cybernetic nature of art. What is remarkable is the range of styles his systems esthetic was able to describe, including conventional sculpture, kinetic art, performance, environmental art and the rudiments of institutional critique, which would only blossom in the years following his withdrawal from the art world.

Burnham gained notoriety with the 1968 publication of the essay, "Systems Esthetics," in *Artforum*, and the book, *Beyond Modern Sculpture*, in the same year. The following year Burnham revisited his theories of system art in another *Artforum* essay, "Real Time Systems." In 1970, Burnham published *The Structure of Art*,

synthesizing his earlier writings with structuralism (the first full-length book of structuralist art criticism), then curating the 1970 exhibition, "Software," at the Jewish Museum. Due to the perceived failure of the exhibition (stemming from financial trouble, logistical difficulties with the more elaborate living works, and literal software failure), Burnham faded into obscurity and spent the remainder of his career on an increasingly abstruse Kabbala-derived interpretation of Dada artworks.

The systems esthetic is a strange melange of cybernetic metaphors, at times talking of "software" and "subroutines" in the spirit of 1960s developments in computer programming, and at other times utilizing the language of feedback and thermodynamic notions of information from the cybernetics of the 1940s and 50s. Indeed, artist Robert Mallary devoted an entire essay in *Leonardo* to lamenting Burnham's "gross misuse" of software as a metaphor to support the "Manichean anti-physicalism" of his systems esthetic ("Notes on Jack Burnham's Concepts of a Software Exhibition," 189-190). That said, Burnham's approach can be understood as follows: the institutional apparatus surrounding a work of art (its publications and marketing material especially) are the software that makes up the true operations of art as a system, over and against the physical objects that make up a work.

What is remarkable is the underlying cynicism of Jack Burnham's understanding of art's social function, irremedially distant from the idealism of Ascott. In "Real Time Systems," he begins by likening artists to the "programs and subroutines" of art as system, writing, "They prepare new codes and analyze data in making works of art. These activities are supervised by metaprograms which consist of instructions, descriptions, and the organizational structures of programs" (*Artforum*, 1969). Though I leave the question of the valorization of the individual

artist to personal taste, we must understand that Burnham is taking a firm stance predicated on the art system's hierarchical guiding of the artist by institutional power. Unlike Ascott, Burnham shows little interest in there being an emancipatory function for art. The art world remains a stable system regardless. Prestige granted to artworks resistant to the gallery system are identified as still "emanat[ing] from the self-metaprogram" of the art system itself, rather than coming from outside of it. The feedback loop is centered around the self-preservation of this system, as it "maintain[s] its vitality by constantly reaching outside of itself for data." Underneath the elaborate metaphors of information processing and software is a basic point, that the circulation of art information is a feedback loop preserving the art system outside of the needs and interests of either the artist or the audience. Where Ascott sought a unity of the art/artist/audience triad through feedback, by the same principle Burnham does away with all three.

This is best exemplified in Burnham's sustained attention to a single artist, Les Levine. Mentioning him favorably in several key essays, Burnham frequently invokes Levine as the exemplar of his systems esthetic. In "Real Time Systems," Burnham argues that Levine excells at utilizing the software of art to its best abilities, with his market oriented performances involving investments in the stock market, the selling of ambiguous disposable plastic industrial objects, and the establishment of an actual restaurant, fittingly titled *Levine's Restaurant*, modeled after the pre-fabricated interior design of Howard Johnson's. On these works, Burnham writes, "As I see it, Levine is simply circumventing the roundabout process of producing paintings and sculptures for sale and, instead, making the message - money - become the medium." Burnham continues, arguing that *Levine's Restaurant* is "the ultimate real time

artwork devised to date," suggesting that by situating these market ventures in the software of the art market, Levine is revealing its workings and furthering the inner processing of the art world. It is a recursive operation, a self-reflective artwork that Burnham views as the essential workings of art.

Making room for matters of taste, including my own, it could be argued that this is a failure in Burnham's project, and that his subsumption of the art object into its information processing as part of a larger art system is overgeneralizing a particular historical configuration of art institutions at the expense of actual art works, or more strongly, a complete retreat from discussion of anything resembling aesthetics. Perhaps, after the poor reception of "Software," Burnham's Kabbalistic turn may be interpreted as an equally extreme attempt to restore aesthetics to the analysis of artworks. Be that as it may, the question elided by both Ascott and Burnham is whether a self-reflexive art born of the feedback model may be supporting a limited picture of what art actually is and does.

As we see, by the end of the cybernetic art experiment, the behavioral vision of Ascott, expanded by Burnham in his sytems esthetic, had shifted from living objects to art systems as a whole. This may be understood as a shift from first to second order system, in that the art system itself becomes the means and materials. This occurs in parallel to what Lucy Lippard terms the "dematerialization of the art object" and the rise of conceptual art in the late 1960s and early 1970s. The dynamism of early cybernetic arts shifts to exploring the information flows of art systems and their related software. The foundations of institutional critique and conceptual art appear in Burnham.

Jack Burnham's attentiveness to the reception and promotion of a work as a broader part of the art system had some fruitful results, while also lending itself to supporting works by artist-cum entrepreneurs like Les Levine, whose work often mimicked the production of consumer objects with an uncritical eye. The critical apparatus Burnham employed, and which Levine himself encouraged, rendered the message a rather inarticulate and contradictory version of institutional critique. Much of cybernetic aesthetics, in lieu of a successful mathematical definition of "the beautiful," or of formally innovation on cybernetic grounds, would risk falling into a purposeless mimicry of consumer or machine society, treating art as a function of the marketplace on the least interesting grounds. Despite the rigor and precision of Burnham's analysis, I argue that his turn to the cultural software of art is fundamentally a misstep. Though the second-order move is remarkable, it effectively leaves the task of the work of art behind, in favor of an analysis of the power structures that underlie its production and distribution.

Taken together, Ascott and Burnham illustrate how feedback in art is inseparable from a conception of feedback as a model for the dynamism of social interactions, if not the workings of society as a whole. If society regulates itself through feedback, cultural artifacts are unmistakably contributing to this process. The standing of art as a social institution with an inherently conservative function is engaged by both theorists, with remarkable unanswered questions nagging behind both of their frameworks. Ascott, aligned with 60s counterculture, demonstrates an optimistic faith that the closed system of past art institutions of the past is permanently open. Supported by the continuation of avant-garde practices blurring art and life, and McLuhan's suggestion that the artist's role is to anticipate and articulate

media conditions of the future, the possibility that feedback's regulatory function might persist never occurs to him. The climate of 60s radicalism was such that open systems was the only model for the application of cybernetics to society. Conversely, Burnham's formalism and greater precision in describing art as a system allows him an insight that art is inseparable from its surrounding "software" - the means by which art is interfaced and propagated, including the institutions of critical and financial capital that allows a work of art to exist. Curiously, Burnham's choice to identify Les Levine's work as the epitome of this tendency indicates that art can never be separated from the social power that underwrites it. Burnham occupies the more interesting tension by never raising the question of whether this can or should be critiqued. By identifying art with its social software, its conservative regulatory function - as negative feedback - is highlighted to the detriment of other potential visions for art. That this conception underlies many of the later works in the genre of institutional critique suggests that this tension lies in that genre. The questions of who art is for, who is authorized to make it, and what its purpose is, remains elided.

We have observed the significant role played by employing the concept of feedback to art. Drawing on cybernetic devices and their cousins in kinetic sculpture, the capability for works to exhibit lifelike features leads to a reinterpretation of other art forms along similar lines. This raises two questions. How are living systems, biological or otherwise, playing a role as the substance or active agent in a work? Further, what feedback role does a work itself play? What are its regulatory or disruptive functions, such that it may recursively preserve or transform its environment?

The astute reader may have observed that the feedback model is developed in the late 1960s, near the end of cybernetics' scientific and cultural dominance, and at the end of the first major phase of computer art. I have raised the questions of the social issues relating to this approach, not only for ethical reasons, but to indicate that it is not impervious to an emerging cybernetically supplemented ideology that masks other points of origin for cybernetic aesthetics. In the very least questions of the social conditioning of art (or as Heidegger might put it, its positioning) are important but still avoid the question of what art actually is and does, especially under the new conditions that cybernetics establishes. It is here that I propose that the formalism of information theory plays a greater role than has been currently recognized. Though hardly free of the sloppy art history and ambiguous ideology of the other computer art forms, we may note that information more closely approaches the heart of the cybernetic moment by seizing upon the role of chance in the creation of works of art. Making the computer graphic the paradigmatic line in computer art raises questions of the nature and structure of information, and thus, a more interesting understanding of the work of art as message. Most exciting is the potential counter-narratives offered by a re-centering of information in cybernetic aesthetics. Situating the rise of the computer graphic with contemporaneous developments in optic art and concrete poetry, and their shared debt to information theory, we see the emergence of an information-based aesthetic that is, at its heart, showing how its particular formalism is emergent at its core. We will find, on close investigation, that poetry begins to emerge here.

It is worth noting that the earliest computer art at stake here was a laborious process without "real time" results. The gap between input and output was sufficiently

large as to force the domain of exploration to be in these sorts of highly abstracted formal experiments. Noll notes that what the most pressing issue of this period is a lack of "real-time interaction" with the artwork, observing "a rather long time delay between the running of the computer program and the production of the final graphic or acoustic output." There was a decisive lack of *feedback* such that the terms of the work could be defined by the artist; the terms had to be set in advance ("The Digital Computer as a Creative Medium," 146).

Many of the artists and theoreticians named were indebted not only to cybernetics, but to another earlier tradition of modernism, specifically continental avant-garde movements including but not limited to Dada, futurism and constructivism. In much the same way that postmodernist aesthetics frequently draw on similar general principles and practices as those of modernism, most of the cybernetic artists, some of whom did not begin as artists, have up to a half century of modernism in poetry and the plastic arts to refer to.

Though it has not been understood as such, research on computer-generated texts and images serves as a commentary on the arts. Even at its most overinvested in mathematical rigor, the results (mostly by accident) are discoveries of new formal principles that drove several decades of early computer art. Information theorists attempting to produce images and texts were caught between the future and the past - working within a new technical milieu with novel stakes, while also inheriting a legacy of works from both the canon and modernism, without a precise grasp of either. In lieu of an aesthetic theory to guide these experiments (as if there could have been beforehand), many chose to work in approximation.

As John R. Pierce reminds us, information theory, cybernetics, and the extension of both into the arts is a matter of approximation and imitation. Information theory attempts to approximate human language in order to imitate it. But without an information-rigorous ideal standard, examples are appealed to - Shakespeare and Joyce for language, and abstract painting for visuals. Approximations abound. Pierce notes that in the 1950s and 60s, engineers and artists cut their teeth on computer-generated approximations of Francis Ponge's prose poetry and James Joyce's *Ulysses*, heralded as the most information-dense book ever written (50, "A Chance for Art," *Cybernetics, Art and Ideas*, ed. Jasia Reichardt). Early pixel art was created as an attempt to render photographs on a display. Other examples include AARON, a device programmed to create physical paintings, thus imitating the painter herself. Most significantly, A. Michael Noll made overt attempts to generate works by avant-garde painters, including optic artist Bridget Riley and Dutch De Stijl painter Piet Mondrian.

Of these, most paradigmatic is the so-called "Mondrian experiment," in which Noll developed an a computer-based approximation of Piet Mondrian's *Composition with Lines*. Both works present a cloud of short, black and straight lines of various lengths extending either horizontally or vertically, occasionally intersecting without an *evident* pattern. The Mondrian piece, dated 1917, is a painting in the conventional sense, and has more evident clusters of intersecting lines, and is still a painstakingly regular work of formal abstraction. In Noll's approximation, the lines "were placed according to a pseudorandom number generator with statistics chosen to approximate the bar density, lengths and widths in the Mondrian painting" (145, "The Digital Computer as a Creative Medium"). The computer means of visual production serves

as a commentary and interpretation of the work. Though the essay, now a piece of the literature on the painting, makes no claims about the historical or biographical conditions of the work, or even within the formal abstraction Mondrian was forwarding over his career (the only identifying materials are the artist and the date of creation), by approximating it Noll is making a critical claim about the work. What persists is medium, form and pattern in the work. Notably, by choosing a work with regular and identical line widths, limited to the horizontal and vertical axes and with a limited set of line lengths, the painting lent itself best to being composed by a computer plotter. The choice of image was easily (comparably, as Noll's programming work was enormously time-consuming) mapped onto a graph and thus more easily randomized. In an informal poll of 98 Bell Labs employees and two unaffiliated participants, only 28% could tell which was computer-composed, and 59% preferred the computer version.

Noll's conclusion was that the formal play in the painting could easily be reproduced by computer means, achieving a victory for the advocates of the computer as a legitimate medium for art. In this regard, Noll established himself as an early leader in computer art. The generative procedures in this work are part of an ensemble of more clearly "original" works, suggesting that the materials of abstract art are not merely amenable to computer art, but contain something of their substance in them. With Noll's homage to Op artist Bridget Riley, *90 Parallel Sinusoids with Linearly Increasing Period*, Noll argues that there is in formal experimentation an anticipatory computational character. The works anticipate computer art and can thus be replicated by it. In the process, Noll helps develop new techniques of visualization, algorithms for new textures and modes of appearing, such that while he

might not be a canonical "artist" in the traditional sense, he has at least contributed to what later artists, animators and designers would develop more fully in later decades.

Imitation is a central theme of the philosophy of early computer science, as in Alan Turing's famous thought experiment known as "The Imitation Game." The Imitation Game, first explored in 1950, tasked a computer and a human to correspond with an interrogator only through written messages, each with the goal of proving that it was the real human; if the computer successfully defended its false claim as human, the task of artificial intelligence would be complete. With this paradigm so firmly in mind, and identified explicitly by computer art pioneers like Noll, it becomes less difficult to see why imitation might serve as a conceptual anchor for early computer art.

The picture becomes somewhat more complicated when we look at the interpretive claims of the new painting. We have suggested that the Mondrian was already amenable to computer reproduction, and not only because of the regularity of the formal experiment. Noll chose a modern work for reasons that are absolutely understandable and thus need to be defamiliarized. What appears is an information aesthetic.

As with feedback, information itself has an extensive theorization. Applying mathematical information theory to art is not without its pitfalls. Recalling Hayles' early pathbreaking analysis of the cultural impact of information, defining information in terms of redundancy allows for the role of meaning to appear as a paradox. A higher quantity of information is not necessarily 'more' meaning, and when applied to questions about the nature of art, can lead to attempts to quantify a vaguely defined notion of beauty rather than a richer consideration of information and

form. This approach frequently takes two forms. The first, often applied to analysis of poetry, is an appeal to an age-old notion of economy of communicative means to transmit maximum information. Much like a poem is purported to say a lot in few words, so any work of art manages to contain more information. This approach frequently draws upon canonical works, presuming that their cultural capital translates into some excess of information that is never satisfactorily defined. The second, with a more catholic appreciation of modern works alongside the classics, avoids thinking in terms of amount or economy,in favor of formal discussions of order versus disorder. Anxious to avoid falling into the trap of classical notions of form, the artwork is proposed to be striking some ideal balance between order and disorder, or regularity and surprise. Again, this balance is never defined, but gestured toward.

A relative latecomer to the field can be helpful in illustrating these pitfalls. Herbert Franke's very interesting 1977 essay, "A Cybernetic Approach to Aesthetics," which attempts to define a psychology of art by assigning a fixed number of "bits" that can be communicated by a visual work at a given time. Franke's problem, if we were to critique this essay, is that the project is trapped in a picture of cybernetics whose own history is erased, taking its principles for granted and holding the arts at arms length, placing them on a museum wall. Fortunately, earlier approaches serve us much better.

Among the first treatments of information aesthetics was a 1958 monograph by information theorist Abraham Moles, translated into English as *Information Theory and Esthetic Perception*. Moles grounds his work in the physiology of the human body, attempting to define mathematically the nature of the eye and ear especially as communications channels. Following Norbert Wiener's definition of

man as a computing brain receiving information through the sense organs, Moles explores the upper and lower bounds of sensibility to define the basic communication platform in which redundancy patterns - information - may be best communicated aesthetically. On first blush, Moles appears to fall into the same traps identified previously - an overemphasis on measurement, and a discussion of information, redundancy and pattern that hovers between Shannon and Wiener's contradictory definitions of the terms. Though even reviewers contemporary with Moles suspected his work to be mere gimmickry, I argue that Moles' insights far outweigh the outdated mathematization.

Early on, Moles writes, "A message is a finite, ordered set of elements of perception drawn from a repertoire and assembled in a structure." Though this is directly in line with the understanding of information developed by Shannon and Wiener, for Moles it is a definition that he roots in a fundamentally embodied perception, with clear upper and lower bounds (what he respectively terms the "saturation threshold" and "sensitivity threshold"), within which communication is possible to the sense organs (9). The senses - vision and hearing in particular - are considered to be channels with particular capacities and limits. For hearing, for example, there is a minimum frequency a sound must be to be audible; for vision there is a maximum intensity of light before the viewer begins to feel pain. It is between these sensory minimums and maximums that the message can occur. We can think of a sensory limit as the phase-space in which aesthetic perception occurs. Once these limits are defined, for Moles the work of defining emergent form along information lines can be laid out.

Moles aligns redundancy with information, facing occasional ambiguities

before ultimately aligning redundancy with the capacities of the medium on the one hand, and the pattern making/breaking nature of information on the other, in the process moving toward a definition of form along the lines of difference in ways that are remarkably productive for the contemporaneous developments in the arts. The key is in how Moles defines redundancy, pattern and repetition. In Moles' account, repetition (which he terms as 'periodicity') is a form of patterning that is, not surprisingly, a redundancy, which he identifies as "low" in information. Moles writes, "Awareness that a message is periodic, plus knowledge of a single period, make the information furnished by the message tend to zero." Recalling the strain of information thinking, where information is solely the "difference that makes a difference" and not the pattern, Moles is searching for where this occurs. His insight is that the information-poor redundancies that are perceived in any pattern is in fact serving as a basis enabling the communication of that key difference to take place. Moles suggests that, once the experiencer notes periodicity, they bracket the repetition and adjust to the object in order to perceive the periodicity en masse. To make intelligibility the repetition becomes substance. Redundancy produces the medium, and thus the sensory effect, of the work. This principle extends, as we will see, from minute periodic vibrations in the air experienced as sound, to the use of repetitive color patterns in a painting, to generalizable repetitions of anything in any art medium, including words. Moles continues, "In phenomenological experience, the 'substance' of a musical tone is a 'stuff' of which we grasp immediately only the beginning, the duration, the variations, and the end (67)" Recalling that repetition is experienced as substance, it is at a second order that the interruptions of that substance, "the beginning, the duration, the variations, and the end" make the

perceiver able to "grasp immediately" the perception. If the substance we perceive is, at a primary structural level, periodic, it is at higher levels of organization that other forms of variation determine our formal experience of the substance. Information as the communication of difference remains, though situated in a perceptual domain amenable to formal description of artworks.

If the first-order medium of a visual work is based on statistical redundancy, depending on a sense of a pattern's infinite iterations as a substance, then it is at a second order of organization that we come to the problem of form, of which Moles offers an account in the context of information. He writes:

> One of the fundamental characteristics of the human receptor is the existence of a maximum limit to the flow of perceptible information. When this maximum flow is exceeded, the individual selects, with the aid of criteria derived from his previous experience, forms from the message presented to him. Forms are abstractions, elementary stages of intelligibility. If these criteria fail him, the individual is overwhelmed, left behind by the originality of the message; he loses interest (74).

The periodic or redundant forms of a work, for Moles, are perceived as substance precisely because of the bounded nature of communication. The thresholds of perception, though rooted in the physical body, are defined along information terms that are generalizable to the nature of the message itself. Message redundancies are aligned with saturation thresholds, serving as a basis for the communication of differences, or interruptions, where the "real" message takes place. Form is understood as this interplay between the unnoticed redundancies that serve as the "stuff" of a message, and the arrangement of differences that specify it. Moles emphasizes that forms are "elementary stages of intelligibility" because, in the stream of information we experience in the world and in works of art, we find useful

moments of redundancy and variation that allow us to shape our perception into coherent objects.

Though abstract, we will find this to be the kernel of a particular information-informed approach to three parallel art movements of the 1960s: computer graphics, optic or "Op" art, and concrete poetry. Each movement's critical statements makes an explicit overture to information theory, and even at its most loosely employed, utilizes something of the formalism described by Moles. The implications of this are, on the one hand, the idea that embodied perception can be understood as a matter of a communications channel, and on the other, that patterns of redundancy and difference are the basis of visual form.

I now turn to some examples to show the types of emergent form that appear as resonant with this framework. Looking at contemporaneous works in Op art and concrete poetry, we can identify not only an amenability to an information-based interpretation, but also a peppering of references to information. Op art, taking kinetic sculpture as its point of departure into experiments with visual effects, using structured contrast in a limited selection of colors. As the name suggests, Op Art was positioned alongside Pop Art in the mid-1960s, the former named by the press as an alternative, equally eye-catching to Pop. The difference is the strict formalism, evidenced by treatises like John Tovey's *The Technique of Kinetic Art* - written primarily on Op art, and echoes Moles' information formalism. Bridget Riley's *Blaze 4* is a striking example of this formalism. The work utilizes quite simple patterns - concentric circles, alternating black and white lines - lend themselves to an emergent complexity with which they are figured. Though the illusion of perspectival depth is produced by the relative thickness of the rings at various positions, their distribution is

not neatly determined by the focal point; the rings are offset to cut against depth without undoing it entirely. Likewise, the alternating black and white within the rings vary in angle and width in each ring, relative to one another and to the position of the rings. The patterns are related to one another by higher-order patterns that run through them, undoing the central perspective by forcing the viewer to trip over the constantly shifting orders of variation. The result is a flickering, unresolvable chaos of perception. The eye briefly seizes on points of brightness that appear to illuminate aspects of the work at various rhythms, but they are undone by the dark interpenetrating the bright, making one look elsewhere at the painting and starting the process afresh.

Artist and author Cyril Barrett remarked on this work: "The eye (and the mind) is threatened with a complete breakdown in its power to control or structure what it sees. It is overwhelmed with contradictory information, much of it created by its own mechanisms, which in less extreme conditions, serve to stabilize perception" (44). This is an excellent characterization of the effect of looking at such works, or Concrete works like the Garniers' "cinema," and I only wish to extend its reach. The language Barrett uses is one of confrontation, even madness, but this does not mean that these effects aren't in play in works with less intensity. I seize in particular on the link between contradiction and stabilization. There is a definite effect produced by this ordered differentiation of elements and the transformation that passes through it, and it is precisely this chaotic flicker.

The intensity of this flicker should be interpreted as an index of the virtual, and indeed we find that what flickers is not strictly 'there' on the page, but occurs relationally between the differentially ordered elements, between text and the eye,

between eye and mind. To put it in communicational terms, the very inability to decode the message amounts to a confrontation with something, placing paradox at the heart of perception, a virtual 'something' that presents itself to us only in its irresolvability. Moreover, the flicker is itself subject to ordered differentiation and transformation, and can be utilized as information in a message on a more strictly virtual order. We can say at the very least that the flicker in "cinema" is different in character from that in "Blaze I," and I believe we can go even further. We see, in each of these works, particular species of difference - such as color and position - put into patterned arrangements that are themselves differentiated and put into patterned arrangements. Differences, patterns and metapatterns interpenetrate, producing virtual objects perceived immanent to the work. But because these virtual objects are perceived against the backdrop of the work, still rife with potential other objects, the perceived evaporates and reappears elsewhere, different, at other orders.

Likewise, visual experiments in the poetic realm began to turn toward this information formalism. Beginning in 1950, Eugen Gomringer began to produce a type of poetry called "constellations." Minimal, precise and laid out geometrically on the page, these works nodded gently to Apollinaire's calligrams while asserting their own ground. With the rigor of an industrialist, the poems were calculated to produce meaning and effects with as few materials as possible, with the seeming goals of reproducibility and efficiency. The results could be called nothing else but poetry.

In Jasia Reichardt's contribution to the enormous retrospective edited volume, *White Heat Cold Logic: British Computer Art 1960-1980*, edited by Paul Brown et al, Reichardt draws a remarkable parallel. In Reichardt's reckoning, the two most

omnipresent international art forms of the 1960s were concrete poetry and computer art. She begins her essay,

> Of all the twentieth-century art movements, two movements that came to the fore during the 1960s distinct from anything that had come before. Each included international exponents from the very beginning and both hovered on the borderlines of the art world without ever reaching its center. The first was concrete poetry, and the second computer art (71, "In the Beginning…").

Nowhere but an edited volume on computer art would concrete poetry be seen as the more prestigious, recognizable genre whose reception history could serve to illustrate the lesser known parallel history of another genre. Reichardt's parallel does this as well as underlining their shared historical moment. What would their parallel emergence have to say about one another? Reichardt is well positioned to tell us, as three years before "Cybernetic Serendipity," she curated perhaps the most high-profile exhibition of concrete poetry, titled "Between Poetry and Painting" and also held at the Institute of Contemporary Arts. Notably, the exhibition catalogue says little; her introductory essay, "Type In Art," primarily focuses on the print medium as a painterly form, with no cybernetic pronouncement to be found. Concrete poetry, on the other hand, comes to have something to say about computer art. In the *Cybernetic Serendipity* issue of *Studio International*, Reichardt includes an essay by Scottish concretist Edwin Morgan, who replicated the early permutational poems of early concretist Eugen Gomringer, in his "The Computer's First Christmas Card." Concrete poetry revealed itself to be amenable to computer reproduction, just like Noll's Mondrian experiment, with the key difference being that concrete poetry was from the outset comfortable computerizing itself. Why?

The discourse surrounding concrete poetry is peppered with cybernetics on two fronts. Its most vocal theoretician proper was Haroldo de Campos, who was instrumental in establishing Brazilian concrete poetry's prestige on the international scene. Cybernetics appears as a metaphor for concrete poetry's workings in his interpretation of Decio Pignatari's "Terra," a permutational poem that uses subtle line-by-line plays on the titular word to generate phrases about the earth, all shaped like a fissure in the soil. On this poem, de Campos writes,

> This word is fragmented until the production of a kind of 'error' - the duplication of the syllable . . . This self-correcting error feeds back the machine-poem (like in cybernetics), and gives it its semantical optimum level. . . . All these syntagmatic elements converge to the semantic matrix of the poem: the idea of a self-regulating poem, like a rare land which ploughs itself (*An Anthology of Concrete Poetry*, no pagination).

Notably, the poem is more than merely "like . . . cybernetics" but is interpreted as its own cybernetic poem. Through the movement of the poem, the extra syllable which rends the "terra" feeds back on itself to create the permutations, shifting syllables with every line. This poem is termed a "meta-poem" for this looping back on itself, despite there being no explicit self-reference in the poem itself. Rather, its behavior and formal properties, resembling a cybernetic device, suggest a potent reading of the poem as self-referential due to this structure.

More significantly, de Campos published a 1960 essay, translated into English under the title, "The Informational Temperature of the Text," which attempted to reply to concrete poetry's critics by appealing to the rigors of information theory. It is here that the the information-linguistic research of folks like C.K. Ogden and George Kingsley Zipf not merely informs or explains a literary work from a distance, but is

activated in the creation of a text. De Campos attempts to respond to the perceived impoverishment of language by concrete poetry, using information theory to make it a strength. Though de Campos does not draw on Ogden's list of Basic English words (the 850 most statistically frequent words in English) in making his Portuguese works, he takes inspiration from the efficiency and communicability promised by this stripped down language of maximum information. In the process, concrete poetry becomes perhaps the only recent genre of poetry not to prize its untranslatability, but to imagine a poetics of maximum translatability.

Indeed, despite the range of approach to legibility and translatability in the concrete movement, it was founded on an embrace of new media technologies, with great pride in its global scope. Concrete poetry, though frequently employing a painterly notion of craft, would be a utilitarian poetics. According to de Campos, this tendency "responds to a notion of literature, not as craftsmanship but, so to speak, as an industrial process. Its product is a prototype, not the typical handiwork of individual artistry. It tends toward a minimal, simplified language, increasingly objectified, and for that reason, easily and quickly communicated" (179 *Poetics Today*). This optimistic, rationalized impression is made even stronger in an earlier text, the manifesto "A Pilot Plan for Concrete Poetry" (named after a similar "Pilot Plan for Brasilia." Writing with his brother, Haroldo, and fellow concretist Decio Pignatari under the group signature of the Noigandres Group, they found concrete poetry as a thoroughly modern project. Drawing on their forebears in Mallarmé, the Futurists and Dadaists in particular, they assert:

> Renouncing the struggle for 'absolute,' Concrete Poetry remains in the magnetic field of perennial relativeness. Chronomicro-metering of hazard. Control. Cybernetics. The poem as a mechanism regulating

> itself: feed-back. Faster communication (problems of functionality and structure implied) endows the poem with a positive value and guides its own making (Solt 72).

Though the language of this manifesto is playful, it signals its technological basis in the language it uses. "[m]etering," "[c]ontrol," "regulating" - the poem no longer resembles an act of human expression, but a precisely designed machine. This machine, like any act of engineering, is subject to the "problems of functionality and structure," situated in a "magnetic field" of textual relations. Further, "hazard" as subject to "Chronomicro-metering" is a subtle, but clear restaging of Mallarmé's early visual experiments in the context of information's measurability.

What is equally important in considering Concrete poetry is that the engineer's precision brought to bear on its composition is in the service of a highly instrumentalized understanding of language. Max Bense, German philosopher and theorist of Concrete poetry, writes, "Whatever consists of signs can be transmitted; that is, it is the subject, emission, perception and apperception of a communication scheme that can typify a specific design pattern which concrete poetry can show" (73). Bense demonstrates that the design aspect of the poetry is aligned with a desired communication.

A student and collaborator of Abraham Moles, Max Bense hovers as a quiet intellectual force behind both concrete poetry and computer art. He appears in "The Informational Temperature of the Text," and is most likely the other term in the Pilot Plan's debt to Mallarmé. If hazard, an expanded notion of chance that activates the physical space of the page as an absolute condition of signification, the "chrono-micro metering" most likely stems from Bense's theory of generative aesthetics, which

utilized chance, or hazard, in a controlled and measured way on both micro and macro scales.

Max Bense's writings, almost entirely in German, played an enormous role in the so-called Stuttgart School of aesthetics. The Stuttgart School was a remarkable moment of exploration of the intersections between aesthetics, semiotics, computer art and concrete poetry, including the computer graphics pioneers Georg Nees, Frider Nake and Manfred Mohr. Bense's writings optimistically applied information theory and semiotics to a mathematical notion of aesthetics. Writing on the subject from the 1950s onward, Bense's work found theoretical resonance in concrete poetry, before becoming, alongside Jasia Reichardt, among the most significant theorists and champions of computer art in Europe.

In conversation with Moles' mostly biological and psychological formalism, Bense advanced an objective and mathematically grounded aesthetic that, while now dated in its enthusiasm for raw numbers, attempted to account for what programmers were doing when they were generating algorithms for visual works. Though prolific, his best known work is his 1965 manifesto, "The projects of generative aesthetics," published alongside an early (and controversial) computer art exhibition in Stuttgart. Fusing the information theory of Claude Shannon with Charles Saunders Peirce's semiotics, it identified any element of a work of art - be it sound, color, words, or other materials - as signs that would be organized according to their statistical distribution in a message.

Bense conceived of the work of art on the micro and macro levels, with different information principles applied to each. On the micro level, Bense advocated following the "principle of distribution" - that is, utilizing the probability measure of

each element in order to draw upon the effects of chance (57). Here, Bense explicitly invokes Shannon's text-generation research, thinking of the first, second and third-order statistical approximations of English as a process by which novel sentences (and by extension, other works) may emerge). On the macro level, Bense employs Moles' formal considerations in order to advance a notion of form as an arrangement of the elements, in a tension between order and disorder. Bense devises three potential arrangements:

1. producing order from disorder;
2. producing order from order;
3. producing order from a mixture of order and disorder (58)

As we can see, Bense is interested in order, first and foremost. He is careful to follow Norbert Wiener's definition of disorder as being informationless, as interesting to the viewer as the sequence of the word "is" repeating over and over. As Christopher Klütsch argues in his comprehensive survey of information aesthetics, Bense's project always concerned the triumph of order over disorder. Art is an instance of negative entropy, echoing Norbert Wiener's belief that life is a pocket of order against a sea of disorder (69, "Information Aesthetics and the Stuttgart School").

The result is an employment of information to create algorithms for creating artworks. Bense's work, and those of his students, was intended as experiments in the strict sense of the word. They believed they were not merely creating beautiful works, but defining beauty as such on grounds rigorous enough for the information age.

And yet, there remains something fundamentally conservative about this outlook. Feedback as a preservationist function in cybernetic arts appears at the very core of Bense's attitude about generative aesthetics. Is there another approach? We

will find that there is, resting on the significance of the role that chance plays across cybernetic aesthetics. Chance becomes the primary formal and generative principle of computer art. As the stories go, many of the engineers who went on to become computer artists attributed their first graphics to bugs and glitches in their programs that happened to produce interesting visual results. Others graphed various complex functions of their own design, an open exploration of what types of patterns emerged, before adding components to their programs to impose shapes onto their figures, or create the illusion of three-dimensional space. As Abraham Moles, one of the earliest theorists of computer art, aptly put it, "Aesthetics is no longer essentially a philosophy of beauty, but an experimental science based on psychology, sociology and the theory of creativity." The ideal of computer art becomes somewhat more sophisticated, from a triumphalist notion of rationally perfected imitations of past classics, to chance-generated works somewhere between the laboratory test and the art object.

As we have seen, chance is not just a table of random numbers, but a concept with considerable range of application. The information-specific approach to chance remains haunted by the thermodynamic fear of entropy, resulting in heat death, inducing early computer artists to always attempt to keep it at bay in the form of feedback. But there are other employments of cybernetics terms in the arts, also seizing on the conceptual significance of chance, that do not have the same terror. It will be John Cage, avid reader of information theory and cybernetics, and perhaps the single most influential author on chance in 20th-century art practices, that will reappropriate information for the purposes of noise, disorder and chaos. It is in the next chapter that poetry will appear in earnest. Chance's role in the arts as a generative phenomenon will appear in algorithms of a different sort, namely, Cage's

“chance operations.” These chance operations, once they turn to performance are the “dada algorithms” that illustrate one of the most significant new roles for poetry in the cybernetic age - as information, that “difference that makes a difference.” The kernel is in the restaging of the power of the word.

Chapter 5. Saying Yes to Chaos: John Cage, Interpenetration, Information

"I-Ching was delighted to be 'computerized' (accumulating advantages); advised modesty, recourse to ancient wisdom." Cage uttered this at least once in the late 1960s, in one of the many question and answer sessions of his extensive lecture career. We know this because this statement appears on a stack of pre-written notecards, selected at random in response to a question ("Sixty Replies to 30 Questions," John Cage Papers). This was a standard practice for Cage since his 1949 "Lecture On Nothing," where he prepared six nonsense answers to be stated, regardless of the question. Cage wrote a new batch around 1967, which included the one cited above. The practice of answering questions in this way illustrates several key features of Cage's career: his standing as a public intellectual making most of his income from paid lectures, his embrace of chance as an operating principle in all facets of his life and art practice, and the playful means by which he communicated his ideas.

The response references the computerization of the *I Ching*, a chance-based Chinese divination method that was (from 1951 onward) Cage's primary sourcebook and methodology for chance. Though Cage was a reader of the *I Ching*'s oracular texts, he primarily employed the method as a random number generator.[1] Though of spiritual value, the practice was as much a means of automating the composition process as it was a source of "ancient wisdom." Though incidental, it is a strong indicator of how Cage understood cybernetics, and how it impacted his work. Cybernetics plays a supplementary role in Cage's work; never the sole influence, it

[1] The *I Ching* is practiced by tossing sticks or coins to generate one out of 64 possible outcomes. As Cage would explain in "Composition as Process," he would assign various values to those outcomes to determine pitch, duration, loudness, and other features of his compositions.

appears referenced a few handfuls of times over his first (and most important) three books. Cybernetics would augment Cage's overall ethical, aesthetic, technological and political paradigm. Cage's emphasis on depersonalization of the artwork, embrace of chance and direct involvement in the new social landscape created by automatic machinery and mass communications. Further, this purview is inherently a poetic one, with a unique relationship to the word that is shaped and steered by cybernetic definitions of information. In Cage's vision, there appears a conception of the world as consisting of and governed by information. Cage the poet would give expression to this world.

The occasion for the notecard above was an encounter, after years of experimentation with electronic sound with mixed results[2], with a computer. The composer spent the years 1967-1969 in residency at the University of Illinois to produce a work in collaboration with computer composer Lejaren Hiller (creator of the first computer generated musical work, *Illiac Suite*), commissioned by the University of Illinois in Urbana-Champaign. The work, titled *HPSCHD*, was composed for harpsichords and multiple tapes of prerecorded synthesized sounds. At five hours and incorporating light and video, *HPSCHD* is (along with his later five-part *Europeras*) among the most ambitious of Cage's works. In contrast to the difficulties that plagued other immersive electronic works, notably the 1964 *Atlas Eclipticalis* (where performers in the New York Philharmonic did not take the work seriously enough to follow the score properly), or the 1965 *Variations V* (Robert

[2] Cage's electronic compositions, from his *Imaginary Landscapes* to *Variations IV-VI* and his performance in the famous "9 Evenings of Art and Engineering,) included the use of radio, tape cartridges and wireless receivers, with ambitious plans for performance that frequently suffered mechanical failure, as well as the failure of musicians to properly perform it.

Moog failed to build the equipment on time), the performance was a resounding success.

A more important fruit of this work was the computerization of Cage's broader process, which the composer gushed about in a letter to friend and fellow artist Alison Knowles:

> Guess what? A Fourtran [computer program]'s being prepared called ICHING! We'll never have to toss another coin! Also, [computer composer and Cage collaborator Lejaren] Hiller assures me that it yields something other than what is now called 'random.' On Thursday after the machine's worked for say 2 seconds, I'll have God knows how many hexagrams -- and they will have been translated into numbers! (September 25, 1967, John Cage Correspondence)

For a composer whose work often depended on generating numbers by means of hundreds to thousands of coin tosses, the automation of such a process represents a dramatic shift in the ability to conceive and execute works. However, there are indications that the efficiency afforded by the computer did not allow it to control every aspect of the work. In a letter to Lejaren Hiller, Cage suggests that additional aesthetic concerns motivated his approach to incidental sound in the generated recordings. Cage writes,

> I'm of the opinion to preserve the other unprogrammed noises i.e. echoes, so far one very soft gliss., and the astonishing sounds which come from scratches I'm told on digital tape. They have variety & in the end will modify the immediate understandability that results from harmoniousness (programming) (September 29, 1968, John Cage Correspondence).

Where the computer provides "immediate understandability," Cage wishes for unintended sounds to "modify" it. Though the bulk of the labor was in the programming, Cage's comments suggest a remaining desire for the work to be open to accident, a desire from the earliest days of Cage's career. An embrace of unintended

and un-"harmonious" sounds well predates this letter. Cage's very first manifesto for percussion and electronic music, "The Future of Music: Credo," stakes its claim on erasing the distinction between music and other sounds. He states, "Whereas, in the past, the point of disagreement has been between dissonance and consonance, it will be, in the immediate future, between noise and so-called musical sounds" (4, *Silence*). Cage had already broken off his studies with Arnold Schoenberg for precisely this reason, indicating further that new compositions would break from music notation just as Schoenberg broke from tonality. By the time of the 1955 essay, "Experimental Music," Cage had become even more forceful. A composer should "give up the desire to control sound, clear his mind of music, and set about discovering means to let sounds be themselves rather than vehicles for man-made theories or expressions of human sentiments" (10, *Silence*). This renunciation of control motivated Cage's very turn to the chance operations he would computerize in the late 1960s. This renunciation was motivated by a democratic appeal to the inclusion of all possible sounds in music. The appeal of the computer was in the efficiency with which it could carry out Cage's composition methods, not the harmoniousness, a concept Cage had spent decades critiquing.

Cage's writings during the time of composing *HPSCHD* are equally rooted in aesthetic principles developed earlier. These writings, which would be collected in the book *M*, also stage simultaneous materials in a way that allows accident to generate new possibilities than he intended. Cage envisioned his writing as a collision of words in various types and positions on a book-length scale. The result would be not poems but a poetry that could appear in infinite forms. He writes, in a letter to Willard Lockwood of Wesleyan University Press,

> The 'work' is an agreed upon number of pages, say 60-80, each page having chance-determined words in chance determined positions on them (including angles), in a large number of type faces, ink intensities, ink percentages in combination with other ink percentages, each page being transparent. Accompanying the book would be several different opaque sheets (white, grey, beige perhaps) which could be placed between any of the transparent sheets, thus changing the 'poetry' of the 'work.' Should say potential poetry, since the user would be reading it in (March 27, 1969, John Cage Correspondence).

The proposed work's near infinite capacity for recombination echoes Oulipo works like Raymond Queneau's 1961 *Cent mille milliards de poèmes*[3]. Both shift a part of the chance-based production to the reader, who would complete it anew with each recombination. Where Queneau's 'potential' literature and Cage's proposed work are similar in the implied readerly engagement, the scale of Cage's proposed work was much larger, applying chance to the book itself. Though evidently having its pages ordered in advance, by making them transparent it would emphasize forms of connection between pages rather than separating their content. Unbound paper pages would serve as means of organizing groupings of transparent pages. In this design, the very structure of the book is changed, opening it to forms of readerly participation not anticipated by Queneau.

This text, despite Cage's enthusiasm and tentative if bewildered acceptance from the press, was never realized. *M* would more closely resemble *A Year From Monday* and its predecessor, *Silence*, with their typographic experiments remaining limited to a single color. And yet, *M* would still include the typographically involved "62 Mesostics Re Merce Cunningham," center-justified acrostic poems generated by computer using hundreds of typefaces that resulted in word clusters resembling

[3] The text presented 10 sonnets with interchangeable lines, allowing the reader to generate 100 trillion potential poems.

concrete poetry; and “Mureau,” which applied the same principle to generate dense blocks of typographically shifting text based on entries from Thoreau’s diary. Both texts were enormously involved productions, with enough chance-determined elements to suggest that they benefited from the reams of *I Ching* hexagrams generated by computer[4]. Cage’s vision for a transparent book were partially realized in these works, but only the aspects that could be realized in the automation of his chance operations. The ‘hardware’ difficulties raised by his other goals could not be smoothed over so easily.

The seeds for these writings were planted a decade earlier. In 1961, Cage made a similarly daunting request to the same publisher. This time, the text was already written: a quartet of simultaneous lectures titled “Where Are We Going? And What Are We Doing?” intended for publication in Cage’s first collection, *Silence: Lectures and Writings*. In a letter to the press, Cage made his initial suggestions, which included overlaying each lecture line by line in differently colored inks:

> Here is a text. As the title page explains it is 4 simultaneous lectures tho' one can use less (3, 2 or 1) and he needn't bother to read it all, or at all. You . . . use all or part of it for your purposes. I would like the simultaneity represented typographically by presenting in colors several inks (the type large enough to make legibility possible, if one devoted himself). My painter friends tell me that my idea has a chance of working (undated, John Cage Papers).

Cage continues to specify potential colors to be used for each text, which each lay on top of the other, with periods representing where one or more lectures would be silent. The idea was that the right type size and effective use of color would allow reader, if "devoted," to differentiate between texts. The letter concludes by making allowances

[4] The papers for the mesostics, in particular, are accompanied by countless pages of computer printouts.

for line length, given proper notice to Cage of any changes. Readerly participation here is a much more difficult task, requiring sufficiently effective color differentiation on the print-end to distinguish between the four overlaid texts. Cage's "painter friends" misplaced their optimism; the text was printed in black ink, differentiated by four fonts of the same typeface: roman, bold, italic and bold italic. Rather than overlaying the text, the lectures were alternated line by line. Cage's ambitious plans for his written texts appear to frequently reach beyond the means of his publishers, just as he appears quite willing to settle for compromised versions.

Though these texts are chance-based, a feature they share with *HPSCHD* is an attempt to juxtapose elements in the approximation of simultaneity. Like the immersive experience of the *HPSCHD* event and earlier attempts at sound-performance events of the mid-60s, Cage's writings present words as simultaneities, overlapping and crowded. This emphasis, beyond even chance and indeterminacy, is one of the most persistent themes of Cage's career, and will be the focus of our analysis of Cage's cybernetic poetics.

As I have noted, Cage's embrace of the computer was late. In 1967, Cage was well into his middle age, and had already cemented his critical reputation and aesthetic philosophy. Returning to the notecard about the computerization of the I Ching, we find hints of an engagement between the two. Cage evidently appreciated the computer's way of "accumulating advantages," as the written record of his compositions suggests a shift from hand-written tables of chance operations (the laborious back end of the composer's work) to printouts of computer-generated results, applied to Cage's music *and* writings. Though Cage's anecdote of computerizing the *I Ching* implies the oracle's approval, there is an ambiguity: was

Cage asking the old, coin based *I Ching* for permission, or begging the newly computerized version for forgiveness? Though the latter is implied, the ambiguity speaks to a place between the analog and the digital, the spiritual and the technological, that Cage's use of the *I Ching* straddled all along. It is an indication that Cage's chance operations were already an automated process resembling the computers he would embrace, and also a suggestion that some remainder in Cage's thought, the appreciation of simultaneity, would elude or exceed the computation of Cage's practice.

Cage's aesthetic shares strong resemblances with the cybernetic aesthetics explored in the previous chapter, but has marked differences. Cage shares the social vision of feedback-based behavioral art and systems aesthetic, but with a more anarchist flavor that both embraces and problematizes cybernetic notions of world improvement. Cage also embraces chance and emergence as a formal principle in keeping with Moles' and Bense's information aesthetic, but where Moles and Bense conceived of their project as an objective aesthetic science, Cage blurred the lines between art and the world. Cage's engagement with cybernetics is not only formal, but social and ethical, with a systematically fleshed out relationship between the two. Tracing Cage's evolution from experimental percussion to chance and indeterminacy to performance, we will see an increasing emphasis on simultaneity. This emphasis is formalized by cybernetic principles and oriented to the themes of cybernetic society. A close analysis of the role of "interpenetration," Cage's term for simultaneity, in *Silence*, will reveal the creation of a poetics of information: statistically approximated through chance operations, performative, and showing how the "noise" of everyday life can become a simultaneous plurality of signals.

Silence is an exemplary text, extensively designed and arranged to convey a message beyond its words alone. As we have previously observed, Cage would use his musical compositions as generative templates for his writings. One purported purpose was to align the content with the form, in order to show what the text was describing. The foreword to *Silence* clarifies this motivation, saying, "My intention has been, often, to say what I had to say in a way that would exemplify it; that would, conceivably, permit the listener to experience what I had to say rather than just hear about it" (xxix). The clarity of purpose is striking; the text is intended for the listener to "experience" what Cage "say[s]." The implication is that the primary text is understood to be a lecture. Unlike the following two books, *A Year From Monday* and *M*, which tend increasingly toward essays and poetic works, the most significant texts in *Silence* are lectures. The foreword indicates that the texts are performative, intended to act and not simply offer content. The texts in *Silence* do as much as say. Further, the texts have a specific purpose, which we may describe using Heidegger's definition of poetry: saying and showing. The texts exemplify Cage's picture of the world, and the ways that the arts may navigate it by means of chance. Cage does so by making the form indicate the content.

The textual innovations of *Silence* are explicitly staged as serving the ends of poetry. In the foreword, Cage recounts a story of a friend, M.C. Richards, asking if Cage (already known for unconventional lectures) would most shock his audiences with a straightforward presentation. He is to have replied, "I don't give these lectures to surprise people, but out of a need for poetry." Cage defines poetry as being such "by reason of its allowing musical elements (time, sound) to be introduced into the world of words" ("Foreword," XXX). Indeed, many of Cage's writings draw directly

on his composition methods: “Lecture on Nothing” (and its sequel) is arranged according to his earliest theories of rhythmic structure, “2 Pages, 122 Words on Music and Dance” is shaped by imperfections in paper just like *Music for Piano*, “45’ for a Speaker” has its materials decided by the I Ching just like *34’ 46.776” for Two Pianists*, and “Where Are We Going? And What Are We Doing?” has its subject matter determined by transparent sheets just like *Cartridge Music*. For every innovation in musical composition, Cage would invariably offer a lecture or essay written in a corresponding way. Echoing Cage’s famous *4’33”*, Cage in “Lecture on Nothing” would state, “I have nothing to say / and I am saying it / and that is poetry / as I need it” (109).

From the beginning, Cage demonstrates a preoccupation with poetry that presages the role it would take in his later works. In an earlier essay, “Grace and Clarity,” focusing on dance and published in *Dance Observer* in 1944, Cage contextualizes his polemic with a lengthy passage from Coventry Patmore’s *Prefatory Study on English Metrical Law* (92). Cage’s invocations of poetry emphasize form above all else. Cage as poet is concerned primarily with matters of form, in order, as Cage suggests later in the essay, to convey “contemporary meaning.” The mathematical precision of his composition style appears also to be a carrier of meaning. This is clarified in the following observation from “Composition as Process,” in which he writes, “Composing, if it is writing notes, is then actually writing, and the less one thinks it’s thinking the more it becomes what it is: writing” (34). In many ways, this point connects to Cage’s standing as a “philosophical” or “conceptual” artist. And yet, we may take this literally, that composing is understood by Cage as the same process as writing.

In most studies of Cage's multifaceted career, his popular notions of "chance" and "indeterminacy" tend to get the most attention. Though the former especially is perhaps the key term for the method Cage employed, it is of only limited value in capturing the world, and its workings, as Cage saw and attempted to give voice to it. Critics seize on and elaborate well the composer's embrace of randomness in its infinite forms. But other than repeating Cage's own doctrines, there is little understanding of where the ideas came from or what a potential broader vision might be that motivated them. Jackson Mac Low, a poet whose chance-based and procedural poetic forms (by which an author composes a work following strict rules to generate a text) drew on Cage's own writings, offers a summary of Cage's poetics in "Something about the Writings of John Cage." The essay primarily draws on Cage's own more or less plain prose introductory texts accompanying the more experimental works, providing a convincing picture of Cage in the aggregate, where the composer would elide a straightforward answer. Usefully, he distinguishes between the chance operations of the early writings and the process of "writing through" other texts that appears in later writings, which we will spend considerably less time on. The text does not attempt to theorize Cage's writings but does underscore a key feature of these texts: their "large degree of *nonintentionality*" (291). Mac Low recognizes the paradox of noninentionality: that underlying each aspect of a work of chance is a decision in some form. Mac Low suggests that Cage never "entirely evades his individual ego and its predilections, but that he diminishes to some extent the value-judging activity of the ego that excludes possibilities, and thereby he lets in to that extent 'the rest of creation'" (292). The distinction Mac Low makes is between a zero-sum notion where the ego must be "entirely" evaded, and a notion of the

individual ego as diminished, removed from a central position but still a participant. The ego contributes always, but threatens to exclude possibilities if given a central position. Mac Low's analysis quietly points to the following aspects of nonintentionality: a non-dualistic and decentered approach to the creative subject, whose creative works can either open or close contributions from the outside world.

Others, writing on Cage in the edited volume *Composed In America*, also emphasize this aspect of Cage's art, to such a degree that no less than three authors refer to it as a "poethics," frequently linked to Cage's desire to "demilitarize syntax" ("Introduction," 9). Gerald Bruns' "Poethics: John Cage and Stanley Cavell at the Crossroads of Ethical Theory," continues the theme nonintentionality in the sphere of the popetic. After a somewhat meandering account of ethical theory occasionally diverging from questions relating to Cage, Bruns hones in on what he identifies as a fundamental ethical issue in the composer's writings: "Certainly a crucial link between poetry and ethics lies in allowing words, or particles of words (the sounds of parts of words, and with them the world of things, not to say of others), to live their own lives; it means listening, not tuning things out but letting them take us along" (220). Eric de Visscher takes the same approach in his account of the role of silence in Cage's aesthetic philosophy, titled "'There's no such thing as silence . . .': John Cage's Poethics of Silence," arguing that the key shift from Cage's early term "structure" to silence involves nonintentionality. Cage's thought, according to de Visscher, is an evolution from a "structural" understanding, "in which silence is considered to be an absence of sounds," to a "spatial" understanding, in which "silence is made up of all the surrounding sounds which together form a musical space," to a "(non)intentional" understanding, in which both forms can be understood

as lacking in "precise direction, determination, or meaning" (129-130). De Visscher suggests that Cage's "poethics" was not simply an ethical purview outside of the work, but a formal property of the work's production, which we will address in this chapter.

In poetry scholarship, Marjorie Perloff is a towering figure in Cage studies. Conversant with the composer's entire career and offering probing readings of a wide range of Cage's writings, Perloff more than any other has laid the groundwork in linking literary study to the varying output of a composer who happened to write a great deal of poetry. Perloff integrates John Cage into each of her main areas of focus: the history of experimental writing, late 20th century postmodern literature, and later writings on post-Language school conceptual writing.

In her 1981 text, *The Poetics of Indeterminacy: Rimbaud to Cage* and into the 21st century, Perloff would define postmodern poetics in terms of indeterminacy in signification. Taking cues from poststructuralist theories of textuality, Perloff's poetics of indeterminacy stages the text as a matter of unfixed meaning, making the reader an active producer of the text. This poetics deliberately echoes Cage's own concept of indeterminacy, but it is important to keep in mind that indeterminacy here means something broader: an indeterminacy of signification in poetry as a whole. Perloff is concerned with establishing a tradition for this indeterminacy, and as such places Cage at the end of the sequence. Thus, Cage is a belated contributor to a tradition in which "the symbolic evocations generated by words on the page are no longer grounded in a coherent discourse, so that it becomes impossible to decide which of these associations are relevant and which are not" (18). Poetry shifts away from producing a single meaning to the production of multiple meanings. Perloff

places emphasis on the undecidability of meaning, which grounds her poetics in problems relating to interpretation. This is a *hermeneutic* indeterminacy, in which the opacity of a text is primarily a problem of interpretation rather than production. Perloff's emphasis on skillful close reading is meant to serve as an example for the type of interpretive richness this tradition - and by association Cage's writing - offers to a reader. And yet, when Perloff devotes her final chapter to Cage, the discussion is almost immediately given over to a discussion of the performance poetics of David Antin. Perloff's analysis argues that the performance poetry of Cage - with David Antin, Jackson Mac Low, and Jerome Rothenberg - "reintroduces narrative in the lyric structure" as well as thought (289).

In the introduction to her later *Radical Artifice*, Perloff argues for Cage's prominence as a poet on the basis of his immersion in media. She writes,"The importance of Cage for postmodern poetics cannot be overestimated," arguing that Cage intuited "that from now on poetry would have to position itself . . . in relation to the media that, like it or not, occupy an increasingly large part of our verbal, visual, and acoustic space" (xiii). As Perloff's own career would shift, her interest in media and conceptual writing would take center stage, with Cage remaining a prominent touchstone. Frequently, however, broader statements about the place of the composer would be buried in Perloff's often dense readings of texts.

Perloff's most direct statement on Cage's poetry comes from an essay in *The Battersea Review*, titled "John Cage: Conceptualist Poet," focusing primarily on Cage's mesostics and "writing-through" works. Designating Cage the beginning point of the controversial early 21st-century poetry movement summarized her later turn to conceptualism as the apotheosis postmodern writing in general, "appropriate for the

information age when we are increasingly skeptical about the possibilities of mimetic representation." As in previous writings, the task of postmodern writing is to navigate a media environment in which signification is fragmented and indeterminate. Cage's writings are paramount for this understanding of postmodern writing, drawing on other texts as a part of this fragmentation, resulting in "a poetry that neatly avoids what Charles Olson called 'the lyrical interference of the ego' even as it makes it possible for the poet to present a highly individual view of the subject in question" (*Battersea Review*, Winter 2013). Perloff's essay offers a means of piecing together the narrative and rhetorical forms of Cage's poetics. Perloff, like Mac Low and the many authors on Cage's "poethics," straddles the line on paradoxes opened up by noninentionality.

A passage on Cage's writings on Schoenberg in "Mosaic" sums up Perloff's reading of Cage as a whole. The writing "enacts that complexity by placing past and present, momentous event and casual anecdote, on the same plane" by combining multiple levels of textual referentiality - Schoenberg's writings and Cage's stories about Schoenberg - as a single flattened text. Perloff suggests that Cage is "effacing himself as fully as possible in the written text" in order to critique and "question" the modernist values of his predecessors. Perloff's emphasis is on choice - not that of individual words, but of the overall concept, method and materials comprising the work.

David Patterson's "Words and Writings," included in the *Cambridge Companion to John Cage*, observes this in the employment of referentiality in the composer's writings. Though Cage's texts are dense and allusive, open to other voices

than his own, there are still definite patterns suggesting an author at work, rather than a mere conduit.

For example, many moments in Cage's ongoing diary series, "How to Improve the World: You Will Only Make Matters Worse" reappropriate political texts to highlight his own impassioned, if paradoxical, view of global planning. The diary series represents a very anarchic and thoroughly Cagean picture of political and social issues, despite (or because of) its being comprised primarily of anecdotes and references to other texts. Though the references in "Diary" reflect a genuine interest in the subject, the bulk of the work takes place in the juxtaposing of ideas from other thinkers as a reflection of Cage's own. This is more or less explicit in the passage from section LXXIV, first published in *A Year From Monday*, "Ephemeralization. Away from the earth into the air. Or: 'on earth as it is in heaven.' More with less: van der Rohe (aesthetics); Fuller (society of world men). Nourishment via odors, life maintained by inhalation: Auguste Comte (System de Politique Positive, second volume)" (152-153). In this passage, Cage groups a number of passages around the theme of "ephemeralization," most significantly suggesting that Buckminster Fuller is for the "society of world men" what Mies van der Rohe is for "aesthetics." Der Rohe and Fuller, both architects, are joined to imply a shared interest in work that is simultaneously abstract and concrete. The joining of the two is partially about them, but more about a general Cagean interest in the idea, which he also connects to the Gospel of Matthew, the philosophy of Comte and the bizarre, uncited reference to a proposal for "life maintained by inhalation." The concreteness of political and social themes joins the airy revery of free-floating poetic citation. The effect is even more pronounced in the end of section CXCIV, published in *M*, "Mao: Destruction means

criticism and repudiation; it means revolution. It involves reasoning things out, which is construction. Put destruction first, and in the process you have construction" (207). Cage's brief flirtation with Maoism leads to his positioning Mao's ideas generally as a continuation of his own. The paradoxical insistence that "destruction" leads to "construction" echoes Cage's own insistence on the presence of sound in silence - a paradox we will discuss in greater detail further in this chapter. In addition, the introduction to *M* (where all of the Mao enthusiasm is concentrated) indicates that Mao and Fuller are juxtaposed in Cage's thought at the time, two opposites who paradoxically join in radical modes of transforming the world ("Introduction," *M*, n.p.). Patterson suggests that Cage's references frequently "diverge from their original context, [and] are far more interesting and informative than is his adherence to the original spirit or meaning of these appropriations." Cage's references often are most meaningful when understood in relation to one another, and to Cage's own thought. Referentiality in Cage's texts serves as a vehicle. Patterson refers to this as a "fused" reference, in which Cage joins "aesthetic themes or images from divergent fields," in order to suggest "comparisons against their original functions and contexts" (95, *Cambridge Companion*).

Marjorie Perloff's writings on Cage present a supple understanding of the composer's writings that continually make him amenable to Language, post-Language, conceptual and new media poetics over the course of several decades. In a more general sense, Cage's near infinite quotability provides heuristic fodder for thinking about other texts, especially those by Kenneth Goldsmith. Perloff also contributes to *A John Cage Reader*, titling it after one of our key concepts "'Unimpededness and Interpenetration': the poetic of John Cage." She also echoes

Mac Low in emphasizing the broader effect of Cage's emphasis on mechanized, depersonalized creative processes. "Once the rule . . . has been established, it generates the process of composition. What the rule is, in other words, matters much less than the fact that one *uses* it" (8). "Cage's technique is to collage individual - and often quite unrelated - events . . . in keeping with the Zen belief that it is only the coincidence of events in space and time that reveals to us the 'UNIMPEDEDNESS AND INTERPENETRATION' at the heart of the universe" (13). What is this unimpededness and interpenetration? And what might it have to do with cybernetics?

The person to first make this connection is Joan Retallack, though she is assisted by the writings of N. Katherine Hayles, also presented in *Composed in America* and a mutual interlocutor on Cage and science. Hayles' essay, "Chance Operations: Cagean Paradox and Contemporary Science," explores Cage's chance operations from the perspective of a chaos theoretical definition of chance as "the intersection of independent causal chains" (227). It is an apt way of capturing how Cage's interpenetration combines and separates things with equanimity. She observes that "the point is not to deny connection, since conjunction is a kind of connection. Rather it is to subvert the anthropomorphic persepctive that constructs continuity from a human viewpoint of control and isolation" (228). Basing the rest of her analysis on chaos theory, she departs somewhat from Cage to dwell on temporality. Noting that Cage's use of chance "expresses itself through the profusion of possible paths . . . until it has crystallized into existence through painstaking operations" (231). Drawing on Ilya Prigogine and Isabelle Stenger's theories of irreversible time, themselves indebted to Wiener's writings on time in the first chapter of *Cybernetics*, Hayles

suggests that the paradox of chance operations is resolved by the emergence of single potentials through a field of infinite possible paths.

Hayles then turns, inexplicably, to the "fractal time" of nonlinear systems, suggesting that Cage's staging of music as independent simultaneous events indicates this fractal structure. Without exploring Cage's own micro-macrocosmic conception of rhythmic structure, inviting fractal comparisons in their uniformly applied ratios at differing scales, the connection risks being an empty analogy. Cage's own work appears as an addendum to an already formed agenda framed by the scientific materials at Hayles' disposal. Cage is not read as an interlocutor with science, but rather as a creator whose work just so happen to intersect with novel developments a generation removed.

Retallack for the most part does the same thing, in tying Cage's project to a set of scientific principles without strong enough grounding in Cage's own ideas. The difference is that a greater familiarity with Cage and choosing information brings Retallack much, much closer. Retallack's "Poethics of a Complex Realism" (now the third essay cited to use the coinage) tentatively suggests such a link. She suggests that Cage's "complex realism" speaks to an information-driven world. I subscribe to this view, and only wish to give it a further grounding. Retallack observes, "More information . . . does not necessarily mean greater knowledge or meaning. In fact, information theorists tell us the greater the quantity of information in a system, the more the system moves toward randomness and the more difficult it becomes to find organizing principles" (256, *Composed*).

Retallack's interviews with Cage, published as *MUSICAGE* 1996, provides some suggestions that Cage was drawing on information at least in part to understand

his work. When asked about his highly referential writing style, Cage borrows a "term . . . from Marshall McLuhan, you know, 'brushing information against information'" (52). The standing of texts as information become texts in a play of information. Later, Cage draws on McLuhan again, citing approvingly McLuhan's notion of "pure information being the absence of content" (217).

Indeed, we find that it is possible to connect Cage to information, directly through McLuhan's own unique interpretation of information, and indirectly through Cages separate and idiosyncratic readings. After working through other key texts in the production of *Silence: Lectures and Writings*, we will find that the oft-cited but rarely examined "Where Are We Going? And What Are We Doing?" turns out to be the richest expression of Cage's cybernetic poetics.

Before turning to the poetics of *Silence*, Cage's first book, it is worth noting that perhaps the most useful source for understanding Cage's writings is the same for understanding his music. James Pritchett's *The Music of John Cage*, a musicological treatment of Cage the composer, from his earliest percussion and electronic work to the Cage's return to conventional music notation at the end of his life. Pritchett, challenging a tendency to interpret Cage as a philosopher rather than a composer, insists on attention to Cage's evolution relative to the identity of his compositions, despite the appearance that chance would flatten any distinction that could be made between one work and another. Pritchett's introduction identifies this problem outright, arguing:

> The reduction of Cage's music to this one-dimensional approach is made simpler by the nature of chance itself. Critics frequently assume that the compositions are formless and without distinguishing characteristics since they believe them to be, in effect, barely more than random noise. If everything in them is determined by chance, then there can be no stylistic

> difference between one work and another anymore than there can be a difference between one list of random numbers and another (2).

Pritchett suggests that we interpret Cage's turn to chance as a turn to amorphous works without distinguishing characteristics. The resulting thinking of Cage as primarily trafficking in ideas, though valuable in recognizing the composer's impact on conceptual art, is decidedly less so in assessing the meaning of Cage's work, especially his poetry. Pritchett is right to reject this line of inquiry. Though the force of Pritchett's rejection of "Cage the philosopher" is softened by his attention to Cage's intellectual resources, the primary focus is on Cage the composer.

Though Cage's writings have their own quality distinct from the music, an understanding of the music is essential to interpreting the writings, for the following reasons. First, as a means of understanding Cage's thought, the writings in fact precede the music in public awareness. Though the composer had gained critical acclaim by the end of the 1950s, it was the watershed year of 1958-1961 that saw, as Pritchett observes, "the entirety of Cage's musical thought . . . made public almost all at once." After decades of work, Cage would enjoy a 25-year retrospective concert and well-received Darmstadt-based lecture series in 1958; the release of a record of stories and music, *Indeterminacy*, in 1959; the mass publication of his compositions in 1960 by the prestigious music publisher C.F. Peters; and lastly, the publication of *Silence: Lectures and Writings*, in 1961. *Silence*, in particular, was a surprise success. Pritchett observes that "the audience for the book was wider than that for his recordings or concerts," making his writings inadvertently the first introduction of most people to Cage's work (142).

More importantly, Pritchett recognizes that Cage's writings frequently draw upon the same techniques of his compositions, pairing writings with the music to show how they share formal principles, and with that, a place in Cage's evolving aesthetic philosophy. Where the self-reflexive emphasis of "Lecture on Nothing" on its own structure indicates the maturation of Cage's early interest in "structure" as a key term, "45' for a Speaker" would showcase Cage's newly streamlined and simplified (compared to the more arduous and complex *Music of Changes*) use of chance with the same format as the *Ten Thousand Things* series. And lastly, the indeterminacy and simultaneity of *Cartridge Music* would be echoed by "Where Are We Going? And What Are We Doing?" alongside many other texts.

Pritchett divides Cage's career into sections: 1933-1948, Cage's early percussion work; 1946-1951, (the only overlapping chapter) Cage's early chance works; 1951-1956, the years surrounding the performance of *4'33"*; 1957-1961, when chance-composed works shifted to indeterminacy in performance; 1962-1969, when Cage turned to performance art and multimedia productions; and 1969-1992, when Cage returned to conventional notation. Our attention to Cage's writing will direct us to Cage's 1950s and 60s writings, when Cage is forging his aesthetic philosophy and finding ways to put that philosophy into formally exemplary writing, whose form matched its radical content. As such, we will be drawing primarily from analysis of Cage's writings on chance, indeterminacy and interpenetration. The latter term, especially, draws upon information and connects Cage's work with its technological milieu.

My analysis follows Pritchett's general outline of Cage's development. For simplicity's sake, the bulk of my analysis focuses on texts from 1951-1961,

representing Cage's initial use of chance and increasingly mature approach to technology in performance. The writings from 1961-1973, by a now-famous Cage with a fully developed aesthetic philosophy, will serve as the bookend.

What Pritchett does, that other scholars occasionally neglect to do, is understand Cage's philosophy as under development, and shaped fundamentally by the means of composition at his disposal. Treating Cage's thought too hastily as a unified whole will result in texts serving less as the working through of a particular idea, than as an 'example' of a fully formed set of ideas. Both Perloff and Hayles draw from Cage's "Indeterminacy" lecture, written near the end of the production of *Silence*, whose narrative format allows for the composer's thought to be accessed as a single continuity. Though the stories in the lecture are useful and funny, they do much to bolster the Cage mythos. Repeated ad infinitum by the composer himself, Cage's tendency to smooth over his own contradictions with sound bites is the most common critique by sympathetic readers.

The exemplary character of Cage's texts, a product of earlier decades of experimentation and uncertainty, is taken as a given. The same could be said for Cage's world; the humor and Zen-inflected randomness are present in these stories in a way that implies they were always there. If we wish to better understand Cage and his influence, we must find our way to this point in Cage's career, without taking his end point as a given. As such, this chapter will spend relatively less time on the Cage mythos, placing attention on Cagean key terms and what they mean in their context.

Even more than chance, Cage's aesthetic abnegation and open-ended texts is the most recognizable link to postmodern aesthetics in general, but needs to be more clearly defined. John Cage is not independently confirming Barthes' "death of the

author" or any other post-structuralist theory of the end of the classical subject, but is rather staging the subject within the ethical and ontological reconfiguration created by communications technology, and is doing so as his own rigorous intellectual project. Cage's project is open-ended in its manner of signification, and problematizes the role of the subject in the work's realization, but its motivations are different. The subject is redefined as a noise source that can be embraced but frequently needs to be delimited by means of an external feedback: chance-based composition. Its political motivations are in the name of an anarchistic, communal participation in a world of others. Cage does not argue for an elimination of a personal voice and taste, any more than he is arguing that the subject never existed in the first place, but rather, he is suggesting that, in a world of many, with consciousness "externalized" by communications technology (as McLuhan would put it), the interference of subject can be supplanted by an opening up, an embrace of what some would call the commons.

To read Cage as an exemplar of postmodernism, or an exemplar of novel scientific advances, is to miss the fact that he was responding to the latter in order to forge the former. John Cage's work does not "reflect" or "prove" cybernetics, it is in fact a response to it, used at least in a supplementary fashion to formulate an aesthetic philosophy that would become the benchmark of postmodernism. Where discussions of postmodern poetry and new media tend to run independently, intersecting only as generalities, scholarship is now in a position to think them together in a more concrete, historical way. We may identify Cage as drawing on information principles to supplement his key concepts, allowing them to be joined to a more explicit embrace of technology and cybernetic society later in his career.

Two other terms, chance and indeterminacy (though related, they have distinct meanings) are frequently invoked in studies of Cage's poetry. However, I will demonstrate that these are in fact only the means to a desired end of simultaneity as an organizing principle. By attending to the precise nature of Cage's chance operations as they are utilized, and how they relate to their source texts and subject matter, I hope to demonstrate through a genetic interpretation that Cage's work is in fact mimetic at its core.

Cage devoted a great deal of his thought to matters relating to form, though it can be argued that it is also a response to an ethical concern on the composer's part, rooted in a historical concern with his moment: the cybernetic moment. We find that Cage's aesthetic categories in place prior to (and lasting somewhat after) his embrace of chance are always inflected by a particular ethical concern: that the individual ego not dominate a work of art.

By the time Cage was selecting earlier texts and composing new texts for *Silence*, his understanding of aesthetic form had evolved into four relatively stable categories: form, method, material and structure. Form would split into "form" and "structure," while content would split into "material" and "method." These subdivisions appear for a single purpose, as a rigorous means of allowing a work to come into being with minimal input from the personality of the composer. By the time of their fullest elaboration in the lectures "Composition as Process" and "Lecture on Nothing," they would secure not only a precise technical means of writing, but the inner discipline to not control the work. They are defined, respectively, as "the division of the whole into parts," "the note-by-note procedure," "the sounds and silences of a composition," and the "morphology of a continuity" (18). To a degree,

these definitions are self-explanatory, in their taut way. The result was not merely a chance-composed work, but a work that would be indeterminate and distinct with every performance. The goal was a piece of music, and with it a work of writing, that would be unpredictable and yet have a precise identity.

Were Cage's formal categories meant to define this indeterminate quality he sought in music? No, rather, they were proposed to delimit the influence of the whims of the composer, in order to *allow* the work to define its own terms. Structure, frequently referred to as "rhythmic structure," is the earliest term developed for his percussion works. Structure was Cage's means of relating the parts of a composition to a whole in time, without relying on a conventional time signature. Instead, proportions of time lengths would be determined by chance and applied to structural divisions and subsections alike. For example, as James Pritchett notes, "Lecture on Nothing" was written in "five parts with proportions {7, 6, 14, 14, 7}, or a total of forty-eight units of forty-eight measures each" (56). Though frequently arcane, Cage's numerical divisions in compositions of this time allow for a work to take shape without interference from what he perceived to be a work's greatest impediment - the personality of the composer. Structure is meant to be empty, not to avoid content but so that content may appear on its own terms. It is inextricable from his notion of form, "the morphology of a continuity." The continuity is in the sustained free appearance and withdrawal of content in a work. As Cage put it in "Lecture on Nothing," continuity "is a demonstration of disinterestedness" (111). Considering Cage's conception of form and structure together, what appears is a detachment from the outcome of a composition that is both a personal practice and a mathematical process. Cage's ideal, for a composition free of the "dictates of one's ego," is to be achieved

by means of personal and numerical discipline. The notable paradox here is that Cage's approach to rhythmic structure depends simultaneously on a focused measurability and a more philosophical approach to emptiness.

Cage's deceptively simple definition of material as "sounds and silences" suggests the open approach to composition that would motivate his entire career. Further, it would allow for Cage's formal approach - simultaneously mathematically precise and abstract - to find a purchase in the organization of sound, or writing or any other aesthetic property.

But as a composer, Cage would always be attuned to one thing: pure sound. Cage wrote in "The Future of Music: Credo," "If this word 'music' is sacred and reserved for eighteenth- and nineteenth-century instruments, we can substitute a more meaningful term: organization of sound" (3). The best composition can do is put sound in the center and get out of the way. This meant removing unnecessary ideas from sounds, including harmony - even the modernist, post-tonal approach to harmony that Cage learned from his teacher, Arnold Schoenberg.

The composer would always define music in terms of sound, rather than melody, harmony, rhythm or any other traditional way of describing music. During his famous 1960 appearance on the television quiz show "I've Got A Secret," Cage responded to a question from host Garry Moore, did Cage identify his work as music? His response, with characteristic emphasis on the word 'sound,' was "I consider music the production of sound, and since in the piece I produce sound, I would call it music."[5]

[5] http://blog.wfmu.org/freeform/2007/04/john_cage_on_a_.html

From early on, this would point in the direction of new technological means of organizing sound. In 1937, Cage was most enthusiastic about new technologies that would allow one "to control the amplitude and frequency of any one of these sounds and to give it rhythms within or beyond the reach of the imagination. Given four film phonographs, we can compose and perform a quartet for explosive motor, wind, heartbeat, and landslide" (3). The evocative examples he provides indicate not only that the sounds of the natural world can finally be appreciated in their own right, but also that they lead the charge of a fundamental augmentation of musical composition by noise. The abstract movement of Western harmony toward dissonance, whose synthesis by Schoenberg into 12-tone music is always presented by Cage as an artificial stopping point, breaks open to a point where literally all possible sounds are available. "Sound" is nothing less than an embrace of sounds in their authentic being. The field of sound offers resources beyond the controls of classical music composition, which ascribes significance to imposed laws of harmony and rejects certain sounds as incidental.

For Cage, a principle barrier to appreciating sounds as sounds is the intellectual categories we impose on them. In the early essay, "Experimental Music" (not to be confused with "Experimental Music: Doctrine"), Cage calls refers to the tradition of Western harmony - dividing tones and associating them with laws of harmony - as "musical habits" to avoid (10). Cage goes into this in greater detail in "Lecture on Nothing," remarking, "I begin to hear the old sounds as though they are not worn out. Obviously they are not worn out. They are just as audible as the new sounds. Thinking had worn them out. And if one stops thinking about them, suddenly they are fresh and new" (117). Aligning "thinking" with the old traditions of Western

harmony (for Cage a musical dead end), Cage sought a means not of making the sounds alive, but for recognizing the life that existed in them all along.

Though the use of new electronic sound technology, with experimental percussion, embraced the noisy features of sound with fervor, Cage would embrace its seeming opposite as a means of freeing it with silence. Cage's broader philosophy of music and art would be completed by the joining of sound with its opposite in silence. A pivotal moment in Cage's career is his visitation of an anechoic chamber, recounted frequently in his career. The artificially silent space still yielded the sounds of his own body's functioning, leading him to realize, "Until I die there will be sounds. And they will continue following my death. One need not fear about the future of music" (8, "Experimental Music"). Cage immersed himself in sound, always thinking of the endless presence of sound in lived experience. The continuity of sound was ontological; Cage was invested in sounds in their being, as they are.

When thinking about John Cage, one can easily fall into a paradox that seems difficult to resolve, namely: if one is 'required' to remove the will of the artist from the art, is this itself a willed artistic activity? In the 1958 lecture cycle, "Composition as Process," Cage narrates the development of this idea, pointing the way to an answer. In the first example provided, the prepared piano employed in *Sonatas and Interludes*, Cage is surprisingly open about his approach: "The materials, the piano preparations, were chosen as one chooses shells while walking along a beach" (19). In some ways this implies an openness to the outside world that Cage will prize, using quotations from Zen, but in other ways it still does not quite capture Cage's concerns. Cage explains, "They are therefore a collection exhibiting taste" (25). The sentence is

deceptively haphazard, as the calm indifference implied echoes the Zen discipline of other passages in *Silence*.

> "Thoughts arise not to be collected and cherished but to be dropped as though they were void. Thoughts arise not to be collected and cherished but to be dropped as though they were rotten wood. Thoughts arise not to be collected and cherished but to be dropped as though they were pieces of stone. Thoughts arise not to be collected and cherished but to be dropped as though they were the cold ashes of a fire long dead" (39).

If, as Marjorie Perloff notes, John Cage is still making aesthetic choices while attempting to decenter the individual from the creative process, the results complicate how we understand aesthetic choice in the first place. Cage never disavows taste and choice, but advocates that an artist not not blindly follow "the dictates of his ego," as he noted in "Indeterminacy," the second section of "Composition as Process" (36-37). The "ego," or rational mind, was something that Cage attempted to resist with urgency. Why? Earlier in the lecture cycle, in the section titled "Changes," Cage asks a series of rhetorical questions, the assumptions of which can help understand the reason for resisting the workings of the conscious mind. He writes, "The mind, though stripped of its right to control, is still present. What does it do, having nothing to do? And what happens to a piece of music when it is purposelessly made?" (22). The mind is "still present," but is "stripped of its right to control." It is this impulse to control that is the issue.

Control, which alongside communication defines cybernetics as Norbert Wiener saw it, would appear to be the main problem for Cage. Is he an anti-cybernetic artist? In fact, Cage's aesthetic philosophy, based in part on the rejection of the ego's tendency to control, is conditioned and brought to fruition by cybernetics. Cage's

approach to form and content are technological, attempting to secure *through* the technological a pure ontology of sound. Paradoxically, the means of eliminating the mind's tendency to control was itself a cybernetic process, which treated the mind as a noise source and attempted to control it. Cage's cybernetic poetry does not employ feedback to regulate the outside world, but regulates the self to bring it into relation with the world.

Feedback can be understood as a form of systems self-reference whose primary goal is to correct and preserve the identity of the system, by correcting perturbations that threaten its integrity. What would such a feedback be correcting? Cage's feedback deliberately kept within very sharp limits the interventions of the human within composition, creating at least in the abstract a notion of sounds emerging by and from themselves. However, in the process of bringing this about, Cage's feedback does not *erase* the stamp of the human, but rather finds the proper place for the human in the work, and as a result ends up defining the human anew. The body as an instrument, accompaniment to instrument or more abstractly as a component of the composing process, now has a role that has been formed to fit.

Cage famously remarked that he did not want to undergo psychoanalysis (127, "Indeterminacy"). The task wasn't the freeing of the self to produce more. Strikingly, it takes the unconscious not as a wellspring of creativity, but as a destabilizing force. In this regard, though cybernetics has many relationships with psychoanalysis, in the form of cybernetics' greatest poet, the unconscious would become one of the few "noise sources" that would need to be restrained in order to produce order. Cage's cybernetic poetics does not resemble the others, because by embracing the limitations of the cybernetic conceptions of the brain, it yields a richer connection to cybernetic

society. Cage's depersonalization was a proto-hippie amalgam of Zen Buddhism, Indian philosophy, avant-garde art and cybernetic discourse that followed, if not outright paved, the pathway between counterculture and cyberculture that would characterize early Silicon Valley culture, from homebrew computer clubs to the *Whole Earth Catalog*.

To understand Cage's depersonalization on its own terms, it is worth examining certain passages of his writings as being marked by the cybernetic moment, and would increasingly find their place along those lines. In a 1967 piece published in the *Toronto Star*, titled "McLuhan's Influence," Cage reflected on McLuhan's notion that a cybernetic society led, through new media, to an externalization of consciousness. This would change the role of the artist from the individualistic romantic genius to a participant in life and art as cybernetic processes. He wrote,

> We are now, McLuhan tells us, no longer separate from this environment. New art and music do not communicate an individual's conceptions in ordered structures, but they implement processes which are, as are our daily lives, opportunities for perception (observation and listening).

Though Cage was not taking explicit queues from Roy Ascott's cybernetic theories of art, Cage's understanding of art as process resonates with Ascott's notion that the dynamism of contemporary art serves a cybernetic function. Cage traces this influence to 1961, when he was writing "Where Are We Going? And What Are We Doing?" when Cage came to an "awareness of McLuhan's point that nowadays everything happens at once, not just one thing at a time" (170-171, *John Cage: An Anthology*). This notion of a totality that absorbs all of society into coordinated processes,

transforming the function of art, is inseparable from the general belief that cybernetics was a transformative social force. As in our previous discussions of Wiener and Heidegger, cybernetics is inescapable, folding everyone into cybernetic society. Where Wiener, Olson and Heidegger were concerned, Cage was optimistic, seeing positive conditions to draw on rather than react against.

The article dates this influence to 1961. At this point Cage was writing one of the last works to be included in *Silence*, "Where Are We Going? And What Are We Doing?" In John Cage's personal papers, the files on "Going" contain a remarkable note that spells out his aesthetics as historical and ethical shifts corresponding to the earlier categories, on grounds reflecting the values of cybernetic society. I present it as a transcription for clarity, with my notes in square brackets.

> conception to perception [form]
> control to acceptance [method]
> predictability to unpredictability [material, sounds]
> object to process [structure] (Steno pad, undated, John Cage Papers)

This note, written to highlight some of the ideas to be covered in "Going … Doing," is a small moment of clarity that represents at least a few of the guiding ideas at a period closest to the final assembly of *Silence: lectures and writings*. As such, it lies in between the drawn-out technical development hinted at in *Silence*, and the broader aesthetic ideals that suffuse the book and contributed to its immense popularity. Cage's formalist terms (form, method, material and structure) appear not just as the language of avant-garde music composition, but as hinges in a proposed transformation in our conception of art.

What is this transformation? Is it personal, social, historical? In many ways, it is all of the above. Though Cage's work shifts dramatically following the

publication of *Silence*, these ideals remain the basic template of Cage's statements to follow. Cage's work between *Silence* and the 1973 publication of his third book, *M*, will increasingly turn to world politics, performance and the literary, but *Silence* remains the statement of purpose, and we would do well to interpret notes like these as articulating a fundamental orientation toward Cage's broader project. Conception to perception, control to acceptance, predictability to unpredictability, object to process. This transformation is not just historical, but from Cage's period of searching to a complete aesthetic philosophy. Though the four terms will appear in Cage's writings for the rest of his life, they will no longer play a significant role in shaping his actual works. Rather, Cage frames his work around 'poethic' conceptions of openness to a dynamic and involved world.

This response to the cybernetic moment hinges on Cage's concept of interpenetration, developed in the late 50s in response to information theory, and coming to fruition in Cage's response to 'McLuhan's influence' in 1961. Though interpenetration only appears occasionally in *Silence*, and in the early works not at all, it is the single most important structural principle of the entire book.

Critics have observed that the texts in *Silence* are neither arranged chronologically nor comprehensively. Though the earliest text, "The Future of Music: Credo," does indeed open the book, the rest of *Silence* is out of order, and excludes the most explicitly autobiographical text, the 1948 lecture "A Composer's Confessions." David Patterson observed that "owing to the deliberately non-chronological ordering of the contents . . . the inattentive reader can easily confuse Cage's writings of one period with those of another" (86, "Words and Writings," *Cambridge Companion*). Why?

Silence has many core themes, including sound and silence, chance and indeterminacy, electronic music, and zen, among many others. One could name any one of them as the "primary" theme of the text, justifying the non-chronological ordering on those grounds. However, regardless of which idea gets the most page space, the theme most relevant to the conception of the book as a whole - including the selection, formatting and sequencing of its texts - is the Zen-borrowed concept of "interpenetration," often in tandem with "unimpededness." Appearing in "Composition as Process" and making sporadic appearances in his later writings, interpenetration and its sister term serve as a productive paradox of autonomy and interrelation - precisely the conditions for autopoeisis, as Maturana and Varela would put it two decades later. It is also discussed much less than his other concepts. Marjorie Perloff's essay, "'Unimpededness and Interpenetration': the poetic of John Cage," does not explore the term in any depth. James Pritchett's *The Music of John Cage*, in the few pages it devotes to the term, tantalizingly suggests that it played a crucial role in Cage's adoption of chance. Pritchett suggests that Cage turned to chance following his reading Daisetz Suzuki, who introduced him to unimpededness and interpenetration, and his storied visitation of the Harvard anechoic chamber, which solidified his conviction that composition entailed an attentiveness to ambient sound. Experiencing concretely the simultaneity of sounds even in an artificially "silent" place, Cage began relying on chance to allow works to define their own terms (74-76). This principle would be applied to his writings as well. I argue that closer attention to this term will not only reveal the hidden architecture of *Silence* as a book, but that it is also the point where Cage's debt to cybernetics is most productive.

Silence was a mammoth of book design and typesetting; most works had a unique visual style including not only spacing on the page, but precisely delineated variations in type, weight, size and capitalization. Most importantly, many points in *Silence* boast multiple texts simultaneously, fitting Cage's stories and critical context in the blank spaces and occasionally alternating texts line by line. The disconnected stories that comprise the lecture, "Indeterminacy," are partly collected near the end of the text and partly distributed over the course of the book. This design reflected the content, in which concepts are both separated and interwoven, to suggest the ways that everything from mushroom hunting to Ludwig Wittgenstein were interrelated.

Interpenetration appears as a visual structuring principle in the earliest text in *Silence*, the polemic "The Future of Music: Credo," written in Seattle in 1937. Over its brief three pages, paragraphs of essayistic prose are alternated with fragments of a capitalized series of declarations, lending sense to one another while also being legible separately. The most ambitious piece, "Where Are We Going? And What Are We Doing?," extends this principle to four different lectures for over 60 pages, while its runner up, "45' for a Speaker," intersperses textual collage (from the rest of the book) with alternatively typeset instructions for simultaneous unrelated physical actions to be performed while reading the text. Though the subject matter varies, the visual effect of the text's design foregrounds simultaneous events, distinct but interrelated. This design went so far as to be incorporated into its marketing, as the promotional materials alternated passages from the book with critical "blurbs," differentiated only by color (1961-1967," John Cage Papers). The paperback edition of the sequel text, *A Year From Monday*, would also be formatted in this way.

What happens when texts interpenetrate in the manner Cage pursues in *Silence*? First, texts are segmented according to a given scheme and laid out such that they alternate in some form. This results in a fragmentation of the text, such that they not only appear in heightened material form, but with reference to the schema of segmentation. This attention to the materiality of the text opens up an indeterminacy in the fragment such that a greater variety of meanings is invited as a matter of interpretation.

Attaining this condition by means of segmentation and interlinear arrangement allows for an interaction between the interpenetrating elements based on unseen properties inherent in the materials. This interaction is emergent and can be understood in terms of the elements joining to produce a system as yet unseen. The emergent properties hinge on the indeterminacy of meaning opened up by the ordered segmentarity of the elements. When texts interpenetrate, emphasis from one element to another shifts and points of unexpected convergence or sense appear. When this takes place, the reading of the text is not merely propelled by the literal sense that subtends the individual elements, but by a rhythm or pulse that emerges in the convergences and shifting sense of the elements together.

"Interpenetration" appears as a concept in the final lecture of the "Composition as Process" cycle, and this final lecture is fittingly titled "Communication." It comes from the lectures of Daisetz Suzuki. Cage relates how he learned the term, saying that according to Suzuki, Europeans think in terms of cause and effects, while "Oriental" thinking is based on "an identification with what is here and now." Like cybernetics, Cage's understanding of Zen eschewed cause and effect for alternative ways of understanding the natural world. Cage writes,

> [Suzuki] then spoke of two qualities: unimpededness and interpenetration. Now this unimpededness is seeing that in all of space each thing and each human being is at the center and that furthermore that each one being at the center is the most honored one of all. Interpenetration means that each one of those most honored ones of all is moving out in all directions penetrating and being penetrated by every other one no matter what the time or what the space (46).

Cage draws on Zen as way of bypassing what he saw as a restricting Western tradition, with its rigid musical harmony, emphasis on cause and effect, and belief in self-contained individuals, among other things. Interpenetration, the more commonly used term of the two, is a model for thinking of how all beings can be interrelated. Placing "each one being at the center" while simultaneously "moving out in all directions penetrating and being penetrated by every other one." It is a model of relationality rather than cause and effect, in which "each thing and each being is seen as moving out from its own center" (37, "Composition as Process: Indeterminacy"). In this paradox, where all things are related and all things are independent, Cage finds a way to think about the simultaneity of sounds and silences together.

Despite this being defined in the abstract, Cage put it into practice quite simply, by treating any work or performance as an opportunity for juxtaposition, without a pre-existing notion of how the juxtaposed elements would come together. Paradoxically, interpenetration serves as a motivation to avoid making connections between elements, preferring instead to let things exist alongside one another, or further, to separate them. This tendency is fairly consistent in Cage's 1950s thought. In the 1955 "Experimental Music: Doctrine," he address what he sees as the unnecessary use of a common rhythm in music, saying "You insist on their being together? . . . If you have no particular togetherness in mind, there are chronometers.

Use them" (15). Indeed, his performances with collaborators, including music-dance works with Merce Cunningham, and lecture-music pairings with pianist David Tudor, the elements were kept strictly separate. In "Composition as Process: Indeterminacy," Cage explains,

> It is indeed astonishing that music as an art has kept performing musicians so consistently beating time together like so many horseback riders huddled together on one horse. It is high time to let sounds issue in time independent of a beat in order to show a musical recognition of time which has already been recognized on the part of broadcast communications, radio, television (40).

Cage turns toward separation because he deems connection not only forced and inauthentic, but as counterintuitive as multiple riders on a single horse. Further, that communications technology already approximates the conditions of simultaneity, or interpenetration, as a general truth to be recognized by the arts. As Cage put it in "Where Are We Going? And What Are We Doing?," attempting to impose connections misses the existing connections between things that already exists. He wrote, "Nothing needs to be connected to anything else since they are not separated irrevocably to begin with" (228-229).

"Composition as Process: Communication," problematizes the mathematical model of communication, in order to link information theory with interpenetration. It makes the essential connection between the two, in a way that would lead to his later overt embrace of cybernetic principles filtered through McLuhan and Fuller. The lecture itself is peppered with more esoteric references to Wiener's *Cybernetics* text, and one explicit, if playful, reference to information theory. Cage, of course, does not accept information outright. Rather, he presents information in a general collage of

questions, quotations and references, playfully side-stepping the point in a way that underscores his understanding of information. Cage asks a series of questions about the definition of communication, and in the process exposes these fundamental ambiguities. Can a statistical measure speak to the uniqueness of a work of music? How do we distinguish between art and non-art? Rather than banishing the colloquial sense of information and communication, Cage puts it front and center:

> Is communication something made clear?
> What is communication?
> Music, what does it communicate?
> Is what's clear to me clear to you?
> Is music just sounds?
> Then what does it communicate?
> Is a truck passing by music?
> If I can see it, do I have to hear it too?
> If I don't hear it, does it still communicate?
> If while I see it I can't hear it, but hear something else, say, an egg-beater, because I'm inside looking out, does the truck or the egg-beater, which communicates?
> Which is more musical, a truck passing by a factory or a truck passing by a music school? (41, *Silence: Lectures and Writings*).

Cage introduces uncertainty into the message of the mathematical model of communication. Cage links communication with musicality, in order to cast suspicion on both. Coming in and out of focus, communication as a definable thing exceeds our grasp. We are presented with situations in which things may or may not communicate, playing on our assumption that they do not. Asked which communicates, a truck seen through a window and an egg-beater in the room conflict for attention, and the reader (or listener) appears to be forced to choose. The reality, of course, is that each is equally likely to present itself to us, and each is equally valid in communicating what it is. If communication, in the information theory sense, implies a decision granting different weights to different things, Cage attempts to undermine this understanding in

favor of an all-encompassing noise where everything communicates simultaneously, whether or not we receive the message.

Further in the lecture, Cage prefaces one of his quotations with the following quip, "Here's a little information you may find informative about the information theory." The remarks again underscores that Cage is simultaneously taking the mathematical model of communication seriously, while riffing on its ambiguities. The quote itself comes from a minor cybernetics text, Stanford Goldman's 1953 *Information Theory*, which Cage presents in all caps:

> FOURIER ANALYSIS ALLOWS A FUNCTION OF TIME (OR ANY OTHER INDEPENDENT VARIABLE) TO BE EXPRESSED IN TERMS OF PERIODIC (FREQUENCY) COMPONENTS. THE FREQUENCY COMPONENTS ARE OVERALL PROPERTIES OF THE ENTIRE SIGNAL. BY MEANS OF A FOURIER ANALYSIS ONE CAN EXPRESS THE VALUE OF A SIGNAL AT ANY POINT IN TERMS OF THE OVER-ALL FREQUENCY PROPERTIES OF THE SIGNAL; OR VICE VERSA, ONE CAN OBTAIN THESE OVER-ALL PROPERTIES FROM THE VALUES OF THE SIGNAL AT ITS VARIOUS POINTS (47).

What is remarkable is what Cage draws from it. Following Suzuki's definition of interpenetration, the Goldman passage reveals similarities that Cage is pointing our attention to. The passage describes a signal as a compression of other frequencies taking place simultaneously. Likewise, this condition allows for one point in a signal to reflect the whole of the signal, and vice versa. For Cage, the tendency toward a conception of a signal as all signals taking place at once, and in harmonious interrelationship, was reflected in his repeated emphasis elsewhere in the lecture on the Zen concepts of "unimpededness and interpenetration" (46). In this conception all things, including trucks and egg-beaters, exist simultaneously independently and

interrelatedly. He selects this passage on information theory to indicate this - each sound having its own place, while also existing in a larger totality.

Given these passages, there is another significant reference to cybernetics in the lecture, one that is easy to overlook. At the beginning of the lecture is a more disparate series of questions, including the two that follow: "If we had any sense in our heads, wouldn't we know the truth instead of going around looking for it? How otherwise would we, as they say, be able to drink a glass of water?" (43). Who is the "they" to which Cage refers? What sort of concern over being able to drink a glass of water is part of common parlance? And what does it have to do with our inner sense, and our endless turning outward for truth? One potential answer, that can never be fully proven, is that Cage is making a subtle allusion to feedback as a metaphor for consciousness. In fact, Norbert Wiener's chapter on feedback in *Cybernetics* begins with a description of a patient unable to drink a glass of water due to a failure in biofeedback. "Another patient comes in. . . . Give him a glass of water, and he will empty it in these swings before he is able to bring it to his mouth. What is the matter with him?" Wiener explains that the patient is unable to coordinate his motion due to a failure in his "proprioceptive or kinesthetic sense," which Wiener explains as a form of biological feedback. (95-96, "Feedback and Oscillation"). In the context of a lecture titled "Communication," it may be rephrased: "without [communication], how might we, as they say, be able to drink a glass of water?" Cage is subtly alluding to the then-novel understanding of communication as feedback.

Such an interpretation would be a reach, were it not for two factors. First, that Cage read and recommended Wiener's *Cybernetics* to artists. John Brockman, a young contemporary of Cage, would recall being given a copy of Wiener's

Cybernetics as well as attending a series of dinners hosted by Cage, where intermedia artists discussed the writings of Wiener and Marshall McLuhan ("The Collective Conscious," https://edge.org/response-detail/11958). And second, that it is specifically the sort of oblique reference that Cage delighted in. Thinking about Cage's use of interpenetration and information in relation to McLuhan and the externalization of consciousness, the "sense in our heads" that Cage refers to is the old understanding of consciousness, prior to the cybernetic definition. In the latter, consciousness is a feedback loop based on perception, challenging our understanding of subjects as self-contained.

Where "Lecture on Nothing" provides his definition of poetry as "nothing to say and . . . saying it"; and "Composition as Process" situations information theory in Cage's composition methods; and "Indeterminacy" captures Cage's world through humor and storytelling, the composer would pursue his cybernetic poetics in another text. The most formally complex work in *Silence*, "Where Are We Going? And What Are We Doing?", is the centerpiece, taking the organizing principle of interpenetration to its natural limit. It is the longest lecture and most ambitious, being four simultaneous lectures, laid out as interpenetration, and attempting to answer the questions set out in the title. Like many of the other lectures, it is formally exemplary, slyly mimetic in its attempt to capture the experience of cybernetic society. The chance operations that provided the core instructions for the work are profoundly complex, but with fruitful results; the text was the springboard for Cage's social concerns, transitioning from the formalist concerns of *Silence* to the social concerns of *A Year From Monday* and *M*.

In the introductory text preceding the lecture, Cage positions the text relative to his interest in science, and drawing upon it to depict "nature in her manner of operation." This mimetic function is qualified by what Cage saw as the momentous changes in science at the time, noting, "I find nature far more interesting than any of man's controls of nature. … Not all of our past, but the parts of it we are taught, lead us to believe that we are in the driver's seat." Cage thinks otherwise, wanting to cede control to nature, creating a text that can depict nature on its own terms. The introduction ends in the affirmative: "Let us say Yes to our presence together in Chaos" (194-195). Though cybernetics is not mentioned directly, we will find that this "chaos" corresponds directly to the noise of information theory.

"Going" is frequently alluded to, but rarely examined in any detail. As we discussed, Joan Retallack draws on Cage's depiction of "nature in her manner of operation," finding in Cage a "complex realism" adequate to a world of information (256). Retallack rightly notes that Cage's interest in representing nature attempts to meet and correspond to this new reality. Helpfully, she reads Cage as responding to the "noncompressibility of information" (257). Unfortunately, she does not name or comment on the text that this comment on "nature in her manner of operation" refers to - "Where Are We Going? And What Are We Doing?" (250, *Composed in America*). However promising, her discussion elides a fuller analysis of "Going," let alone interpenetration more broadly. Jackson Mac Low has helpfully referred to "Going" as the beginning of Cage's poetics, informing the explicit poetry of "Mureau" and the mesostic works (291). And yet, Mac Low does benefit from his closeness to Cage, drawing primarily on Cage's own published statements about the work. Marjorie Perloff, as we observed before, has not said much about

interpenetration, and has in fact spent more time on a text sharing "Going"'s namesake ("Where Are We Eating? And What Are We Eating?") than the text that inspired it. Richard Brown's mostly excellent year-long project of reading through Cage's works, collected online as *A Year From Monday: Reading Through John Cage's Writings*, essentially gives up on interpreting the lecture, suggesting that the lecture is a "philosophical joke," whose statements "are of no particular significance." Brown goes so far as to suggest that Cage's use of *Cartridge Music* to compose the work was a sham, covering "a sort of stream of consciousness writing that does not really stick to any particular idea, but instead flows seamlessly" (http://www.ayearfrommonday.com/2012/02/where-are-we-going-and-what-are-we.html). Given what we know of the seriousness with which Cage took his chance-based writing, as well as his resistance to stream of consciousness writing with its rootedness in the individual ego, the lack of evidence for Brown's claim suggests that it is based in frustration with the text's difficulties rather than research into its genesis. Further, as we will find, looking at the notebook manuscript drafts of "Going" reveal that its subject matter is precisely chance-controlled, often down to the sentence.

Here, the rigors of Cage's procedural form are most explicit. Cage does not merely carry through a pre-given set of instructions, in the vein of a purely chance-determined text. Cage's cybernetic poetics does not culminate in the total mechanization of the writing process. Rather, Cage positions himself, as writer. He uses means to frame his own writing process, to assign himself with writings to complete. Because of this, Cage's poetics are not simply a procedural formalism, an update of classical prosody for the typewriter (or now the word processor), but a way of pushing Cage to put words to things.

The occasion for the lecture was a lecture at Pratt Institute, to be delivered in 1961 and written in 1960 while in residence at Wesleyan University. The published version of the introductory text recounts, "I was told that the burning questions among the students there were: Where are we going? and What are we doing? I took these questions as my subjects and, in order to compose the texts, made use of my *Cartridge Music*" (194). "Going" is in fact four lectures, designed to be delivered simultaneously. Cage read one of the lectures over recordings of the other three, but also allowed flexibility in the manner and number of lectures delivered or played.

Like the other major texts in *Silence*, Cage wished to present the lecture such that the typographic form reflected something of the nature of the performance. In the case of "Going/Doing," the aim was to present the text of the lectures simultaneously. The resulting choice was to present the four lectures in close to 200 four line sections, each presenting a line of the lecture. The lectures are distinguished by their typeface; the first in bold, the second in italic, the third in bold italic, and the fourth in Roman (plain) weight. One may use this to guide the reading of a particular lecture in the midst of other texts, as in the example below:

> **who wins (We're going out.) A teen-ager-**
> *course be his again, but what*
> ***our heads that existence, the existence of***
> *

> **served custard that had wheyed--said, "My**
> *would he do? I asked the three girls*
> ***a sound, for instance, is a field***
> At the beginning of our going, it seems

> **mother bakes custard too, but she**
> *what they would take with them*
> ***phenomenon, not limited to***

that we are going our separate ways,

The 64-page lecture(s) can be read four ways, with each type style able to be read linearly, if painstakingly, on its own. The texts themselves stop and start at varying points, leaving intervals of as many as four and as few as zero texts in a given four-line unit. Due to the proximity of as many as three other texts at any given point, one is liable to "slip" into another lecture.

Though the writing is in some ways an accessible mix of Cagean proclamations and stories, it is characterized by some of the most abrupt shifts in subject matter to be found in the entirety of *Silence*. For example, the second lecture begins (after three blank lines) with four unrelated sentences, "*Those of us who don't agree are going around together. The string Duchamp dropped. He took the apartment without being able to pay for it. They danced on a concrete floor*" (195). Other than the first sentence containing the word "going," there is little indication of how the materials will be related to the subject. The passage continues with a story, "*One New Year's Eve I had too many invitations. I decided to go to all the parties, ending up at the most interesting one. I arrived early at the one I was sure would be dull. I stayed there the whole evening-never got to the others*." We find another hint at the theme of "going," nested in one of Cage's parable-like stories. The themes of chance (embracing the unexpected outcome), simultaneity present themselves in a brief moment of sense. The second lecture then goes "silent" for another seven lines, before beginning again, "*Three birds and a telephone ringing. Does that relate to where we are going?*" (195-196). The text appears to call attention to the confusion of the reader: does the reference to the birds and telephone have anything to do with the subject Cage took on? What is Cage talking about?

Though there are longer, more continuous and direct passages, "Going" proceeds in this way without any apparent narrative, touching on subject matter both relevant and irrelevant to the subject in fits and starts, in passages of varying length. Among the longest are stories, the longest of which range from Cage's abortive attempts to purchase a book of matches to a long summary of the life of Ludwig Wittgenstein. When Cage addresses his chosen subject matter, it is often obliquely, as in the following passage of the first lecture. Cage writes, "**You want to know what we're doing? We're breaking the rules, even our own rules. And how do we do that? By leaving plenty of room for X quantities**" (197). Most references to where "we" are going or what we are doing have this quality, written in second person plural, using "going" or "doing" as anchor words for abstract or metaphorical language, or in stories.

As we have noticed, Cage's ideas for the construction of the lecture stem from a desire to "imitate nature in her manner of operation." The "manner of operation" is, of course, interpenetration, as a textual representation of the simultaneity that Cage saw as the spirit of the cybernetic moment. Enacting this for the lecture required, in Cage's eyes, that "meaning is not easy to come by." This is partially achieved by the daunting layout, but also takes place at the level of meaning. Cage takes his meditations on communication and applies them to the entirety of the lecture, ensuring that meaning and meaninglessness interpenetrate in the lectures, taking place simultaneously. This is hinted at in a passage of the first lecture. Bookended two stories, Cage asks, "**Which are you supposed to read: the article or the advertisements?**" (211). In a newspaper, both articles and advertisements occupy the same space, interpenetrating visually. Further, Cage's question makes an astute point

about the newspaper as a medium. Is the "message" the article, or the advertisement that pays for it? The implications of this question animate any reading of the text, as Cage set out to include both: writings relevant to the subject matter of "going" and "doing," told obliquely, and irrelevant writings designed to bury the meaning even further in a wash of ambient textual noise.

Just like other writings, "Going" is intimately bound with a musical composition, *Cartridge Music*, as Cage noted in the introductory text. It was composed first for electronic music, when Cage's primary approach to composition was, as Pritchett observes, "the design of electronic sound systems," in which the "cartridges" meant the electronic pickups used to to amplify different ambient sounds (152, *The Music of John Cage*). *Cartridge Music* can be applied to any sound source, because it requires no notation other than specifying when sound sources would be "on" or "off," with additional features allowing for select variations in how the amplification would be applied. Thus, the pairing of four lectures, composed via *Cartridge Music*, and evoking interpenetration, suggest a continuation of the theme of communication but explored on a deeper level, impacting the form and the content in ways that inform but do not surface in the text. Other texts were written using *Cartridge Music*, including "Rhythm, Etc.," "Jasper Johns" and "Robert Rauschenberg: The Artist and His Work," though "Going" is the most ambitious text written in this manner. The novelty of *Cartridge Music* is its being written for electronic tape, and thus less concerned with notes than with coordinating multiple sound-generating elements simultaneously, specifying the times and a sound source would be on and off. It is a composition not simply based in electronics, but drawing on their spirit.

Cartridge Music was conceived as a way of coordinating any sort of musical ensemble of any instrumentation, but was written specifically to accommodate the on-off nature of electronic devices. It is a chance-based work, though radically different from any works composed using the *I Ching*. Rather than tossing coins, *Cartridge* music involves the overlaying of marked transparent sheets to determine the timing, duration and type of event to be performed on a given instrument. In an early draft of the introductory text, Cage included a description of *Cartridge Music* and how he applied it to "Going," which were later omitted from the version published in *Silence*. *Cartridge Music* is essentially comprised of five transparent sheets overlaid at random. The first sheet, selected from 20 for the purpose, represents any ensemble of instruments with different numbers of irregular shapes. For the lecture, Cage "used the sheet having 2 shapes, since the subject of the lecture had 2 parts," the two parts being the questions, "Where Are We Going?" and "What Are We Doing?" Cage thus replaced "instrumentation" with subject matter in this usage of the work. The other transparencies would cumulatively prescribe "musical events" for each instrument, in what order and with what timing. A sheet with "points" and another with "circles" would each describe different events, based on whether they were inside or outside of a given shape. Another sheet with a somewhat random, squiggled line would intersect with these; following the line would indicate what events would happen, and in which order. The final sheet, marked with a stopwatch, would indicate the timing of these events ("Autograph draft of headnote," John Cage Papers).

Cartridge Music, as suggested above, indicated where to talk about the subject of "going," and where to talk about "doing," based on the chance overlaps of shapes

and other markings. Further, it would determine how Cage would talk about them. Cage wrote, “Points within one shape refer to Where are we going, within the other to What are we doing [ibid]. Points outside the shapes indicated the discussion of irrelevant subjects. Circles within the shapes indicated relevant stories, those outside irrelevant stories.” Cage drew readings, and following the line, determined what he was obligated to write; a story about going, an irrelevant remark, a remark about doing, etc.

The composition of “Going” is made complicated by translating the “timing” in *Cartridge Music* to spacing on the page, resulting in the lecture being organized in 60-line “minutes” of text, not visible in the published text but used to arrange the final spacing on the page. Timing in *Cartridge Music* is based on a stopwatch-like figure divided into seconds on the final sheet; it is too complex to describe in detail, but in short the overlay randomly chooses two points on the stopwatch to serve as the duration, such as from second 3 to second 56 (53 seconds), or from second 56 to second 3 (7 seconds). Cage translated timing to spacing on the page, treating each line on a notebook as one “second” (complicating matters, Cage’s performances were two seconds per line). As Cage observes, “May superimpositions were required in order to obtain sufficient material for 4 complete texts” (“Autograph headnote,” John Cage papers).

The aptness of *Cartridge Music* for cybernetic poetics is threefold. First, it is rooted in the adaptive and immersive experiments with cybernetic, electronic performance that would characterize Cage’s music in 1960s. Second, it uses simultaneity - closely related to interpenetration - as a composition principle. Third, and most importantly, it allowed Cage to not simply make “the point” about

cybernetics, but to make precisely structured digressions, with the point being the sense of misdirection at all levels. One of the more compelling aesthetic choices was to factor digressions in, by allowing chance to determine when an "irrelevant" subject would be explored. As we will see, the effect spills over into the statements explicitly written to purpose, resulting in a text that elliptically, noisily, meditates on the nature of cybernetic society. In doing so, Cage would set the terms for his future engagement with Marshall McLuhan and Buckminster Fuller.

John Cage's manuscripts for "Where Are We Going? And What Are We Doing?," housed at Wesleyan University, include five identical ruled steno pads used for lecture(s) organization and composition, with additional loose drafting material. Four of the steno pads are dedicated respectively to each of the four lectures, drafted according to predetermined times and other than a few discrepancies in alignment with the final printed version, and a handful of small amounts of text moving to different points, the manuscript text is almost identical to what appeared, interpenetrated, in *Silence*. Included in these four steno pads are incidental notes with directions from the chance operations in prose and hand-drawn chart form. A fifth notebook includes additional instructions and writings that were likely a first attempt at the writing style.

It appears that, regardless of whether each lecture was written 'straight through,' that they are composed of shorter chunks with lengths and subject matter determined by chance. Cage would apply another transparencies-based chance operation to determine each small piece with a given order. Cage would then write each one using only the allotted line lengths. For example, the first lecture begins at the "1 second" point (line 1) and goes silent at the eight line. It reads, "**If we set out**

to catalogue things today, we find ourselves rather endlessly involved in cross-referencing. Would it not be less efficient to start the other way around, after the fashion of some obscure second-had bookstore?" (195), and with the steno pad manuscript including a "1" at the first line and an "8" in the first empty line following the passage (**CITE,** Box 13, Folder 7,). After over a dozen lines of silence, the lecture begins again at second 34 for a briefer piece of text that goes silent at second 38. Cage appears to have used an overlay for each small section like this, determining the subject and length of each small unit of writing. The notebooks have these time lengths throughout, indicating that the sequences were planned in advance and written accordingly. Separate from the writing, some of the notebooks include diagrams indicating timing and sequence of each unit[6].

As we return to the passage from the second lecture, cited at the outset, we find that we are able to determine the purpose of its contents. The complete stretch of text reads,

> *Those of us who don't agree are going around together. The string Duchamp dropped. He took the apartment without being able to pay for it. They danced on a concrete floor. One New Year's Eve I had too many invitations. I decided to go to all the parties, ending up at the most interesting one. I arrived early at the one I was sure would be dull. I stayed there the whole evening-never got to the others* (195-196).

Looking at the notebook for the second lecture, the first four lines, which correspond to "Those of us . . . concrete floor" (the first four sentences) are marked "4-8," while

[6] Though it is outside the scope of this chapter to piece together the precise composition of the lecture, it appears that Cage struggled to precisely determine a workable sequence. It appears that the first 'readings' of the transparencies generated unworkable text lengths, and that Cage instead generated the units separately before selecting and ordering them - still chance-based, but with more of an unidentified hand of the composer. Further analysis of the materials could resolve the ambiguity with greater certainty.

the latter portion is marked "8-16," indicating different purposes for each bit of text. Though there are no clear clues in the extant manuscripts, one can make an educated guess that lines 4-8 were to be filled with irrelevant statements (with questions raised by the word "going"), while lines 8-16 were to be filled with a story relevant to "going."

The above is meant to position our understanding of the text, to see the following three features: the indebtedness to his cybernetically derived use of interpenetration, creating a text as a noisy channel; the implicit social context of cybernetic society that Cage is responding to; and the actual references to cybernetics and automatic machinery and computers that form the basis of the text.

Cage's writings, misleadingly referred to as "stream of consciousness," in fact display a high level of organization. The difference is that this level of organization is designed to hold meaning at bay. Meaning is never abandoned, but rather reframed. We find that it is in the particularly constructed meandering that the narrative of cybernetic poetics takes place. If we follow certain recurring motifs, we find that this very approach leads associatively to concerns at the heart of cybernetics. Cage makes frequent references to machines that are mostly elliptical, on further analysis reveals the depth of his thinking about machines, information and media. Very near the beginning of lecture 1, Cage writes,

> **We're putting art in museums, getting it out of our lives. We're bringing machines home to live with us. Now that the machines are here so to say to stay with us, we've got to find ways to entertain them. If we don't, they'll explode, but as for going, we're going out. Did we just notice the moon or was it there always? Where we're going is not only to the moon but out into space. Home is discrete points. Space is an infinite field without boundaries. We are leaving the machines home to play the old games of relationships, addition and who wins. (We're going out.) A teen-ager -- served custard that**

> **had wheyed -- said, "My mother bakes custard too, but she doesn't put water in it." Let us admit, once and for all, that the lines we draw are not straight** (198-199).

Looking at the first notebook, the directions are for a text running from seconds 43 to 3, with no indicated differentiation of content ("Steno Pad, I," John Cage Papers). For lack of contextualizing archival materials, we must determine the meaning on our own. We see references to going throughout, though the passage is elliptical. Cage remarks twice that "We're going out," as well as noting that "we're going . . . to the moon" as well as into space. Along with the clearly irrelevant story of the custard, there are loose self-contained statements about space and machines that also appear to be irrelevant. And yet, the first reference to "going out" followed by its parenthetical, suggests that each sentence in some way refers to going. The first two sentences each imply movement with suggestive parallels: "**We're putting art in museums, getting it out of our lives. We're bringing machines home to live with us**." Art is separated from our lives and homes, while machines enjoy the opposite, becoming something like companions as they "live" with their owners. Cage's language suggests separation and containment, a "home" which he opposes with "going out." This is compounded in his distinction between "home" and "space" - the former is "discrete points," while the latter is "an infinite field without boundaries," something more closely resembling unimpededness and interpenetration than the assumed regularity of "lines we draw." Along the way, Cage manages to also jab at the much-protested separation of art and life. The fulcrum of these statements appear to be machines. Art has been replaced by machines, which now appear to be so complex as to demand our constant attention. Though the parallel structure suggests the conservative line of technology replacing authentic aesthetic experience, Cage appears to cede purpose to

them readily; they will play "the old games" of calculation, while "we" go out. Out includes space, the moon, all enormously dependent on machinery, suggesting that there is a necessary purpose to these dynamic machines that Cage is considering.

Over the many comments on machines, mostly concentrated in the first lecture but also in the others, Cage calls for new, better machines. Playfully, Cage observes, "**It's very curious. I remember recording machines with dials and clutches. Then later there were push buttons. Now one has the feeling we're going to have dials again. We need desperately when it comes to a machine to be able to go at any speed**" (205-206). In some ways, the first four sentences of this passages suggest nothing other than a blasé attitude toward technological change. It is worth keeping in mind that he is emphasizing the lived experience of machines. Cage is referring to buttons, dials and clutches, not gears and vacuum tubes; he is focusing on machines as they are experienced and used. In short, these are the machine interface, and as we will observe shortly, they are the parts of machines that can be seen as extensions of the human body.

The last sentence of the passage, articulating a "need' for "a machine to be able to go at any speed," again suggests that while Cage's tone is playful, machines apparently play a significant role in Cage's universe. Cage might riff on the ubiquity of machines, but continued technological innovation remains on the composer's map. The need for the machine "to be able to go at any speed" further suggests a computer with increased processing power. This is borne out by a passage near the end of the lecture, where Cage remarks, "**What we need are machines that will enable us to do all the things we could do before we had them plus all the new things we don't yet know we can do. Perhaps you would say we are going mad. We are certainly**

aimless or might you say that is our aim" (243-244). Again, Cage insists on 'needing' machines, though we now get a sense that these machines are not currently existing, but machines exceeding the scope of the cybernetic project, that are so effective they not only meet human needs, but anticipate new ones. By acknowledging the possibility of "going mad," the composer acknowledges the unrealistic demands he is making of machinery. It is worth noting, to complicate matters, that Cage is talking about "going" mad, meaning that the above has been related to the question at hand: Where are we going? The answer is a world filled with machines, relentlessly driven to continue their advance.

Thus far, the passages on machines have been presented in a mostly playful light. We have seen Cage evoke the experience of a life filled and managed by an unprecedented number of machines. And further, that Cage has suggested computers and information in these references; the machines live, process information, and solve tasks that humans haven't yet known they needed solved. Where most of these passages have appeared in the first lecture, in the third the link to cybernetics is made much more explicit. Cage writes, "***I think the knowledge as it gets extended (and you see that I mean information) will get into books that will be read not by us, but by machines, because there will by that time be too many***" (249). Here more than anywhere else does Cage signal a theme mostly addressed by other thinkers: information overload. There will soon, in Cage's phrasing, "be too many" books to be read by humans. Once knowledge becomes information, it becomes a mass of data, unnecessary to engage except by machines. Presaging conceptual writings emphasis on information networks by close to a half century, Cage himself becomes a mechanistic reader, engaging texts by the algorithmic processes of chance operations

rather than conventional linear reading. Crucially, Cage's understanding of information resonates with his interlocutors in McLuhan and Wiener, as an extension of knowledge in the media theoretical sense. It is not simply that machines are now the primary information processors, displacing the human activity of reading, but that Cage orients himself toward information as a new way of thinking about communication in the first place. Information is an extension, contributing to the exteriorization of the nervous system.

Cage makes this explicit in the fourth lecture, where he describes a moment of this extension in lived experience. The composer tells a long story about a minor conflict with the appointed housekeeper for Cage's office at Wesleyan. Not unexpectedly, the two differ in how to keep the "house and desk in order," and what that order means. Cage recounts making "a sweeping gesture around the room suggesting the embrace of the chaos that one could see there," and insisting that the housekeeper leave the papers as they are. Cage explains, "There are advantages and disadvantages. . . . You might call living in chaos an exteriorization of the mind. It is as though the things in the room, in the world, in the woods, were the means of thinking" (216-219). These last two statements are the strongest affirmation of the cybernetic purview in the entirety of *Silence*. Information is not "something made clear," as Cage put it in "Composition as Process: Communication," but an extension of all things in the general state of chaos. As information, capable of introducing changes in physical states, this extension becomes operationalized in a larger cybernetic system. It is not that the things themselves think, though Cage would perhaps be sympathetic to this prospect, but rather that they "were the means of thinking." That is, the unimpededness and interpenetration of all things that Cage

subscribed to was not simply an abstract spiritual principle, but a condition of things related to one another by their being joined in the information circuitry of a larger cybernetic system.

Cage intuits the fundamental links between chaos and information, identifying these characteristics not as "mere" disorder but a rethinking of order as a total participation in a cybernetic universe. He writes, "**We're getting around to the usefulness of science (I don't mean probability) (I mean seeing things just as they are in their state of chaos)**" (212). What does it mean to appreciate the "usefulness of science" but not have it mean probability? The very foundations of cybernetics are in statistics. It would appear that this would contradict any sense of Cage drawing upon cybernetics. But the end of the sentence helps point the way; "seeing things just as they are in their state of chaos." Chaos emerges as a dominant theme because chaos itself is not disorder, but the coextensiveness present in both the 20th-century mass media ecology and the natural world. The result is that the answer to the question, "Where are we going?" is frequently "nowhere," albeit a nowhere with its own sense of purpose. Cage remarks, "**We do not determine where we go by where we'd like to go. We are too aware of everywhere**" (218). Awareness of everywhere is possible with increasing medial connection across the globe. This means that "everywhere," like "space" in the previous passage, is simultaneously abstract and concrete; it refers to totality, but it also refers to the connected globe.

Near the end of the second lecture, Cage goes into greater detail with respect to interpenetration, arriving in the process at the politics of anarchism. He ties anarchism to the self-abnegation of his earliest work, deftly negotiating one of the paradoxes of interpenetration. In much the same way that interpenetration both invites

and discourages connection (all things already being connected), it also complicates our understanding of self-expression. Cage calls for "*leaving our emotions where they are in each of us. One of us is not trying to put his emotion into someone else. That way you 'rouse rabbles'; it seems on the surface humane, but it animalizes, and we're not doing it*." Like Cage's earlier doctrine of separating elements of a performance, one should not force a connection between the emotions of one and another. One leaves the emotions "where they are," just as one leaves the machines at home. The motivation, here, is ethical and political, concerned with the ways that forcing emotional connections "animalizes" one another. Cage explains, that by leaving the emotions where they belong, refusing to force them upon one another, "*a paradox takes place: it becomes a simple matter to make an identification with someone or something. But this is virtually impossible in terms of ideas and feelings*." Revealing a kernel of something resembling rationalism, the composer suggests that the conditions of cybernetic interpenetration do not depend on the affects. Though this point can and should be examined further, it reminds us that the paradox is a fundamental aspect of Cage's picture; it is not 'mere' connection, as this represents certain dangers that he wishes to avoid. The condition he wants to reach is articulated at the end of this passage, as he writes, "*But what we are doing is in our ways of art to breathe again in our lives anarchistically*." Anarchy, for Cage, is the ethical limit point expressing how he things people must live with one another. Cybernetic society, which externalizes consciousness based on communications, does not need to connect every aspect of one another for connection to be realized, as it is already happening. To embrace chaos, like anarchy, is for Cage an attentiveness to this fact, rather than something to be broad about (252-254).

Cage builds to an embrace of chaos, specifically chaos as a condition of the exteriorization of the mind. That is, the chaos of life in the age of cybernetics and information. His turn "to breathe again in our lives anarchistically" is Cage's broader ethical approach to the cybernetic moment. As we see, as interpenetration unfolds in "Where Are We Going? And What Are We Doing?," it becomes a meditation on the nature of machines, and information as extensions of ourselves.

For such a meandering, difficult text, "Where Are We Going? And What Are We Doing?" stages a cybernetic poetics of interpenetration, and in the process arrives at the global political and ethical concerns that would motivate much of Cage's later writings. The sense of connection that Cage identifies is not simply a spiritual one, and therein lies the complications that Cage delights in proliferating. This connection requires autonomy and disconnect together. Cage finds personal coherence in this, by identifying how information's extensive properties allows for the conditions of interpenetration to be all the more apparent and realized. The result is a turning toward noise, not simply as a musical principle, but a social principle. Cage's poetics is a poetics of noise.

As we have observed in "Where Are We Going? And What Are We Doing?," John Cage draws on his electronic composition, *Cartridge Music*, to stage interpenetration as the singular poetic principle of the cybernetic moment. More enticingly, Cage finds himself concluding, if concluding is an adequate word for it, on anarchism as the political principle of the cybernetic age. This anarchism began in Cage's embrace of sounds unencumbered by traditional musical categories, and was elaborated as an aesthetic philosophy over the course of decades of writing, culminating in *Silence*, as the unified cybernetic poetics of interpenetration.

The foregoing chapters of this project, especially those where Heidegger's comments on technology are concerned, have suggested that the politics of cybernetics lie in the varying cybernetic definitions of the social, naming nature as change, and in the process subjecting political life to new forms of precarity. Under the spell of McLuhan's proposed narcissistic relation to technology, I have argued that most thinkers of cybernetics have not fully grasped how their admittedly nuanced thinking on technology and history has in fact made them complicit in endorsing the operations of cybernetic society. It is fitting, then Cage's cybernetic poetics does not simply apply to the social shifts of new technology and media, but is embedded in it.

With Cage having provided a potential answer to those questions, he would later ask in *A Year From Monday*, "Where Do We Go From Here?" As Cage put it years earlier in "Experimental Music," the answer is "an affirmation of life - not an attempt to bring order out of chaos nor to suggest improvements in creation, but simply a way of waking up to the life we're living." Information as an aesthetic form is fundamentally a joining of the creative process with life itself. Further, with the alignment of an uncontrolled chaos with social life, which I maintain is the hallmark of cybernetic society. More important than this, however, is a statement only just before: "Where do we go from here? Towards theatre. That art more than music resembles nature." Cage would find that the noise and simultaneity he sought to produce in works like "Going" were to be found more easily in the lived world. Rather than strictly controlling the content of works to depict this cybernetically framed state of nature, Cage would turn to works that would more effectively activate it as it was going on in the present. Art would become social action, suited for the

conditions of anarchy that cybernetics in part produced, to which Cage would respond in kind.

Conclusion. The Measure of the Occasion

The core of this exploration has been on two underserved issues: the standing of poetry as information, and the historicity of cybernetics. At the core of both is an understanding that the cybernetic moment bore witness to a renewed appreciation of the nature of language. Cybernetics not only uncovers the poetry underlying the arts, it allows for poetry to be appreciated for what it does, whether in the renewal of performance poetics in the 20th century, in the autopoiesis of machinic and organismic realms, or in the event of the emergence of language in moments of transformation.

The guiding assumption of this project has been that the application of statistical measure to communication is not at odds with poetry. Cybernetics understands of language as information, and rather than restricting the potential for poetry, this ultimately opened and helped clarify its purpose. Cybernetics furnishes an "apology" or "defense" of poetry for the twentieth century that remains to be appreciated in the twenty-first. It is a poetry with both the conservative function of guiding and steering society, and the radical task of disrupting existing social structures, defining new conduits for thought.

Cybernetics can certainly help us understand phenomena like digital poetry, and new media art in general. We observed that information aesthetics in part depends on the unacknowledged role of poetry. Combining traditional media theory with cybernetic aesthetics can help furnish poetics as a multimedia prosody. We know fairly well how sound patterns work in traditional rhyming poetry, but we know less of the medial structure of words given on a page, or in three dimensional space, or in performance, or juxtaposed with other objects in other media. More important than

new media arts and their vicissitudes of fashion and investment in actual and social capital, is the sense that we can understand *mere* poetry, read on a page or read out loud, with new meanings in light of cybernetics.

We began this study with an overview of the metaphor of the ocean as a fundamentally cybernetic metaphor, describing the challenges of a complex and chaotic world, as well as the social and technical means of controlling it. The ocean becomes information, a totality and wellspring of possibility. Along with the potential to examine all metaphors in this way, we can understand nautical metaphors as hinting at predecessor poetics of information.

The sea is more than a metaphor. Its constraints led to the bulk of the earliest scientific achievements and remains the site of passage that is both ontological and political, just like cybernetics was for Heidegger. Stéphane Mallarmé's fascination with the ocean in "A Dice Throw" and M. NourbeSe Philip's *Zong!* treatment of the meaning of the ocean in recovering the history of the transatlantic slave trade, represent the bookends for thinking of cybernetics as an oceanic metaphor. Its ontological and political concerns alike foreground precarity, chance, loss and the challenge of presenting these concerns in language. Rather than being abstract questions, they have material stakes in the continued unfolding of cybernetic society.

One of the fruits this offers is in a more refined institutional critique of poetry itself. Where earlier critiques of cultural institutions emphasize primarily some external agent shaping the work, we may see understand the recursive operations of the artwork as serving a conservative function in the form of feedback. When we describe the 'self-reflexive' nature of poetry, or understand poetry in terms of its relationship with language, we are describing poetry as playing the role of feedback

loop of society. This should not furnish us with the means of critiquing all reflexivity in poems as inherently conservative, but rather, can serve as an index for the social function of the work in question.

Understanding poetry as in part having a cybernetic function allows us to reinterpret both the social function and meaning of works understood as the "canon." A close attention to classical lyric poetry reveals that recursive moments - by which the poet refers to their poem(s), to their role as poet, and to poetry as such, can be understood in light of the self-reference of social systems through poetry. Given this, how does the self-referential nature of much poetry indicate the organization of society? How might it clarify the role of class and caste, race and gender, and other markers of power and status, as well as what has been left on the precarious outside of social systems? Self-reference in poetry is in many ways a conservative operation. For example, the highly contentious divide between avant-garde and lyric poetry that became pronounced after the rise of Language school poetics can be productively reread in terms of the recursive function of both styles with regard to language.

We highlighted the role cybernetics plays in the emerging political questions of the twenty-first century - in globalized and hyper rational governing structures characterized as neoliberalism. The political implications of cybernetics are not simply in traditional questions of control and freedom. They are also in who gains the benefits of stable society, and who is left subject to precarity and chance. The problems that plague the liberal global order - economic instability, environmental collapse, regional conflicts and the resultant humanitarian crises that arise - are the environment of the mostly Western social systems that, by relentlessly managing

these crises to their own benefit, neglect to see the suffering of billions as a problem bound up with their social operations.

In this study, we have only begun to raise the question of the ‘political potential’ of cybernetics. I have avoided two possible directions this can take: an overly hasty appreciation for the ‘autonomy’ of cybernetics, with its libertarian overtones; and conversely, an equally hasty dismissal of cybernetics discourses for their apparent lack of concern with situated forms of injustice, especially the raced and gendered forms that do not appear to be readily solved by cybernetic formalisms. Instead, I have taken a descriptive path, following Heidegger’s analysis and tracing it through later critiques of late capital through a cybernetic lens.

Over the course of this project, I have mostly avoided commenting on one of the enduring contributions of cybernetics - as a broad epistemological framework for thinking about ecology. The pronounced ecological turn of the last decade furnishes a robust understanding of ecological questions as both totalizing - containing the entirety of the biosphere - and intersectional in its appreciation of social and "natural" systems as joined. Further, this turn fully appreciates the epistemological role that poetry can play in understanding the biosphere in its fullest sense. Though this project has focused narrowly on the new media arts contemporaneous with the earliest cybernetic research, it is intended to be a contribution to this broader need for providing new understandings of the systems in which we live. Extensions of this project would highlight Charles Olson's contributions to this question, as his writing presents a "whole earth poetics" foregrounding poetry as information, illuminating our lived technologies.

More broadly, cybernetic poetics allows us to understand postmodern poetry as an exploration in conversation with science, philosophy and politics. Where some lines of analysis of the poetic avant-garde appear to become absorbed in the operations of social systems, limited by its purported critique of those systems, there remains a sense that postmodern poetry's greatest gift was its contribution to knowledge. Free-associative, phenomenological, procedural and documentary poetic practices are not simply "critiques" of existing systems, but inquiries into systems that are emerging and undiscovered.

I hope that these chapters illustrate not only the significance of cybernetics, but that of poetry in understanding the turning of history. Poetry need not be either the corrupting influence of a pure logos in the Platonic vision, or the saving bulwark against the encroachments of technology. The epochal temporality of this project, treating the ‘moment’ of cybernetics, invites a tendency to include with a pronouncement of beginnings and ends. One is tempted to conclude that poetry ‘only just’ began in the cybernetic moment, or that poetry attains the rank of positive science, as the unacknowledged cyberneticians of the world, or that cybernetics is the poetry following the ‘end of man,’ or ‘end of philosophy.’ I choose not to bolster the uncertainty of prophecy with the tools of cybernetics. Poetry, like humanity, simply remains, with poetry forever attuned to the measure of common experience, and the complexity of its occasion.

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