Dreams for Our Perceptual Present: Temporality, Storage, and Interactivity in Cybernetics

Orit Halpern

In his memoir *Ex-Prodigy,* the MIT professor and cybernetics researcher Norbert Wiener once wrote: "I longed to be a naturalist as other boys longed to be policemen and locomotive engineers. I was only dimly aware of the way in which the age of the naturalist and explorer was running out, leaving the mere tasks of gleaning to the next generation."[1] Developing this theme, he would later write: "even in zoology and botany, it was diagrams of complicated structures and the problems of growth and organization which excited my interest fully as much as tales of adventure and discovery."[2] In a series of popular books and technical manifestos, Wiener would go on to interrogate this "problem" that complexity posed. Written in a reflective moment after World War II, his comments sought to mark the passing of one age to another—the end of "exploration," and the emergence of another type of "organization."

This was no small claim. When situated within the context of Wiener's other works about communications theory and computing, this seemingly minute comment about personal memory gestured to a fervent hope: that an epistemic transformation involving the relations between temporality, representation, and perception was in process. Wiener indicated a desire to see an older archival order, adjoined to modern interests in taxonomy and ontology, rendered obsolete by another mode of thought invested in prediction, self-referentiality, and communication.

1. Norbert Wiener, *Ex-Prodigy*, 3rd ed. (1953; Cambridge, Mass.: MIT Press, 1972), p. 63.

Configurations, 2005, 13: 285–321 © 2007 by The Johns Hopkins University Press and the Society for Literature and Science.

Wiener dreamed of a world where there is no "unknown" left to discover, only an accumulation of records that must be recombined, analyzed, and processed. He argued that in observing too closely and documenting too "meticulously" one is unable to deduce patterns—to produce, in his words, a "flow of ideas." He wrote that "if he [a student] decides to take notes at all, he has already destroyed much of his ability to grasp the argument in flight, and at the end of the course has nothing but a mass of illegible scribble . . . it is far better to give up the idea of taking notes and to organize in his mind the material as it comes to him from the speaker."[3] *Ex-Prodigy*'s obsessive implication was this gap between thought and action, and not, as the autobiographical genre might lead us to expect, the need to document or account for past experiences. This subtle shift of emphasis away from concerns with documentary and personal experience opens a site to excavate the historical reformulation of relations between representation, memory, and communication.

I wish to take up this turn away from an "external" world and the devolution inward, in this case to the very self, as a starting point to consider the relationship between the archive and the interface in digital systems. What might we make of this move from a concern with recording an external, perhaps "natural," world in its entirety, to an obsession with processing the already recorded traces of memory? How do we wish to frame this shift to forms of representation whose reference is reflexive rather than indexical? Wiener was not naïvely recounting his failures in finding adventure; rather, he was articulating an aspiration for forms of technology—both of thought and of machine, or perhaps of thought as a machine—that had not yet come into being when he spoke. In his work, and in that of his many compatriots in the arts and sciences of the time,[4] we hear sim-

2. Ibid.

3. Ibid., p. 130.

4. Such statements rethinking the role of representation, memory, and perception were repeated in many fields at the time, ranging from anthropology to biology, to sociology, to computing, to architecture. For more information on the influence and use of information theory and communication science in a variety of fields, see Evelyn Fox Keller, *Refiguring Life: Metaphors of Twentieth-Century Biology* (New York: Columbia University Press, 1995), pp. 89–99. For an opposing argument on the role of information theory in the history of molecular biology, see Lily E. Kay, "Cybernetics, Information, Life: The Emergence of Scriptural Representations of Heredity," *Configurations* 5 (1997): 23–91; idem, *Who Wrote the Book of Life? A History of the Genetic Code* (Stanford: Stanford University Press, 2000). Keller views cybernetic and information theories as providing the possibility to view life in its complexity, while Kay argues that the notion of codes is ultimately reductive. These debates reflect and advance the larger premise of this article. On postwar attempts to build a unified theory of science, see Geof Bowker,

ilar statements that voiced a not-yet-realized aspiration to transform a world of ontology, description, and materiality to one of communication, prediction, and virtuality.[5]

But if Wiener attempted to propagate the "new," it came into being only through the memory traces of the old. It was by way of Freud, the exemplar of a previous century's sciences, that Wiener implied the impossibility of describing a world in its totality, of ever rendering "reality" legible. Instead, he argued, we are faced with an "incomplete determinism," an operative lack that cannot enter description, but can produce something else—a self-referential and probabilistic form of thought:

> One interesting change that has taken place is that in a probabilistic world we no longer deal with quantities and statements which concern a specific, real universe as a whole but ask instead questions which may find their answers in a large number of similar universes . . . this recognition of an element of incomplete determinism, almost an irrationality in the world, is in a certain way parallel to Freud's admission of a deep irrational component in human conduct and thought.[6]

This form of probabilistic thought that emerged at the turn of the last century would now, in Wiener's work and that of his compatriots in the information sciences, be connected with theories of messages. Wiener was comfortable with conceding that the universe in its plurality may never be known. This concession, however, was only made to allow for the possibility that within far more localized situations the future—chance—might yet be contained by way of technology.

But Wiener's invocation of Freud also complicated his own vision for technology and science. His statements posed the possibility that the contemporary systems he hoped to bring into being were not ab-

"How to Be Universal: Some Cybernetic Strategies, 1943–70," *Social Studies of Science* 23 (1993): 107–127. And on the cultural impact of cybernetics, see Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, Mass.: MIT Press, 1996). For the impact on architecture, design, and the arts, see Beatriz Colomina, "Enclosed by Images: The Eames' Multimedia Architecture," *Grey Room* (Winter 2001): 6–29; John Harwood, "The White Room: Eliot Noyes and the Logic of the Information Age Interior," *Grey Room* 12 (Summer 2003): 5–31.

5. The "virtual" is used throughout this essay to denote that which does not yet exist but is being brought into being. It serves as both an operation and a field for conditions of possibility. I am not using the term, however, in the sense of a simulation or a simulacrum; the virtual cannot exist as a materialized form in the present.

6. Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society* (1950; Cambridge, Mass.: MIT Press, 1954), pp. 7, 11.

solutely amnesic to their history: they would be, and still are, haunted by the residual problems of recording, translating, and transmitting information, and associated concerns with indexicality, signification, and representation. Unconsciously, perhaps, even Wiener acceded to the possibility that not all forms of information could be similarly recorded and transmitted without loss, transformation, or change. It is precisely this site, where the traces of older histories mark the desire for the production of the new, that I will excavate in the following paper.

Wiener's texts, and the work of his compatriots in cybernetics and the neurosciences, serve as useful vehicles, therefore, to begin investigating this historic attachment and displacement of older technical questions of documentation, inscription, and perception into terms of information and communication. The relationship—explicitly detailed in the work of many early cyberneticians—between the record, the diagram, and communication bridges between our contemporary discourses about archiving, screens, and interactivity and historical concerns with memory, temporality, and representation. At this pivotal moment, demarcated by a catastrophic world war, these sciences were part of producing an aspiration for a new world made up of information—but not without producing a novel set of conflicts, desires, and problems. I turn, then, to outlining what the conflicted relations between the archive and the screen might still have to say to our desire for "interaction" and communication with and through our machines.

Cybernetics: Communication and Control

The very definition of cybernetics already assumes a complex relationship to temporality and history: bridging the past with an obsessive interest in prediction, the future, and the virtual. Cybernetics is, in Wiener's words, an "emergent term" derived from the Greek *kubernetes*, or "steersman," the same Greek word from which we eventually also derived the word "governor."[7] As the etymology suggests, cybernetics is thus a science of control or prediction of future action. In further adjoining control with communication, it is an endeavor that hopes to tame these futures through the sending of messages.

These rather abstract ideas of communication as the source of control consolidated themselves within the milieu of military research and development in antiaircraft defense systems during the Second World War. Under the imperative of rapid defense in re-

7. Norbert Wiener, "Cybernetics in History" [1954], in *Multimedia: From Wagner to Virtual Reality*, ed. Randall Packer and Ken Jordan (New York: Norton, 2001), p. 49.

sponse to the novel velocity of aerial warfare, Wiener, working with neurophysiologists and doctors and influenced by Vannevar Bush's work on early computational machines (the differential analyzer), argued that human behavior could be mathematically modeled and predicted, particularly under stress—thereby articulating a new belief that both machines and humans could speak the same language of mathematics.

By reformulating the problem of shooting down planes in the terms of communication—between an airplane pilot and the anti-aircraft gun—Wiener and his compatriots hoped to devise better defense systems. The fundamental premise of these mathematical communication models was that the specific mechanism of any entity did not matter; it was "black-boxed." Only two things mattered: (1) what actions an object took in response to a communicative exchange with another entity in its system, and (2) the prediction of future behaviors from the accumulated data of previous interactions. This effort to predict airplane location became an effort to compute human action, and, ultimately, an aspiration to develop communication between a range of entities—animal, machine, and human.[8] This transformed attitude toward difference arguably heralded a new attitude toward the enemy, where the Enemy "Other" and the self behaved the same.[9]

The interest of cyberneticians shifted in this research from describing in detail the mechanisms of actions, to only considering the actions. Therefore, they refocused on the ability to calculate the probability that one set of interactions (the missile hitting the plane) will occur, over other, perhaps less likely but possible, interactions. Rather than describe the world as it is, their interest was to predict what it would *become*, and to do it in terms of homogeneity instead of difference. This is a worldview comprising functionally similar entities—black boxes—described only by their algorithmic actions in constant conversation with each other, producing a range of probabilistic scenarios.[10]

8. Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21 (1994): 228–266.

9. Ibid.

10. The above synopsis is based on the foundational article put forth by Norbert Wiener in collaboration with Arturo Rosenblueth and Julian Bigelow, from Harvard Medical School, in 1943: Arturo Rosenblueth, Norbert Wiener, and Julian Bigelow, "Behavior, Purpose, and Teleology," *Philosophy of Science*, 10 (1943): 18–24. For further information and explanation about definitions of behavior, communication and purpose see: Arturo Rosenblueth and Norbert Wiener, "Purposeful and Non-Purposeful Behavior," ibid., 17 (1950): 318–326.

This obsession with communication as a question of potentiality and choice became the guiding framework for thinking about digital communication. Claude Shannon and Warren Weaver, Wiener's compatriots and colleagues, working at Bell Laboratories, formalized this ideal of communication in *The Mathematical Theory of Communication*. According to this pivotal work, which would influence information and communications theory for the next few decades, all communication was now digital; to argue for digitality was to argue for communication as a choice between discrete units. In the realm of digital communication, information does not denote meaning, only the choice between possibilities within a *structured* situation—structure denoting, in this case, a formally defined system where the range of possibilities for communication is designated (in this case by binary-encoded signs). Weaver summarized this emergent idea as "not so much to what you *do* say, as to what you *could* say . . . . The concept of information applies not to the individual message (as the concept of meaning would), but rather to the situation as a whole."[11] Information theory as emerging from cybernetics thus aspires to the future tense, while existing in a heterogeneous temporal state where the control of this future comes through the abstraction of processes from historical data to produce preprogrammed, self-contained conditions.

This "situation" found its analogue across the social field. In programmed computers it was reflected in von Neumann digital computing architecture as a decision between on/off or 0/1, and "unit amount" as "bits." Computers came to be viewed as systems where the accumulation and rearrangement of basic decisions—"0/1"—would produce the conditions of possibility for a wide range of potential actions.[12] But it was not only in the realm of digital machines that information theory took hold: this aspiration for the perfect and unadulterated transmission of information as control of the future within a self-referential and contained space impacted everything from postwar architectural movements to genomics to politics. Cybernetics as a "science of form" would in many minds replace materialism, and relocate an earlier age of matter and diachronic de-

11. Claude Shannon and Warren Weaver, *The Mathematical Theory of Communication* (1949; Urbana/Chicago: University of Illinois Press, 1963), pp. 8–9.

12. One of the readers of this paper insightfully noted that the conflation of making decisions, or binary choices, with the encoding of data is a remarkable action on the part of cyberneticians: it effectively evades the difference between making a decision and data storage—two activities that, as the rest of this paper will attest, are quite separate.

scent—an age defined by Darwin, Hegel, and Marxian history—to "an age of form and the synchronic structure of information."[13]

The very continuation of the terms "cyber" and "cyborg" in our imaginings of digital technology, information networks, and human-machine interaction bears witness to this dissemination of cybernetics and information theory throughout the social field.[14] These words also remind us that in this transformation the residues of historical questions and techniques reemerge—often with force.

Temporality and Communication

We might, then, seek to historically situate this relationship between older discourses and the present cybernetic one, in order to ask what is at stake in such a movement where we begin with an effort at documenting an external enemy and end with the question of prediction and communication.

The concept that statistics may have something to say to communication engineering did not, of course, appear out of nowhere: this work already sat upon a longer history of feedback engineering, a modern concern with statistics, and Wiener's own work in Brownian mechanics in the 1930s. Wiener was already interested in introducing notions of statistical thought and probability to engineering.[15] This was an engineering that sought to be operational through

13. Bowker, "How to Be Universal" (above, no. 4), p. 111. See also Edwards, *Closed World* (above, n. 4). The most literal exemplar of this emergent interest in communication and its impact on social science, policy, and economics was the series of Macy Conferences on cybernetics, which were held during and after the war, in which many of the central figures in computing, wartime research, communications and systems theory, anthropology, neuroscience, and psychology participated. The historian-physicist Steven Heims has argued that these conferences served as an important site in producing a vision, and a funding basis, for the postwar social sciences in the United States: Steve Joshua Heims, *The Cybernetics Group 1946–1953: Constructing a Social Science for Postwar America* (Cambridge, Mass.: MIT Press, 1993).

14. For some examples of the impact of cybernetics on contemporary media and digital technologies, see Packer and Jordan,, *Multimedia* (above, n. 7); Timothy Druckrey, ed., *Electronic Culture: Technology and Visual Representation* (New York: Aperture, 1996); Lev Manovich, *The Language of New Media* (Cambridge:, Mass.: MIT Press, 2001). For an excellent summation of its broader impact on culture and on notions of human subjectivity, see Katherine Hayles, *How We Became Post-Human: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999).

15. Steve J. Heims, *John Von Neumann and Norbert Wiener: From Mathematics to the Technologies of Life and Death* (Cambridge, Mass.: MIT Press, 1980). David Mindell, and others, have also noted that feedback, a core aspect of the ideas of cybernetics, computing, and information theory, has numerous earlier origins. Feedback already played a role and was formalized as an engineering concept earlier in the twentieth century as an

a recognition of the impossibility of full objectivity or exteriority to the system: error and chance became the very platforms from which technology emerged.

Wiener, and his colleagues, thus took a modern concern with the "taming of chance"[16] and the emergence of statistics, and attached it to the possibility of prediction and communication in engineering. Wiener frames his own project to apply a statistical form of thought to mechanics as a fundamental reworking of older modern dualisms, in the interest of overturning and replacing historical questions with new ones. Wiener and compatriots such as Warren McCulloch, who pioneered cognitive psychology, were trained in and responded to longer traditions in philosophy.[17] Wiener specifically invokes the relationship between Bergsonian "vitalist" and Newtonian "mechanical" and deterministic temporalities, arguing in *Cybernetics* that our age of complex automata and feedback systems exists in an active Bergsonian "vitalist" time, which is to say a temporality that is nonreversible and probabilistic (the past and the future are always interpenetrated through conditions of potentiality). He further correlates Bergsonian attitudes toward temporality with the lifelike or evolutionary, potential of cybernetic systems.[18] In articulating this understanding of time as irreversible but not necessarily progressive, he is reflecting and advancing a discourse of temporality that had already become dominant in many fields by the turn of the century.[19]

Wiener, however, also sought to signal a break from these previous histories. He had already explained that there are methods outside of meticulous documenting from observation that are worthy of our attention. He argued that we live in a universe of "process,"

answer to problems in spreading telephony and communications. Control and homeostasis were also formulated as problem for both organisms and machines in industrial systems. See James R. Beniger, *The Control Revolution: Technological and Economic Origins of the Information Society* (Cambridge, Mass.: Harvard University Press, 1986); David Mindell, *Between the Human and the Machine: Feedback, Control and Computing before Cybernetics* (Baltimore: Johns Hopkins University Press, 2002); Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (Los Angeles: University of California Press, 1992).

16. Ian Hacking, *The Taming of Chance,* Ideas in Context (Cambridge/New York: Cambridge University Press, 1990).

17. For an excellent summation of McCulloch's relationship to Wiener and his philosophical influences, see Michael A. Arbib, "Warren McCulloch's Search for the Logic of the Nervous System," *Perspectives in Biology and Medicine* 43 (2000): 193–216.

18. Norbert Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine* (Cambridge, Mass.: MIT Press, 1961), pp. 42–44.

19. See Hacking, *Taming of Chance* (above, n. 16).

where in localized spaces "possibility" can be created through the recourse to action.[20] In focusing on complexity, and aspiring to produce new forms of organization, cybernetics sought to displace the question of referentiality and insert that of prediction.

The disavowal of the present in the interest of prediction recalls a previous historical move by which "presence" and the present emerged as formal sites of articulation and concern—the historical moment from which Wiener and his colleagues seek to separate their form of thought and formally introduce an age of complexity or postmodernity.[21] This effort to produce history recalls the French literary critic Roland Barthes's comments on the emergence of both reality and history in the nineteenth century as a cardinal site in the production of the "modern." For Barthes, this is a modernity produced through recourse to an idealized external nature—what he labeled "reality effects"—in literature and other mass media. This concept, itself, of a textual and mediated device that produces both new subjects and new worlds, bears an intimate relationship to Barthes's own contemporary relationship with theories of communication, semiotics, and linguistics.

To use Barthes's framework, cybernetics disavowed "reality effects," in which "reality" is produced through speech acts that seek to resemble the quality of history or "*having been there*." The presentation of reality, a feature of nineteenth-century literature, emerged, according to Barthes, at the moment when human experience was increasingly mediated—through new techniques of writing, reading, and recording. He tells us that reality effects are descriptive, and produce a historical time through recourse to "a referential (and not merely discursive) temporality."[22]

In opposition to this referential temporality of language, Barthes poses the predictive communicative temporality of the honeybee:

20. Norbert Wiener, *I Am a Mathematician: The Later Life of a Prodigy* (Cambridge, Mass.: MIT Press, 1956), pp. 327–328.

21. A number of scholars have seized upon this discursive shift to information, communication, and process as signaling larger transformations in governmentality and subjectivity that identify "postmodernity"; for example, Jonathan Crary and Sanford Kwinter, *Incorporations* (New York: Zone Books; distrib. by MIT Press, 1992); Gilles Deleuze, "Postscript on the Societies of Control," *October* no. 59 (Winter 1992): 3–7; Donna Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991); Jean François Lyotard, *The Postmodern Condition: A Report on Knowledge,* Theory and History of Literature, vol. 10 (Minneapolis: University of Minnesota Press, 1984).

22. Roland Barthes, *The Rustle of Language* (New York: Farrar, Straus, and Giroux, 1986), p. 143.

a language of noncognition and pure form, which, incidentally, would align sociobiology with information theory and computation through numerous donors and research agendas in genetics, social science, and cognitive psychology a few decades later.[23]

> This is an opposition which, anthropologically, has its importance: when, under the influence of von Frisch's experiments, it was assumed that bees had a language, it had to be realized that, while these insects possessed a predictive system of dances (in order to collect their food), nothing in it approached a description. Thus description appears as a kind of characteristic of the so-called higher languages . . . to the apparently paradoxical degree that it is justified by no finality of action or of communication.[24]

This comparison between languages rests on Barthes's own belief that reality, as embodied by the ideal of lived experience, was being destroyed through an emergent industrialization in the nineteenth century. The French critic wrote that the modern obsession with description enacted through interruptions in the diegesis produced a relation of presence or "what is" resistant to meaning—a resistance that supports the ideological belief of a (still existent) reality or experience outside of mediated representation, and yet (paradoxically) available for transmission in the text.[25] He is also arguing that the purely predictive and action-oriented "language" of the honeybee cannot denote presence: such a representational schema cannot speak of experience, for it contains no grammar by which to problematize its abstraction of space and time.

Which is another way of articulating that the modernist grammars deployed the ideal of experience—paraded, now, as an illegible "desire," in Barthes's words—to replace the fact of mediation, thus obscuring that in fact the reader is not there, and neither is the author, because they are separated by the technology of inscription (in this case, writing). Barthes does not, however, restrict such effects solely to literature: this is an entire discursive network that includes

23. For more about the relationships between sociobiology and information theory, particularly in relation to complex systems emerging from nonconscious and basic units, see James L. Gould, "The Dance-Language Controversy," *Quarterly Review of Biology* 51:2 (1976): 357–365; Kay, "Cybernetics, Information, Life" (above, n. 4); Lily E. Kay, *The Molecular Vision of Life: Caltech, the Rockefeller Foundation, and the Rise of the New Biology,* Monographs on the History and Philosophy of Biology (New York: Oxford University Press, 1993); Adrian M. Wenner and Patrick H. Wells, *Anatomy of a Controversy: The Question of a "Language" among Bees* (New York: Columbia University Press, 1990); Keller, *Refiguring Life* (above, n. 4).

24. Barthes, *Rustle of Language* (above, n. 22), p. 143.

25. Ibid, p. 146.

other media technologies such as photography and tourism. Most significantly, therefore, he signals to us that the notions of exteriority and interiority, or of real and represented, are modern conventions, and that for the nineteenth century the displacement or "destruction" of reality became a site of problematization that produced new techniques of representation.

Wiener, however, signals to us precisely the disavowal of the "problem" of mediation in favor of a new set of questions. By extension of Barthes's argument, we can argue that cybernetics, like von Frisch's bees, was invested in developing a universal language temporally uninterested in referentiality through description, producing instead a statistical grammar of prediction. Mediation, which has long been the foundation for the idea of "representation," was therefore no longer a site of problematization or obfuscation. Rather, it became the site of potential and probability. We are no longer focused on the "meaning" or origin of the signal, but rather on its transmission.[26]

I call attention to Barthes, therefore, because he marks both the emergence of a new model of representation in the nineteenth century, and the space that this history has in producing our contemporary critique of mediation and mass media; a critique, one could argue, that only emerged in relation to a new set of questions—those of information and virtuality. Cybernetics is thus complicit in producing both the ideal of an older concept of representation, and the turn toward mediation as a site as potential—for both critique and technology. Wiener, himself, self-consciously sought to mark the passing of an age, and the emergence of a new one, by taking from what was, to produce what may become: "cybernetics is bound to affect the philosophy of science itself, particularly in the fields of scientific method and epistemology, or the theory of knowledge."[27] Wiener points out to us that we are now interested in process, not rigidity, description, or stasis. It is useful to hark back to his initial comments on diagrams and descriptions, where the question of "reality" is not so much gone, as displaced: it is no longer the site of intellectual or technical interest.

26. The film theorists Kaja Silverman and Mary Ann Doane have both argued that one of the central critiques of media in modernity has been the alienation from ideals of reality, usually encapsulated in discourses of representing and capturing the present or "experience." See Mary Ann Doane, *The Emergence of Cinematic Time: Modernity, Contingency, the Archive* (Cambridge, Mass.: Harvard University Press, 2002); Kaja Silverman, "The Dream of the Nineteenth Century," *Camera Obscura* 17: 51 (2002): 1–30.

27. Wiener, *I Am a Mathematician* (above, n. 20), pp. 327–328.

Teleology and Action

We might ask, however, what residual relations persist between these modernist representational technologies and computational thought. Immersed within larger technical projects to build weapons, decode enemy tactics and messages, and, later, produce multipurpose technologies for the inscription, organization, retrieval, and communication of data, cybernetics contended explicitly and implicitly with older questions involving mechanical reproduction and mediated communication in large networks. The researchers of cybernetics and information theory called upon previous modern heritages and discourses involving temporality, inscription, and representation in photography, the cinema, and sound recording, and in the study and production of perception as a scientific and technical question. Wiener, as an example, specifically called upon Henri Bergson, Sigmund Freud, and other philosophers and theorists of both time and cinema. Cybernetic ideas emerged from and operated through a reframing and reattachment of these older concepts and practices in modern thought, to produce the conditions of possibility for an interest in multimedia computational machines.

Bergson would already herald an emergent form of philosophy that anticipates cybernetic ambitions when he announced in *Matter and Memory* that "*I call* matter *the aggregate of images,* and perception of matter *these same images referred to the eventual action of one particular image, my body*," thus collapsing clear demarcations between the psychological recollection or image and the external "reality" of movement.[28] Bergson's overriding ambitions were the production of process philosophy, with its heterogeneous temporality, and emphasizing the elements of becoming, change, and novelty in experienced reality. Perception, in this view, is durational, simultaneously encompassing both an emergent past and a future. Philosophically, Bergson attempted to produce forms of thought that did not remain static and always combined the memory of an event with its future, producing possibility out of the synaptic, or embodied, space that merges historical temporality and sensation with its processing and response. The separation between the body and the representation ceases to exist in the interest of movement. It is in the interest of recuperating this affective kernel of thought in Bergson, that Wiener deliberately turned to producing his own cybernetic approach.

Bergson, of course, did not answer to the same questions as Wiener; but they both struggled with problems of mediation, recall,

28. Henri Bergson, *Matter and Memory* (New York: Zone Books, 1988), p. 22 (emphasis in original).

and action, and each marks the emergence of new historical forms of assemblages and statements. Bergson's philosophy sought to respond to an emergent psychological field in which reality and consciousness were opposed; in which knowledge of the world was always subjective and mediated, essentially bifurcated from "nature"; and in which temporality had become probabilistic and synchronous—inexorably linking the past with future potentials through an inaccessible and mediated present. Bergson and many of his compatriots, most significantly Freud, therefore answered specifically to problems of mediation in a transforming social field.

For both Bergson and Freud the rise of new mass media, technologies of recording and inscription, and the increasing stimulation of the sensorium were sites of vexing problematization and possibility. Freud himself, in producing his conceptions of memory, wrote that modernity was producing many "forms of auxiliary apparatus . . . invented for the improvement or intensification of our sensory functions"; of these apparatuses he mentions the camera, and notes that of the perceptive functions, it is memory for which our devices are most "imperfect."[29] It is this imperfection, in fact, that one can say drew him toward the problems of inscription and storage, and to the management of stimuli to which the unconscious and consciousness respond. The film theorist Mary Ann Doane has pointed out the historical relationship between Freud's problematization of storage, which is in her words a question of "representation and its failure," and the emergence of a larger mediated landscape that produced new questions about temporality and the storage of time as it threatened older symbolic systems.[30] Wiener, also, would return to psychoanalysis as a template for conceptualizing the relations between the record, storage, and communication—as we shall see.

One central modern concern, therefore, was how one might remember, recall, and distinguish moments of experiential meaning from among an endless flow of stimuli. Bergson's refutation of the past as an unconscious reservoir of stored stimuli—a direct response to Freud, in which perception precedes recollection—was in the ontological interests of, in his words, "becoming." This rescripting of divisions between the psyche and action was arguably a move that could make thought, itself, an ontological object and actor. Berg-

29. Sigmund Freud, "A Note upon the 'Mystic Writing-Pad,'" in *The Standard Edition of the Complete Psychological Works of Sigmund Freud,* ed. James Strachey (London: Hogarth Press and Institute of Psycho-Analysis, 1961), p. 228.

30. Mary Ann Doane, "Freud, Marey, and the Cinema," *Critical Inquiry* 22 (1996): 315.

son's effort to reconcile consciousness and reality appears antithetical to psychoanalytic concerns, but both intellectual projects mark an emergent historical transformation in thought where "reality" and temporality are inextricably linked to problematize representation and experience as vexing, but productive, sites of inquiry.[31]

More specifically, both Bergson and Freud would provide processes for operationalizing and activating thought that would be explicitly seized upon, and unmoored, by cyberneticians. While often conflicting, this ongoing discursive engagement between Freud and Bergson also revealed the shared investments of these two modern projects. Both provided tools for creating systems that were self-referential, and where the temporal frames of recording the past and producing the future became compressed: in psychoanalysis, in the production of a psyche through analysis, and in Bergson's work, through process philosophy. Despite a disagreement in content, therefore, both projects can arguably be seen to anticipate the emergence of new technical systems, where the process of analysis, the operationalizing of memory, and the emphasis on affective possibilities became the core tenents. One could contend, taking Freud's and Bergson's concerns with stimulus management, recording, memory, and recall to their extreme, that they both participated in making the psyche both an abstraction and a material actor, often counter to their own aspirations—whether the disciplinary ideals of Freud, or the metaphysical dreams of Bergson. As programs, therefore, both psychoanalysis and Bergsonism contributed to the very possibility of technicizing perception, and even thought—as later efforts in artificial intelligence and cognitive psychology would demonstrate.[32] Wiener already anticipated this possibility by invoking Bergsonian "time" for his automata.

It is in the interest of ontology, however, that Bergson was, specific in his condemnation both of Freud and of the emergent cinematic apparatus for recording and externalizing sensation, when he argued that temporal moments were rendered equivalent, and therefore meaningless or insignificant, through a "cinematographical mechanism" that comprised "ordinary knowledge."[33] At the legendary (though inconsistent) sixteen frames per second, the early cinema made all moments equivalent, with no moment that could

31. Doane, *Emergence of Cinematic Time* (above, n. 26).

32. See Friedrich Kittler, *Discourse Networks 1800/1900*, trans. Michael Metteer and Chris Cullens (Stanford: Stanford University Press, 1990); idem, *Gramophone, Film, Typewriter*, trans. Geoffrey Winthrop-Young and Michael Wutz (Stanford: Stanford University Press, 1999).

33. Henri Bergson, *Creative Evolution* (Westport, Conn.: Greenwood Press, 1975), p. 3A.

enter the realm of "experience" since every moment was the same, producing no grounds for differentiating temporal states.[34] For the cinematic apparatus, difference ceased to exist. Out of still, and technically equivalent, frames, erupts movement—but it is only an illusion: the lapses, the cuts, the overlaps of event and time between the frames are obscured by the projection apparatus. The cinema gave a sense of infinite recording capacity, but its true operation was the spatialization and leveling of time.

Bergson does not restrict this critique solely to the apparatus of the cinema: he calls attention to the fact that this form of spatialized and de-differentiated temporality is a larger mechanism of thought, ingrained within philosophical and psychological determinism, the physical sciences, and the organization of industrial space and production. He goes so far as to imply that the mechanism is internalized, projecting within the psyche a false belief in perception preceding thought. The cinema thus parades as movement-coming-into-being, when it is only stasis—static, because the cinema, as apparatus, produces and supports the illusion that separates an external and recordable world from the production of the image. The desire to represent temporality, one might say, presents for Bergson a larger ethical dilemma involving the possibility of thoughts coming into being at all. But more specifically, modern problems with temporality and memory also produced both new forms of subjectivity and new technologies of thought that would continue to inform later media systems.

Bergson's earlier work in *Matter and Memory* proposes one such possibility, seized upon by Wiener, through a more ambiguous relationship to mediation in the reunification of the image and movement. Bergson wrote for a philosophy in which thought and movement were merged, the *movement-image,* and put a full emphasis on the operational or affective capacity of thought, over and beyond the space between thought and action. For Bergson, perception is theoretically lodged within the real, within the referent, and is external to the subject. This perception is only theoretical, however, because it is inaccessible: "In concrete perception, memory intervenes, and the subjectivity of sensible qualities is due precisely to the fact that our consciousness, which begins by being only memory, prolongs a plurality of moments into each other, contracting them into a single intuition."[35] Certain forms of "memory" are therefore

34. Early cinema actually did not have as standardized a speed for projection as even Bergson presupposed: James Card, "Silent Film Speed," *Image*, October 1955, pp. 55–56.

35. Bergson, *Matter and Memory* (above, n. 28), p. 219.

continually active, producing the future. In the process of "recalling," we induce action.

The fundamental "error" in psychological and physiological conceptions of temporality, according to this reading of Bergson, is the idea that there is a clear separation between sensory perception and representation (or thought): that we first perceive an external world, store that perception as recollection, and then retrieve it, in a set order, with clear differentiation between the material and embodied actions, and the cognitive thought processes. Bergson, it can be assumed, meant nothing of the sort. Rather, as Gilles Deleuze explains, "We do not move from the present to the past, from perception to recollection, but from the past to the present, from recollection to perception."[36] One might say that the mind does not simply respond to and synthesize a series of abstractions gathered from the external senses, which precede the thought, or the image; rather, both action and thought are coconstituted. The experience of perception for the human being is always, therefore, produced in the lag between the stimulus and its recollection: it is inextricably linked to both recording and recalling. Deleuze summarizes Bergson's argument as defined "less by succession than by coexistence."[37] The temporality of the organism is not diachronic—the simple, unidirectional, and stable procession of cause-event—but is rather, in keeping with Wiener's new understanding of automata and cybernetic time, probabilistic and conditional. Deleuze explicitly identifies the historical and methodological possibility of Bergson when he argues that Bergsonism speaks to our contemporary, and post–information-theory, biology, and to our understanding of modern media in the cinema. For Deleuze, rethinking the cinema involves reviewing it as a closed system that produces a new reality—a possibility that he recuperates from *Matter and Memory*, which has an uncanny resemblance to the notions of cybernetic productivity.[38] Taken to its logical extreme, we may argue, as Wiener (and later Deleuze) did, that Bergson's formulations of memory, duration, and perception hint at a world with no exterior—an internally and self-realized one.

36. Gilles Deleuze, *Bergsonism,* trans. Hugh Tomlinson and Barbara Habberjam (New York: Zone Books, 1988), pp. 62–63.

37. Ibid., p. 61.

38. Gilles Deleuze, *Cinema 1: The Movement-Image*, trans. Barbara Habberjam and Hugh Tomlinson (Minneapolis: University of Minnesota Press, 1983). Deleuze explicitly argues that Bergsonian thought anticipates the later terms of the cinema, in which the apparatus, as an information system, allows a mobility of the eye and a freeing of viewpoint. This perspectival mobility recuperates Bergson's understanding of the relations between matter and memory as put forth in his previous work.

This possibility appears literally manifested in cognitive psychology. Warren McCulloch's innovations in neural nets, developed while in association with Wiener, reflect this comprehension of an organism as system, or series of processes—now, however (and in this we mark historical change), assessed through measurable outputs. McCulloch and his mathematician colleague Walter Pitts demonstrated an approach to the mind, answering Kant's idea that "the schema of the triangle can exist nowhere but in thought" with the idea that "a schema for a universal" could exist in the brain, in specific actions of neural circuitry, and not as a priori abstract thoughts. For cognitive psychology, viewing complex actions out of the accumulated systematic behavior of networked neurons put the emphasis on the process, or the algorithmic pattern that facilitated processing, and viewed this processing as productive in itself. Processing was a thing-in-itself, not just an intermediate stage toward a more complete and final state, or a representation of some external thought or reality. Such ideas could be forwarded, however, by making the site of processing—the thought—indifferentiable from the animal-machine body. The image's production is the movement, the operation so to speak, of the network. We can, perhaps as Bergson already signaled, no longer truly speak of representation in its static and referential form.[39] Modern separations between ontology and epistemology, or reality and mediation, may no longer act as organizing principles.

Bergson's critique of the mediated and "spatialized" landscape of his world may therefore have both described and produced the future of the very technologies he condemned. Deleuze, who speaks as a contemporary of Barthes and, in some sense, of Wiener, already argued that Bergson's very notion of the movement-image anticipates the future of perception, and of media-thought. For Deleuze, the apparatus of cinema—taken as an entirety, and including the spectator—was most capable, not of abstraction in the interest of stable representation, but of "emancipating" movement in a manner congruent with Bergson's thought project. Deleuze goes on to explain that this is not merely an abstraction, because this new mode of "being" or thought does not claim reference to an external "real." He argues that Bergson, even in his critique, was close to the cinema—an intimacy emerging from within his philosophy of active systems without exteriority or interiority. Deleuze explains Bergson's formulation:

39. Arbib, "Warren McCulloch's Search" (above, n. 17), pp. 210–212; Warren S. McCulloch, "How We Know Universals," *Embodiments of Mind* (Cambridge, Mass.: MIT Press, 1965), pp. 46–66.

> My body is an image, hence a set of actions and reactions. My eye, my brain, are images, parts of my body. How could my brain contain images since it is one image among others? External images act on me, transmit movement to me, and I return movement: how could images be in my consciousness since I am myself image, that is, movement?[40]

From within this formulation can emerge a self-contained universe, which is constantly producing new forms of existence. "This is not mechanism," argues Deleuze, it is machinism. The material universe, the plane of immanence, is the *machine assemblage of movement-images*. Here Bergson is startlingly ahead of his time: it is the universe itself, a metacinema."[41] The universe has become a space of productive enclosure.

In thinking the cinema in such a manner, Deleuze suggests that it shares an integral impulse with the efforts of cyberneticians, and later computer science, for abstraction through the formalization of process through programming: where abstractions of processes—whether images, algorithms, or interfaces—always produce actions, and refer not to exterior spaces, but to the production of new worlds. In cybernetic understandings, descriptions of processes always become sites for the further production of new techniques of production, rather than static descriptions; materiality, action, and concept are inseparable. Deleuze, as though influenced by cognitive psychology and cybernetics, can find this possibility in Bergson because he is not interested in the external mechanism of projection (the projector) but in the spectator—or, more specifically, the internal relations between the image and thought. He produces a self-referential world which is relational, and in which "abstraction" does not provide a static representation of moment, but constantly produces new processes and communicative exchanges. Deleuze already views the cinema as interface.

This form of statement, this aspiration for an emancipation from the separation between mind and matter, body and consciousness, or reality and representation, speaks to a transformation in the very grammar of philosophy; more specifically, it speaks of a new site of unfulfilled desire, no longer for "life" or the present, but for this new active form of abstraction—in both philosophy and engineering. One could argue for this correlation in the fact that after World War II there was an eruption of such statements in philosophy, science, and education. What this aspiration is producing is not yet clear.

40. Deleuze, *Cinema 1* (above, n. 38), p. 23.

41. Ibid., pp. 58–59.

What could be said is that the realm of the "lived" in the Bergsonian sense, that realm outside of but always desirous of representation, was transformed into an operative site that permitted a new form of technicized perception. The inability to render the present representable was transformed into the condition of possibility for cybernetics. In the martial environments of the World War II laboratory, the critique of modernity—and its horrors—became literally realized as a technical possibility. A strange irony.

Retrospectively, it appears that to make the machine, the animal, and the human compatible, so as to build a not-yet-existent sensorium through a system, necessitated a foundational transformation in points of reference. To comprehend the profound potential transformation in our perceptual field that might allow such a statement to be uttered, it might be useful to consider what is at stake in relocating Bergson's questions to the machine. Self-consciously, cybernetics positioned itself as the inheritor of a previous moment in critical thought. Wiener seized upon the Bergsonian reworking of matter and perception, indeed their collapse. While the implications of such thought, if any, are still in a state of becoming, what this move may herald is the historical possibility of speaking without concern for ontology; the utilization of probability does not come aligned with the problem of indexicality. In relocating the methods of statistics to computing and communications, the project, which could be said to have started much earlier in the nineteenth century, found a material form in digital media technologies.

But Wiener explains to us that we no longer answer to the same questions, that in fact, they are obsolete. What start with a structural similarity to older questions—the separation between vitalism and mechanism, for example, between determinism and probability, or between ourselves and the enemy, ontological questions that seek to explore and represent what exists—become research endeavors without ontological interests. Bergson's "innovation," in Wiener's estimation, was a reconsideration of temporality, and an operationalizing of perception through memory: a philosophical project amenable to technicization and literalization in computing, as we shall see.

Bergson, however, was obsessed with, and still answered to, questions of ontology and of "life." His critique of spatialized time, and his production of a metaphysical thought to accompany an emergent disciplinary science, produced transferable techniques, but his points of reference—disciplinary knowledge, the idea of an "external reality" (even if to critique it), being, interiority, and consciousness—no longer framed the cybernetic endeavor.

Certainly neither Wiener nor his compatriots were directly con-

cerned with problems of experience, mediation, or even explicitly representation. They were concerned, however, with effecting actions in the world—they had an obsession with "purpose." The implication of the deliberate rescripting of older ideas of psychology, perception, thought, and consciousness toward the realm of communication, control, and feedback was a radical reframing in an entirely new grammar, a language now concerned with prediction as its dominant interest and temporal mode. For cyberneticians, the initial questions that had precipitated the modern rethinking of both perception and its relations to temporality—mainly, the increased consciousness of the mediation of the sensorium and the temporal nature of perception—had ceased to be points of reference. The subjective and produced nature of perception could now become the source of an unrealized, but productive, aspiration to model thought—the site of a new dream for freedom and the exercise of will. We return to the start as Wiener aspires to a form of thought no longer aligned with the archive and its ontological and taxonomic orders. Mediation was therefore no longer a problem for Wiener and other cyberneticians.

Eliminating this problem, however, produced new sites of interest. By virtue of all the steps that cybernetics took to produce feedback—which can be viewed as a nascent form of interactivity—two new areas of investigation or problematization emerged: the first was perception, and the second was memory, and these two now had a new relationship, historically speaking. For Wiener, memory itself would become the space tying the past action with the future one, bridging an older concern of presence with a newer problem of transmission and communication. Memory would become the fantasized space of processing, a space where the trace of a stimulus could be utilized to dispense with the totality of the original in order to utilize this abstracted form—this "essence" of the object—for future operations. This reformulation spoke to a post–World War II moment marked by a new set of statements that saw perception, and ultimately even thought, as technical projects. In the course of rethinking communication, older questions of memory and perception were operationalized toward new goals.

Redefining Perception

While cybernetics was invested in facilitating perfect, and rapid, communicative exchanges, the residue of these interactions was a vast cumulative space of data and information. The desire to predict from past behavior called into being some form of recording, storing, and retrieving information. This same process could become the

terminal failure point in the perfect transmission of a communicative message: too much noise would interfere with the signal. Systems not capable of erasing the excesses of stored material, or sufficiently "damping" or time-lagging their impulses, would be prone to error—error always being the failure to effectively transmit a message.[42] Within closed systems, too much information could overwhelm the system's stability. In short, faced with an excess of information/stimuli, the system may lose its capacity to manage and respond. A continually nagging "problem" of overabundant information is the obsession of distributed and networked systems.

As it had for the theorists of perception before them, the selection of information became a pressing problem, for cyberneticians. The failure to adequately sort and sift through stimuli, thus allowing too much "noise" into a system, results in the loss of homeostasis and in excess oscillation and instability. Cyberneticians used the models of servomechanisms that respond too rapidly to a moving target, or of a "functional disease" such as mental disorders or blood clotting, to make this point.[43] For Wiener, such losses of stability were possibilities not only located within the human subject, but operating at the level of large systems, particularly in the case of nations at the brink of atomic disaster.[44]

In cybernetics, avoiding transmission failure but still producing viable feedback systems mandated, therefore, not only storage, but a process of selection by which only that information necessary for response would be stored. Perception came to be defined as the ability to respond, and memory as the site of processing. Abstraction could facilitate transmission: Wiener and other adherents of cybernetic theory, including psychologists, became obsessed by nonconscious acts of abstraction that permit negative feedback to commence without error.

Vision is one prominent example of this reworking of perception into a modelable and technical project. In vision, the eye would take up another function as a machine for abstracting the world—a black box. Vision, that sense that collects so much information, must, in the minds of cyberneticians, have some sort of dampening or straining process to facilitate the flow of information toward a more abstract state where what is stored is not *everything* seen. This process was imagined as a series of steps, each of which brings visual infor-

42. Wiener, *Cybernetics* (above, n. 18), p. 122.

43. Norbert Wiener, "Problems of Organization," in *Collected Works* (Cambridge, Mass.: MIT Press, 1976), pp. 396–397.

44. Heims, *John Von Neumann* (above, n. 15), pp. 304–329.

mation "one step nearer to the form in which it is used and is preserved in memory."[45] Wiener's most "plausible" explanation of vision was as a process where outlines are emphasized. The eye, starting with the retina, must begin filtering the information, otherwise it will lose its ability to transmit the stimulus onward, being bombarded as it is with constant stimuli. Wiener would argue that alterations in "storage elements" are necessary for transmission."[46]

The classic article by Jerome Lettvin, Humberto Maturana, McCulloch, and Pitts about what the frog's eye tells the frog's brain furnishes another example of how the process of abstraction becomes a self-contained feature of this world of emerging nonconscious black boxes (and it should be added that "unconscious" is a misnomer, since consciousness was not part of the discourse). Abstraction was for cyberneticians a concrete feature of the world, not tied to consciousness. The authors worked on moving edge detectors in the frog's eye, and discovered a fiber that: "responds best when a dark object, smaller than a receptive field enters that field, stops, and moves about intermittently thereafter"; they concluded that "the eye speaks to the brain in a language already highly organized and interpreted, instead of transmitting some more or less accurate copy of the distribution of light on the receptors."[47] Their colleague Michael Arbib summarized that this proved that the frog eye (and it is literally an isolated eye, severed from the rest of the brain) could deal with universals like "prey" and "enemy."[48] Perception, therefore, became the same as cognition, as autonomous entities—like eyes—began the process of abstracting and processing information. Only through processing and the selective storage of elements that were not true representations but forms through which future events could be anticipated, could a system continue to work effectively.

While these pronouncements are formalized only as a basis for articulating computational rationales for modeling complex behaviors, at the margins of this analysis is the possibility that perception has, itself, become modelable.[49] This would later become a technical

45. Wiener, *Cybernetics* (above, n. 18), p.135.

46. Ibid., p. 124.

47. J. Y. Lettvin, H. R. Maturana, W. S. McCulloch, and W. H. Pitts, "What the Frog's Eye Tells the Frog's Brain," *Proceedings of the Institute of Radio Engineers* 47 (1959): 1940–1951.

48. Michael Arbib, *Brains, Machines, and Mathematics* (New York: McGraw-Hill, 1964), pp. 32–33.

49. Robert Schwartz, *Perception*, Blackwell Readings in Philosophy, vol. 12 (Malden, Mass.: Blackwell, 2004), p. 155.

project in cognitive and computational psychologies, sociobiology, and a range of other fields. Perception became an informatic entity assumed to operate on some set of algorithmic and communicative principles that could be cordoned off and isolated.[50] Cybernetics would become a mode of operations interested not in representing the world, but in understanding what templates, approximations, agglomerations of information facilitated generalized productions of universal concepts that allowed the eye, now an independent set of processes not attached to conscious reason, to perceive and act on the world.[51]

If perception throughout the nineteenth and twentieth centuries was an ongoing and vexing site of interest, speculation, investigation, and problematization across the social field, from philosophy to human sciences to cinema, cybernetics succeeded in suppressing these previous questions in favor of a modular and literally technical approach. One can say that we really rarely speak of perception anymore except as a medical technology.[52] In relation to the predecessor philosophy-psychology, which already had prepared us for an operational sensorium, the older question of recuperating "life" or "will" became a new problematic of producing action. Perception was temporally marked by past elements, it was a space between information reception, recollection, and reaction—but this was the opening for the possibility of processing, not a vexing problem of the historical record.

Activating Memory

Isolating the terrain of perception into the terms of interactive or feedback exchanges still left us with the second problem—that of memory and storage. As Wiener redefined it, the question was how to cordon off, yet communicate between, the vast realms of raw (and largely useless) information and the sites of processing and translating this information.

Memory continued to be a nagging residue for Wiener and other cyberneticians. To deal with this problem of system stability and the

50. For further information, see Marvin Minsky, *The Society of Mind* (New York: Simon and Schuster, 1987); Simon Ullman, "Tacit Assumptions in the Computational Study of Vision," in *Representations of Vision,* ed. A. Gorea (Cambridge: Cambridge University Press, 1991), pp. 305–317.

51. Bowker, "How to Be Universal" (above, n. 4), pp. 114–115.

52. Jonathan Crary makes this suggestion in the introduction of his work on attention: Jonathan Crary, *Suspensions of Perception: Attention, Spectacle, and Modern Culture* (Cambridge, Mass.: MIT Press, 1999).

demand for a nonconscious abstraction, a new functionalist idea of memory emerged throughout the cybernetic fields. Memory would facilitate the systems' capacity to predict by acting as a repository of only the information necessary for functional reaction. While memory, in cybernetics, is an undertheorized aside to the central concern of communication and transmission—a persistent reminder that it is hard to process or transmit something that has not been recorded or stored—it would come to play a central role in the dreams, aspirations, and structures of future digital systems.

Wiener would define memory as "the ability to preserve the record of past operations for use in the future." Memory itself, in either men or machines, is not represented in Wiener's discussions; it does not possess some metaphoric analogue, such as the *Mystic Writing Pad* of Freud. Memory exists through the absence of a direct metaphoric machinic equivalent. Memory is only a set of discussions concerning where it ceases to function and needs to be repaired—or some new mechanism constructed. There is no absolute representation of the memory ideal. There is, however, a functional ideal: memory is now fantasized as a severed entity with a series of layers or levels of storage. The first form of memory is "short term," which serves the functional necessity of carrying out the current process; these are processes that do not need to be stored but that themselves mandate the implementation of some stored information such as an algorithm, but whose immediate results are of no use. This memory can record quickly (and of course perfectly), be read quickly, and be erased quickly. The second form of memory is one "intended to be part of the files, the permanent record of the machine, or the brain and to contribute to the basis of its future behavior, at least during a single run of the machine."[53] If these notions appear at all familiar, it is because they seem, from this vantage point, to reflect and advance themselves in the compartmentalization of contemporary Random Access Memory and hard-drive systems.[54]

Memory, however, had to be reconnected, now that it had been separated from the realm of communication. Cyberneticians would consciously refer to and reappropriate older disciplinary sciences and

53. Wiener, *Cybernetics* (above, n. 18), p. 121.

54. Von Neumann architecture called upon ideas of memory and neural nets from McCulloch and Pitts, the same ideas that Wiener is using to build the stored program architecture. See von Neumann's initial paper on electronic computing instruments: Arthur W. Burks, Herman H. Goldstine, and John von Neumann, "Preliminary Discussion of the Logical Design of an Electronic Computing Instrument," in *Collected Works of John von Neumann*, ed. A. H. Taub, vol. 5 (New York: Macmillan, 1963), pp. 34–79 (taken from a report to the U.S. Army Ordinance Department, 1946).

representational practices to substantiate this transformation toward a process- or "form"-oriented memory. Wiener would call upon the analogues of photography and psychoanalysis to quickly transfer between the disciplinary scientific and taxonomic model of the world—where the description and classification of a theoretically external and "real world" preside—and another site, one concerned with conditioning perception and producing thought.

Communication failure was, in Wiener's terms, the analogue to mental illness.[55] Wiener (and others) understood disorders such as manic depression or schizophrenia as functional failures to conduct a chain of operations without disruption. These were diseases "of memory," the results of circulating information that was accumulating in the brain and unable to be discharged. The excess of unstable circular processes over time would produce a loss of stability of the system, with signals interfering with and deforming each other.[56] To produce equivalence between the apparent complexity of the organism and the basic recall modes of the machine, time in terms of runs became equivalent to space in an organism. As Wiener stated in "Behavior, Purpose, and Teleology," "scope and flexibility are achieved in machines largely by temporal multiplication of effects; frequencies of one million per second or more are readily obtained and utilized. In organisms, spatial multiplication, rather then temporal, is the rule."[57] A machine could run through numerous operations and basic sets of decisions to approximate what an organism must do through a more complex physiological structure. Memory, therefore, became viewed not as an endless static repository or archive of stored information, but as an active site for the management and execution of these operations. The limitations in storage, in fact, meant that what was stored was an abstraction to execute an action, and not a perfect image or representation of an external sensation. In this sense it recalls the ideal of an active memory from Bergson,

55. These ideas are substantiated in the further work of Warren McCulloch, Walter Pitts, Gregory Bateson, and the Macy Conferences: Gregory Bateson, *Steps to an Ecology of Mind* (New York: Ballantine Books, 1976); McCulloch, *Embodiments of Mind* (above, n. 39); Heinz Von Foerster, ed., *Cybernetics: Circular Causal, and Feedback Mechanisms in Biological and Social Systems, Transactions of the Sixth Conference, March 24–25, 1949, New York, N.Y.* (New York: Josiah Macy Jr. Foundation, 1950); Heinz Von Foerster, Margaret Mead, and Hans Lukas Teuber, eds. *Cybernetics: Circular Causal and Feedback Mechanisms in Biological and Social Systems : Transactions of the Eighth Conference, March 15–16, 1951, New York, N.Y.* (New York: Josiah Macy Jr. Foundation, 1952).

56. Wiener, *Cybernetics* (above, n. 18), p. 147.

57. Rosenblueth, Wiener, and Bigelow, "Behavior, Purpose, and Teleology" (above, n. 10), p. 23.

while extending the belief that memory and perception are now the same thing.

While Wiener had no clear representational schema for memory, he was clearly obsessed throughout his personal writings with the sciences of memory, psychoanalysis being the most predominant of them.[58] Psychoanalysis, or psychotherapy, could be the solution to mental illness, rather than the more violent interventions of the day, such as shock therapy. Wiener's adherence to psychoanalysis lies in the parallel in psychoanalysis to an emergent notion of processing: psychoanalysis works because of the concept that "the function of psychoanalysis in this case becomes one of *processing,* a perfectly consistent point of view with cybernetics. The technique of the analyst consists of tactics by which to mobilize these hidden memories, to accept, and to modify them . . . and in this lies the success of the therapy."[59] Psychoanalysis becomes a process of moving information, not unearthing meaning.

Psychoanalysis, already a terrain of automata and unconsciousness, could mutate to formal technical strategy. In this move, a science that sought to disciplinarily derive knowledge of individuals becomes a question not of truth claims but of perceptual training, a technique to move information and train communicative forms. The process of psychoanalysis could almost be said to mutate toward more contemporary understandings of an "interface"—a zone where messages could be processed and translated in order to continue the seamless movement of information between different areas within the brain, and between the individual and other entities. This concept of interface as translation zone would be further developed immediately after the war, both in psychology and in computing, with ideas about personal computers and windows interfaces. Wiener defined cybernetics as the ability to communicate through a controlling device—a steering mechanism, as the term "cybernetics" suggests—between different entities. This insight, as a contemporary (2001) text on multimedia argues, "is the premise behind all human-computer interactivity and interface design."[60] The controller, which for Wiener could be a psychoanalytic session, a screen, or a steering wheel, continues to operate as that space where otherwise increasingly disorganized, entropic, and differentiated messages can be organized and assembled into communication.[61]

58. See Wiener, *Ex-prodigy* (above, n. 1); idem, *Human Use of Human Beings* (above, n. 6).

59. Wiener, *Cybernetics* (above, n. 18), pp. 149–150.

60. Packer and Jordan, *Multimedia* (above, n. 7), p. 48.

61. Wiener, *Human Use of Human Beings* (above, n. 6), pp. 7–37.

In this imaginary, the role of psychoanalysis was not to specify the content of all the stored memories in the mind, but rather to define the forms—the "affective tone," in Wiener's words—of the stored information. This affective tone would condition future behavior, and the necessity of the therapeutic encounter was to discover the general patterns and modify them—in short, translate and abstract them—into a form compatible with "normal" functioning.[62] The therapeutic encounter, for Wiener, was not about unearthing what was within a patient, but rather in producing a space where the patient and the therapist (and perhaps later, I and my computer) could communicate and effect future interactions. The main purpose was the conditioning of future exchanges. Friedrich Kittler has already suggested that this was, indeed, the initial effect of psychoanalysis: the externalization of the psyche, and its incorporation into larger discursive networks. In demarcating the "discourse network of 1800" from the "discourse network of 1900," Kittler specifies the latter as being concerned with an obsession with the minute, unimportant, and indiscriminately recorded, which characterized the nascent media technologies of the time —most specifically, for our purposes, the camera. But this is a camera no longer aligned with photography, but rather with cinema and the phonograph, technologies that "can record and reproduce the very time flow of acoustic and optical data."[63] For Kittler, the realization of Marshall McLuhan's argument that "the 'content' of any medium is always just another medium" has the implication of making the senses autonomous. Through a variety of new recording apparatuses, the senses can be separated and stored—offering the possibility, which Kittler aligns with the necessary condition for cybernetics and computation, of a sovereign perceptual field where memory, now a technical operation, becomes merely the site of storage for the further circulation and remediation of signals into other media. This capacity of "discourse networks" makes all forms of inscription interchangeable and mobile, and facilitates, for Kittler, the possibility that memory is merely an operative form of storage for further transmission and operations without any alignment to meaning. This process, however, is not solely located at the level of any one technology, but rather at the level of a "network" of which psychoanalysis is but one part. Kittler extends this notion to make psychoanalysis subordinate to, and supportive of, the positivist science of psychophysics.[64] Therefore Freud's obses-

62. Wiener, *Cybernetics* (above, n. 18), p. 149.

63. Kittler, *Gramophone, Film, Typewriter* (above, n. 32), p. 3.

64. Kittler, *Discourse Networks* (above, n. 32).

sive concern, not with the obviously scripted "events," but with slips of the tongue, minute details, and so forth, advances a larger technical assemblage obsessed with delivering recorded and stored events from any clear referential relation to an external, and meaningful, "reality." This formulation of psychoanalysis sits much more comfortably with the isolation of perception as a modelable entity in the interest of cognitive psychology. We may now add that not only does psychoanalysis externalize the psyche, but, in the project of cybernetic thought, it has become an explicitly and directly technical project aligned with computational machines.

Wiener's explicit use of psychoanalysis is, however, a subtle inversion of the Freudian concerns, which disrupts Kittler's excessively seamless, and automatic extension of the 1900 network into the electronic one. As Mary Ann Doane, for example, has framed it, Freud was interested in accumulation: the unconscious, in his essay "The Interpretation of Dreams," is, according to Doane, "a vast storehouse of contents and processes that are immune to the corrosive effects of temporality."[65] Memory records everything. The disciplinary fantasy of psychoanalysis is the total representation and catalogue of this repository—a task that drove the disciplinary enterprise, but that even Freud understood as impossible.

The residue of this vast archive of experience was consciousness. Consciousness was simply the visible and articulable residue or symptom of this memory, a memory that was now "out there" and outside of representation, but whose excesses of information could overwhelm and incapacitate the subject. Consciousness was the filter, the translation zone, allowing the organism to function and producing a teleological and functional temporality—a temporality not of infinitude and flow, but of marked events and history. Consciousness with its related measurable and historical time was thus antithetical to memory, although protective of the organism. Consciousness was a barrier to accessing the moment of impression—the present, or (again) the "real." As a discipline, psychoanalysis wants to overcome this barrier to representation . . . but cannot.[66]

Wiener fundamentally sought to displace these questions by problematizing accumulation and not memory's inaccessibility and representability. Despite this, the older heritages continued to plague the new fantasy. Storage continued to be problematized as an issue of system stability, entropy, disorganization, and noise. The excess accumulation of stored or extraneous information always produced

65. Doane, "Freud, Marey, and the Cinema" (above, n. 30), p. 316.

66. Ibid. See also Doane, *Emergence of Cinematic Time* (above, n. 26).

the problem of lowering the statistical probability for communication, and forcing the system into "oscillations" and instability. These problems of information management now emerged without recourse to the taxonomic, objective, and static terms historically associated with the archive, or the ideal of an external "reality" or "temporality" to be brought into representation.[67] This "problem" emerged most visibly and consciously in conversation over storage and recording media.

Early theories of computing and interface engaged heavily with the fantasies of film and photography as graphical and recording apparatus. Wiener specifically refers to the problem of photography, and more specifically film, as a storage medium, due to its indexical heritage and the demands of erasure and mutability: it was slow, inefficient, unable to keep up with the autonomous recording and circulating computing systems. Photography, argued Wiener repeatedly, could be ideal for its perfection in recording and documenting—except for its slow development and non-rapid erasure.[68] In cybernetics, photography's heritage as a perfect record, indexical and archival, was seized upon to define, and now make problematic, the question of recording and storing information. For early computer and information theory, photography seemed resistant to an important feature of the cybernetic material world—abstraction. The image was solely a storage mechanism; it was static, it did not store processes, or forms that would create future functions. In cybernetic terms, so was film, because it was only a medium of representation, not inscription; it could not respond, react, or change within the temporal structures of real time and prediction. These media were thus no longer the site of training a perceptual field now lent autonomy.

This problem with representation continued to drive interests in designing storage structures not based on tape or the literal medium of film. Wiener would argue for a dream of photography in which the very production of the record through alteration in the storage element (the film) could already also inform the further transmission of the message—in short, the record and its recollection or memory could become more closely synonymous, if not the same.

67. See the chapter "Feedback and Oscillation" in Wiener, *Cybernetics* (above, n. 18). Also see the section "Homeostasis" in Wiener, *Collected Works* (above, n. 43). Shannon and Weaver's work is also largely dedicated to problems of system stability and noise control: Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana: University of Illinois Press, 1964).

68. Wiener, *Cybernetics* (above, n. 18), p. 123.

"We have already seen in the case of photography and similar processes," said Wiener, "that it is possible to store a message in the form of a permanent alteration . . . . In reinserting this information into the system, it is necessary to cause these changes to affect the message going through the system."[69] The potential of mechanical reproduction for distortion and abstraction, so central to modernist concerns about recording, now became the core aspiration for cybernetics and information theory. Wiener signals to us an emergent hope that the acts of recording, storing, and recalling might no longer be held separate.

However, the very things that made film a problematic storage device, also made it the perfect recording device. Control demanded the indexical document. To make a perfect prediction would, it is assumed, demand perfect data. Photography's mechanical nature and indexicality were both its problem, and the solution to systems that sought to build a novel perceptual field that was totally fabricated, referential only to the system and no longer located on the plane of human observation, but still able to visualize and record the world in order to respond to it.

This new relationship between the record and its recognition became a new site of discussion and debate. In the sixth Macy Conference, where many central figures in information theory, computing, and social science assembled, the arguments in attempting to understand memory were specific about trying to distill the difference between the processing elements that facilitate recognition, or perception, and the process by which information is recalled. Memory thus continued to have a tense relationship between its role as a site for storing stable records and the aspiration for it as an operative function, the site of actual processing, and the seat of an active perceptual field. McCulloch struggled to separate memory from learning within a matrix, of his own work, that had made these stored elements already actively processed and therefore no longer amenable to such separations. He argued that human memory has at least "three kinds of things that are distinguishable from the curves whereby one learns."[70] McCulloch lays out an ontology of memory similar to Wiener's, except that there is now a second form of physiologically produced memory, which is hardwired, through training, to perform set acts, such as playing the piano; and a third, and ultimately problematic, memory:

69. Ibid., p. 124.

70. McCulloch quoted in Von Foerster, *Transactions of the Sixth Conference* (above, n. 55), p. 163.

> There is some kind of a process which is involved in skilled acts and is obviously different from the kind of memory that takes snapshots of the world and files them away for future reference, whether or not of any importance at the moment. We do have a memory of the third kind [snapshot], that is not immediately accessible, that has a certain different properties . . . but this third kind of memory, which I strongly suspect is more important in neuroses than the rest, I think first needs an examination of the mechanism of recall.[71]

In this formulation, the problem memory takes the photographic position, and in this position it is, ultimately, pathological—neurotic. And like all neurosis, it can facilitate the subversion and repression of one desire to allow another to set of actions or possibilities to commence. It becomes a site that McCulloch, and indeed all the participants of this segment of the conference—Lawrence Kubie, Ralph W. Gerard, Gregory Bateson, Wiener, and others—view with great interest as a research agenda, and as a core issue in the production of cybernetic models of both minds and machines. The a priori stability and uniformity of the record becomes a form of memory that requires further theorization and investigation. It is precisely this residue of an older vision of autonomous, perhaps "mechanically objective"[72] recording that births a new aspiration toward a hyper-recall that can so perfectly analyze the known and perfectly recorded world as to be able to produce something new out of its own documentary practices.

Later, in his important essay "As We May Think," Vannevar Bush, the head of the American scientific war effort, would formalize this ideal in the fantasy of a not-yet-built machine, the Memex—the memory extender. His idea of the Memex was that a user could access a perfect and total database of information, all recorded on microfiche, and be able to bring up information on numerous screens for comparison and the production of new relationships. The importance was that the machine would break the taxonomic and stable structure of the archive, and work "as we may think," by creating rhizomatic linkages and nonlinear associations between different pieces of information. The hope was that a fully recorded world waited to simply be reaccessed and analyzed. The scientist of the future, Bush hoped, would automatically and constantly be recording the world; there would be faster, and better, and more autonomous forms of recording and picturing, and more automatic and novel forms of indexing. Whatever one wanted to know, one could access

71. Ibid.

72. Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations* 40 (Fall 1992): 81–125.

through an interface to the networked libraries of the future. Once a discovery was made, scientists would "photograph" their own research path, the trails they had followed to get to a result, and would send this "picture" of thought to their colleagues. In short, there would be an endless world of recordings, of which the main goal is not the documentation of an external world—it will have been done, it is a given, as Wiener already signaled, and the military certainly took this as a serious goal—but rather the production of the new. The screen for Bush, and also for Wiener, was not a representation of an outside reality, but a dynamic space to encourage the production of new associations and further interactions—between people, and between people and machines. The screen referred to further modes of interaction, not to anything outside the system, per se; it was not a representational display of a world "out there," but a translation zone aimed at inducing new modes of thought. The Memex was never built, and computers went digital, but nevertheless the essay is considered an important contribution to the dream of networked, hyperlinked, and personal computing machines.[73]

While photography and film would continually emerge as theoretically ideal media for storage in the imaginings of future technologies, their persistence and inadequacy belay this problematic—that of total and perfect recording upon which to make the most accurate predictions, while simultaneously posing an older set of conventions involving storage and time. There is a tense, but productive relationship, between representation and archiving on one pole, and perception, interaction, and immediacy on the other: the site for the development of a new, and as yet unrealized, aspiration by which storage and memory could become one.

To sum up, what can we say about this world of predictive but nonteleological temporality? Of the effort to reframe the terms of memory, representation, and archiving to storage, behavior, function, and transmission? And finally, of the effort to produce these questions in the form of myriad technologies (and I do not just speak of computers here), which split interaction and communication from realms of processing and storing information?

Wiener, and others, deliberately seized on older forms of recording, storing, and transmitting information and sought to produce new points of reference—a new language to encode the very ideal of thought. Yet this also created new sites of failure and problematization, although now no longer around questions of referentiality and

73. Vannevar Bush, "As We May Think," *Atlantic Monthly*, 176:1 (July 1945): 101–8.

historical temporality, but rather around those of interactivity and mediation—the relentless encouragement of future communications. We are forced to ask, however, whether we find the separation between the archive and the interface, between the storage system and the screen, a site of desire and potentiality, or a technological failure to be overcome.

Theorizing the Perceptual Future

Earlier in this essay, I used Roland Barthes to argue that "reality" was produced at the very moment that the world became a mediated one. Does cybernetics, and its affiliates across the social field, mark another such turn? the transformation that Wiener, in his memoir discussed at the start of this essay, describes as the natural progression of one age to another? These questions cannot be divorced from the larger concerns they seek to advance, a series of concerns in which a wide-open world—one that must be described, one whose "truth" mandated our response—no longer holds us at bay.

I opened this essay arguing that cybernetics aspired to an elimination of difference in the name of perfect communication, a perfection of transmission that would obliterate the separation between the archive and the interface, or, to return to Barthes, between the sign and its referent. What Barthes gave voice to in the early 1980s, already well within an age of electronic communications, was the consummate danger that in the aspiration for a "real time" the possibility for signification (and, by extension, thought) would be eliminated to meet the demands of an immediate, and immediately effective, form of interaction—hence the example of the small cybernetic honeybee engaged in thoughtless, but communicative, actions.

If our contemporary media field fulfills the relentless desire for abstraction, and the absolute interchangeability and manipulation of all symbols in the demands for automation, we are left with the question of what ostensible desires are left to be fulfilled on the screen. Do we, as Barthes implied, become little satiated automata? This question returns us to the dilemma between the archival and interactive demands that still inhere within digital systems. Barthes's contemporary both philosophically and historically, Jacques Derrida, contributed his own electronically informed response to this problem. In his interrogation of the fate of the archive and memory, dedicated in 1994 (not incidentally) to Freud, he wrote that in the very process of recording, in the act of seeking to *represent* the world, we make it. We read in the text *Archive Fever* of the "technical structure of the *archivable* content even in its very coming into existence and in its relationship to the future. The archivization produces as

much as it records the event."[74] Derrida preceded these statements by arguing in relation to the new technologies of memory, of which he names computing and electronicization, that

> the upheavals in progress affected the very structure of the psychic apparatus, for example in their spatial architecture and in their economy of speed, in their processing of spacing and temporalization, it would be a question no longer of simple continuous progress in representation, in the *representative* value of the model, but rather of an entirely different logic.[75]

The Derridean critical project in many ways repeats some of the ideals of diagrams and virtuality that Wiener wrote of. Derrida, himself, is invested in producing this new logic He argues for the possibility of ethics, indeed love, through the structuring of communication, and in the failed collusion between the sign and the signifier. It is, in fact, in the impossibility of such collusions that much of poststructuralism has found its imagination. Derrida shares epistemically, therefore, with a field of thought no longer invested in description, origins, ontology, or the present. To seek both life and love through mediation is one implication of this form of thought, and it comes situated (both historically and philosophically) within a relationship to these new machines of inscription, recording, and communicating and their related epistemologies.

This is not an unproblematic relationship. Derrida, in writing of the [current] electronic technologies of inscription, recording, and archiving, also poses to us the ethicopolitical problems of systems that seek to record in order to destroy that which is being recorded—which is to say, that we record to produce the capacity to forget, on the condition of forgetting, in the name of "real time"[76] as the only time: a technological fantasy of accessing the present in the name of immediacy, and erasing the lags and resistances in translating and transmitting information. In recording we have destroyed the need to remember and, Derrida hints, we have mechanized that loss, made it no longer a pain to be felt but a site for further technical projects; at its extreme horizon, devoid of anything but its own technical imperative, this drive becomes "radical evil." This "radical evil" is, of course, the failure to imagine a future through the loss of all

74. Jacques Derrida, *Archive Fever: A Freudian Impression*, trans. Eric Prenowitz (Chicago: University of Chicago Press, 1996), p. 17.

75. Ibid., p. 15.

76. Throughout this essay "realtime" should be understood as denoting a desire for immediacy in interactive exchanges, without assuming an external referent to those communicative exchanges.

points of reference—an automation of recording that facilitates death.[77]

This comment returns us to the original question Wiener poses: What are the stakes between a world based on referential representational schema and one of complex diagrams and ongoing communicative exchanges parading under the guise of "control"? Writing in response to World War II, Wiener asks a moral question as to the application of science to human welfare. He marks a moment where our subjective perception becomes a site of possibility; but this also marks an effort to eliminate phenomenology, "reality," and exteriority as dominant concerns for culture. Writing in the milieu of the Cold War, Wiener is forced to ask in his work *The Human Use of Human Beings* an ethical question as to the possibility of human survival and the fate of humanism in the midst of this strategic conflict couched in the terms of "game theory," strategy, and information, with an endpoint in nuclear confrontation. The specter of Marx haunts Wiener—both literally, as he searches for new possibilities in the aftermath of Auschwitz and the Bomb, and figuratively, in his theory obsessed with the productivity of abstraction and symbolic manipulation.

Marx observed that "ideas . . . first have to be translated out of their mother tongue into a foreign tongue in order to circulate,"[78] and therefore the analogy between money and language—their similarities as arbitrary systems for the production of value—exists only insofar as the latter is understood as translation. Rosalind Morris argues that "the bourgeois and the structuralist response to this observation has, of course, been one that fantasizes the possibility of total commensurability or translatability."[79] This is a fantasy we could extrapolate into the obsession with "real time," reality television, and immediacy at the interface—all markers of a dream world made up of perfectly homogeneous, commensurable, and convergent entities. This is a dream that was once also articulated in the military laboratory, where all entities became behavioral black boxes. If we are to believe Marx's older dicta on circulation and translation, we might then lose the possibility for freedom, or even a future, to the dream of perfect communication where everything can be re-mediated or translated without change, and thought, itself, becomes a technical project.

77. Derrida, *Archive Fever* (above, n. 74), pp.19–20.

78. Karl Marx, *Grundrisse*, trans. Martin Nicklaus (Harmondsworth: Penguin, 1973), p. 163.

79. Rosalind Morris, review of James T. Siegel, *Fetish, Recognition, Revolution* (Princeton: Princeton University Press, 1997), *Indonesia* 67 (1999): 163–176, on p. 165

We must avoid this fate. As I have attempted to demonstrate by way of cybernetics, our contemporary digital multimedia field also responds to older heritages of media, psychology, and philosophy not solely grounded in the mid-twentieth-century war machine. The turn away from ontology as a referent to an external reality and its transformation into a malleable category in computer science, the emphasis on affect and prediction in the interest of a pragmatic performativity, the movement away from metaphysics and phenomenology, have all also informed much of contemporary critical theory, filmic, and artistic practice. The semiotic and semiological portions of poststructuralism, which Friedrich Kittler has posited as historically specific forms of already electronic or postcybernetic thought, are therefore aligned with certain tendencies in digital media interested in seeking possibility through mediation.

It is to this possibility—we may call it an estrangement or "foreignness" from representation—that I turn as is the core site of emergence for poststructural and other critical theories. This inability for, or resistance to, perfect translation is the "source of a complex" and usually unrealized, yet possible, freedom: "It is a freedom (both the 'difference' that Marx posited as the internal contradiction of the commodity between use-value and exchange value, and the temporally defined dimension identified by Derrida's term *différance*) that is the necessary condition, or possibility for revolution."[80] How we define and maintain the temporal and spatial separation between the archive and the interface is part of this struggle. Do communication and translation automatically assume homogeneity and convergence between all media and entities? Cybernetics both posed this aspiration as control, and opened us to its impossibility. Calling on Freud, Bergson, and many others, cybernetics also hinted at the possibility that within our imaginaries for computational and (later) digital media lay far more complex heritages than simply the demand for another uninterrupted and automatic interactive exchange. Despite the rhetoric of convergence—a faith in perfect translation to the point of absolute commensurability that has become the dominant fantasy for media conglomerates and technologists of our day—it has not yet become a new reality, and need not.

Our questions today are, of course, no longer Wiener's. We are no longer forced to respond to the immediate demands of fighting a world war against fascism, of a cold war against a mythic communism, or of contending with a crisis in industrial capitalism. We may not even remember these events. But we do respond to the technical

80. Ibid., p. 165.

legacies and forms of the time period. We are left to ask, in what directions will we try to push our technical imaginaries? I resurrect these relics from the archive—"blasted" from the past,[81] so to speak—in the attempt to excavate other possibilities and tensions for the future. In the numerous tensions, eruptions, and resistances posed from within the cybernetic ideal we confront the implications and possibilities that an archaeology of our own thought produces. The cybernetic concern with human possibility operated through a dream of interaction based in ideals of complexity and an emphasis on process. This fantasy has incarnated itself as a desire to turn inward, to a myopic obsession with our instruments, where the "archival fever" operates at a technological level. What to do with this obsession has now become a defining feature of our present relationship with, and future imagination of, interactivity.

Acknowledgements:

I wish to thank Peter Galison, Charis Thompson, Tal Halpern, Mordechai Halpern, Joe Dumit, Sharrona Pearl, Nasser Zakariya, Deborah Weinstein, and my two anonymous reviewers for their invaluable insights and commentary on this work.

81. This term and my method are clearly influenced by Walter Benjamin, "Theses on the Philosophy of History," in *Illuminations: Essays and Reflections,* trans. Harry Zohn, ed. and intro. by Hannah Arendt (New York: Schoken Books, 1968), pp. 253–265.