Interrogating the Cybernetic Imaginary:

or Control and Communication in the Human and the Machine

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ABSTRACT

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This cultural history explores the coming into being of an emergent cultural sensibility of the computer age, the cybernetic imaginary. Articulated through four events which take place in public discourse – the thinking machine, the game, the future, and information – the analysis suggests that it is in the immediate postwar period that many of the taken-for-granted tropes, metaphors, and assumptions of current cyberculture are presented, negotiated, and normalized. This analysis is conducted in print mass media texts exploring cybernetics, computing machines and their interaction, in the period of 1944-1959. The material includes popular magazines, mass market non-fiction, fiction, and trade journals.

The thinking machine as a discursive event establishes a fundamental, functional equivalence between humans and computing machines, permitting, indeed requiring, the replacement of human mental labour with machines. The game rewrites the notion of what it means to be intelligent, locating valuable knowledge firmly within a model of rationalism. Science and mathematics becomes privileged as the knowledges through which to take decisions in all forms of social organization. The event of the future marks the future as a knowable domain, and a properly knowable domain, marginalizing both the present and the past as relevant to knowledge. This confirms a teleological understanding of history, notions of technological progress, and the valuation of speed. Finally, information is redefined in this period as the successful transfer of valuable

information, rather than about meaning. Communication is thus reduced to a functional, quantitative measurement. Information is offered as a universal measure of knowledge, and information theory becomes a universal methodology.

Yet none of these outcomes is preordained when the computing machine is introduced to the American public after World War II. It is in the process of their negotiation in the public domain that the cybernetic imaginary is produced. The cybernetic imaginary as a set of shared cultural assumptions has significant social power implications for how we understand the computer and our selves to this day -- it marks our age as a society of control.

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An observation; the Program de doctorat conjoint in communications is about bringing together the strengths of each of Concordia University, Université de Montréal, and Université du Québec à Montréal and I can say with certainty and appreciation that my committee reflects the best of that vision.

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I. Introduction: The Ghost Walks Among Us

1. Introduction

> *... by the late 1970s cybernetics had died of dry rot* (Kelly, 1994: 354).

> *Wiener's dream of a universal science of communication and control has faded with the years. ... almost no one today calls themselves a cyberneticist. ... [C]ybernetics, which was based on an inspired generalization, fell victim to its inability to deal with details* (Kunzru, 1997: 210).

If cybernetics is indeed dead, as asserted above by Kevin Kelly and Hari Kunzru, then its ghost walks among us.

Its ghost haunts business management writing. Business guru Peter Senge, in his landmark text, *The Fifth Discipline: The Art and Practice of the Learning Organization* (1994), proposes five disciplines to facilitate the adaptation by employees to the increasingly complex risks of capitalism. The fifth, and most important, of these disciplines is systems thinking, "a discipline for seeing wholes" (Senge, 1994: 68). Senge defines systems thinking as:

> ... a set of general principles – distilled over the course of the twentieth century, spanning fields as diverse as the physical and social sciences, engineering and management. It is also a set of specific tools and techniques, originating in two threads: in 'feedback' concepts of cybernetics and in 'servo-mechanism' engineering theory dating back to the nineteenth century (Senge, 1994: 68).

Cybernetics reappears in popular techno-science best-sellers, like Kelly's own *Out of Control: The New Biology of Machines, Social Systems, and the Economic World*. Conceding the paradox of the undead, Kelly admits that a "[s]hort-hand synopsis of *Out of Control* would be to say it is an update on the current state of cybernetic research" (Kelly, 1994: 453). He recognizes that "... the ideas of feedback control, circular causality, homeostasis in machines, and political game theory were born there [in cybernetics] and gradually entered the mainstream until they became elemental, almost cliché, concepts today" (Kelly, 1994: 452). Jeremy Rifkin, recognizing that the computer has functioned as a central metaphor within genetics, notes in *The Biotech Century: Harnessing the Gene and Remaking the World* (1998), that:

> Wiener came to view cybernetics as both a unifying theory and a methodological tool for reorganizing the entire world. Succeeding generations of scientists and engineers concurred. With the aid of the computer, cybernetics has become the primary methodological approach for organizing economic and social activity. Virtually every activity of importance in today's society is being brought under the control of cybernetic principles (Rifkin, 1998: 184).

Cybernetics breathes again in *Wired* magazine, bible to the hacker-turned-entrepreneur set, as Kunzru also concedes that while cybernetics is dead as a science, its cultural residues live on. Cybernetics continues to speak to analysts of culture and information technology. It was reanimated to ground a radical cyborg politics in Donna Haraway's seminal 1985 essay, "A Manifesto for Cyborgs: Science, Technology and Socialist Feminism in the 1980s." David Tomas suggests in the collection, *Cyberspace, Cyberbodies, Cyberpunk* (1995), that cybernetics currently functions as a "keyword" in a Williamsian sense, moving across knowledge domains to have a much more significant cultural impact than could be originally anticipated. David Porush, writing in literary studies, suggests, "I take the word *cybernetic* to embrace not only the information sciences but a metaphor so deeply engrained in our culture, so silently driven down to the roots of our imaginations, that it achieves the status of an element in a new mythology" (Porush, 1985: 2). Sociologist and artist, Stephen Pfohl asserts, "... that for worse and for better, we are today virtually all struggling to survive and communicate – if differently and in different modes – within the hegemonic exigencies of cybernetic culture" (Pfohl, 1997: 115).

So, why these apparently contradictory, and occasionally simultaneous, claims that cybernetics is both dead and yet a central way that we understand the world around us? Why does a science of control and communication developed in the 1940s continue to speak to us so loudly from its grave? My project explores this question, suggesting that cybernetics as a science may be dead, or certainly mutated, but that cybernetics and the computing machines with which it is inextricably related, influenced a cultural formation, what I call the *cybernetic imaginary*. The cybernetic imaginary began to take shape in the late 1940s and 1950s in public discourse in the United States. This thesis is a cultural history exploring the coming into being of this emergent cultural sensibility of the computer age. Articulated through a series of four events which take place in public discourse – the thinking machine, the game, the future, and information – the analysis suggests that it is in the immediate postwar period that many of the taken-for-granted tropes, metaphors, and assumptions of current cyberculture are presented, negotiated, and normalized. This process begins in the 1940s and 1950s, not the 1980s and 1990s. My analysis is conducted in print mass media texts exploring cybernetics, computing machines, and their interaction, in the period 1944-1959. The material includes popular magazines, mass market non-fiction, fiction, and trade journals.

The four events are discursive ruptures which I trace through these mass media. They are sets of ideas which are struggled over in this time period and eventually rendered normal. This normalization process plays out in six event characteristics which comprise the event. First, the "new" thing is named and framed; second, certain key spokespeople emerge within it, its advocates, challengers and salespeople. Third, often a certain moment emerges as representative of the larger event – distilling its central characteristics. Fourth, any event plays itself out in discourse through certain figures or tropes by which it can be instantly recognized. Fifth, an event, as it becomes accepted, becomes linked with other discourses – either in the past or other new notions which it, in turn, helps to anchor. Sixth and finally, an event ends when the newness by which it is defined is subsumed – when, as with cyberculture, everybody knows what it means and so it no longer needs to be defined.

This process of shared acceptance has implications. The thinking machine as an event establishes a fundamental, functional equivalence between humans and computing machines, permitting, indeed requiring, the replacement of human mental labour with machines. The game rewrites the notion of what it means to be intelligent, locating valuable knowledge firmly within a model of rationalism. Science and mathematics become privileged as the knowledges through which to take decisions in all forms of social organization. The event of the future marks the future as a knowable domain, and a properly knowable domain, marginalizing both the present and the past as relevant to knowledge. This confirms a teleological understanding of history, notions of technological progress, and the valuation of speed. Finally, information is redefined in this period as the successful transfer of valuable data, rather than about meaning. Communication is thus reduced to a functional, quantitative measurement. Information is offered as a universal measure of knowledge, and information theory becomes a universal methodology.

Yet none of these outcomes is preordained when computing machines and cybernetics are introduced to the American public after World War II. It is in the process of their negotiation in the public domain that the cybernetic imaginary is produced. The cybernetic imaginary as a shared set of cultural assumptions has significant social power implications for how we understand the computer and our selves to this day – it marks our age as a society of control.

2. Conjunctural Moments: Cyberculture, Cybernetics, Computing Machines

The cybernetic imaginary is my way of intervening in the social relations of the cyberculture in which I am continually told I live. It is my way of understanding and naming cyberculture as an historically produced phenomenon, containing with it, organizations of power and knowledge, and of trying to understand how cyberculture has become so unquestioned, so all-pervasive, so consistent in its publicly shared attributes, and therefore, so powerful.

At the heart of cyberculture, currently and historically, is a relation between cybernetics and computers. Here I first explore cyberculture, then offer a brief treatment of each of cybernetics and the computer, before exploring their conjuncture, their messy interaction, overlap, and identity in public discourse.

a. Cyberculture

In the introduction to their edited collection, *Cyberspace, Cyberbodies, Cyberpunk: Cultures of Technological Embodiment*, Mike Featherstone and Roger Burrows claim that the "literature on cyberspace is rapidly becoming a significant element in popular culture" (Featherstone and Burrows, 1995: 5). And they are correct. Cyberculture, cyborgs, cyberspace, and other "things cyber" are emerging as a trendy area of research within communication studies, cultural studies, cultural anthropology, and science and technology studies. The cyber writing industry is booming – examples abound -- Aronowitz, Martinson, and Menser, 1996; Bukatman, 1993; Dery, 1993; Dovey, 1996; Escobar, 1994; Ess, 1996; Featherstone and Burrows, 1995; Gray et al., 1995; Hayles, 1999; Menser and Aronowitz, 1996, Kroker and Kroker, 1997; Loader, 1997; Sardar and Ravetz, 1996; Schroeder, 1994; Shields, 1996; Stone, 1995, and they are still being written.

While located across many disciplinary boundaries, I suggest this work shares three commitments. First, it recognizes the significant role that computer technology plays in our society. Second, it recognizes that there have been social and cultural shifts coinciding with the invention and circulation of the modern computer which merit being named, described, and analyzed. Third, it seeks to theorize or account for the relationship between computer technology and changes in social and cultural formations – all are seeking to account for *cyberculture*.

Some scholars take cyberculture as a given, as already defined. In fact, this is part of the problem. Cyberculture has about it that knowing wink that we already know what it is and so we do not have to define it. In this way, its power effects as a discourse become invisible. Alison Adam, in her interesting study of artificial intelligence, *Artificial Knowing: Gender and the Thinking Machine* (1998), recognizes that cyberculture was coined to describe the "explosion" of interest in the various cultural shifts commonly associated with virtual reality, artificial intelligence and the Internet.

She notes the futurist orientation of this interest and observes that "[f]ew cultural commentators can fail to marvel at the extraordinary effervescence of cyberculture" (Adam, 1998: 166).

First, recognizing the role of the academy in the production of cyberculture is essential. Adam notes the significant and growing interest in cyberculture from the social sciences, as I note above. Ralph Schroeder's attempt to define cyberculture recognizes the role of the academy, not as an effect, but as central to its very formation. He states, "[a]lthough cyberculture is mainly sustained by the social organization of intellectual life it is also a product of advances in computing and related technology" (Schroeder, 1994: 526). He characterizes cyberculture as a worldview involving the "transcendence of the mundane use of technology and of [the] transforming culture" (Schroeder, 1994: 524). He argues that cyberculture romantically fuses science and culture.

Others do not foreground their own role in the production of cyberculture. Mark Dery claims:

> [t]here is more to cyberculture than cyberspace. Cyberculture ... is a far-flung, loosely knit complex of sublegitimate, alternative, and oppositional subcultures (whose common project is the subversive use of techno-commodities often framed by radical body politics). ... (Cyberculture) is divisible into several major territories: visionary technology, fringe science, avant-garde art, and pop culture (Dery, 1993: 566).

This hip and hopeful definition reflects succinctly the influence of cyberpunk science fiction literature upon the aesthetic framing of cyberculture as an analytic term.[1]

In the first sustained social science marking of cyberculture as a legitimate domain of study, cultural anthropologist Arturo Escobar offers a more useful conception of the notion, recognizing the interplay of bodies, knowledge, and technology and acknowledging the impact of this interaction on culture.[2] He calls for more research in the field and offers a broader conception of the term than Dery.

> 'Bodies,' 'organisms,' and 'communities' ... have to be retheorized as composed of elements that originate in three different domains with permeable boundaries: the organic, the technical (or technoeconomic), and the textual (or, broadly speaking, culture). While nature, bodies, and organisms certainly have an organic basis, they are increasingly produced in conjunction with machines, and this production is always mediated by scientific narratives (discourses of biology, technology, and the like) and by culture in general. Cyberculture must thus be understood as the overarching field of forces and meanings in which this complex production of life, labor, and language takes place (Escobar, 1994: 217).

What Escobar is trying to capture is the "cultural constructions and reconstructions on which the new technologies are based and which they, conversely contribute to shaping" (Escobar, 1996: 111). Thus, culture and technology are at the heart of cyberculture. He argues that the point of departure for this kind of inquiry is "the belief that any technology represents a cultural invention, in the sense that technologies bring forth a world; they emerge out of particular cultural conditions and in turn help to create new social and cultural situations" (Escobar, 1996: 111).

So, what is cyberculture? Part of its very strength lies in its simultaneous richness and ambiguity. Yet for my purposes I am treating it as a way of describing a particular set of social configurations, particular to North America in the latter half of the twentieth century, in which information technologies play a central role, not only in economic relations, but in how we are defining ourselves as a society. Cyberculture is our way of describing ourselves. My construction and exploration of the cybernetic imaginary is my attempt to articulate the structure of feeling of cyberculture.

I will address in more detail in Chapter 2 the matrix of literature exploring cyberculture; however, the definitions of Dery and Escobar are not uncharacteristic of the field and help to frame my own inquiry. Unlike Dery's (new)romantic definition, Escobar's stresses that cyberculture is more than counter-cultural practice, that it is implicated in the fabric of everyday life. In my view, neither scholar sufficiently recognizes the role which cybertheory itself, has played in the construction of cyberculture. While I appreciate the sensibility of Escobar's treatment, its breadth renders it less useful than it otherwise might be. His piece is a much needed call to researchers and so he is attempting to set out certain issues for inquiry, not offer the final definition for a field.

Finally, and most importantly for my project, there are two attributes of cybercultural writing reflected in the work of both Dery and Escobar which specifically motivate my study. First, both scholars (as well as Schroeder and Adam) seem to suggest that cyberculture is a product of, at the very earliest, the 1980s, not detailing the longer history which exists of many of the central notions of what we now call cyberculture, nor of the many attempts to theorize technology and culture. Second, it is unclear in both analyses what distinguishes cyberculture from other nomenclatures of the digital age such as "information society" or "technoculture." What is the specificity, if any, accorded to the cybernetic roots implicated in the hybrid term, cyberculture?

The "history" of cyberculture begins well before the 1980s. I have found that the public discourse of computers – the fascination with chess-playing computers, artificial intelligence, thinking machines, cyborgs, and electronic brains -- represented in 1990s issues of *Scientific American*, *Time*, *Newsweek*, and so on did not begin in the 1980s with the "invention" of the Internet, but rather originated in the late 1940s and early 1950s. Two *Time* magazine cover stories offer a tantalizing illustration of this.

In the first *Time* magazine, the caption on the cover reads: "Can man build a Superman?" The image is a computer/human hybrid. Inside is an article entitled, "The Thinking Machine." Locating themselves within the "second industrial revolution," the authors look to computer scientists and mathematicians as authorities on computers and the future of the human race. Computers are described in evolutionary terms, winning a game of chess is taken as measure (or proof) of intelligence, and parallels between the functioning of computers and the human brain abound.

In the second *Time* magazine, the caption on the cover reads: "Can Machines Think?" The image is a computer/human hybrid. Inside is an article of the same title and another entitled, "The Race to Build Intelligent Machines." Locating themselves within the "second industrial revolution," the authors look to computer scientists and mathematicians as authorities on computers and the future of the human race. Computers are described in evolutionary terms, winning a game of chess is taken as a measure (or proof) of intelligence, and parallels between the functioning of the computer and the human brain abound.

The second *Time* magazine is dated April 1, 1996; the first, January 23, 1950. The similarities are startling, the differences notable, but what these two covers of the same popular magazine, separated by almost 50 years, suggest is that our current fascination with things cyber is not so recent as critical analysis in the field would suggest. It is for this reason that I want to focus on the time period immediately after World War II when both the modern computer and cybernetics were "invented" and were circulating in the public domain. Secondly, I want to mobilize cyberculture as a specific domain of inquiry which recognizes the continued role that key ideas from cybernetics play. Cyberculture is more specific than technoculture; it is a technoculture of cybernetic technologies.

b. Cybernetics

Cybernetics was defined by its "founding father," mathematician Norbert Wiener, as a science of control and communication theory, resting upon an assumption of "... the essential unity of the set of problems centring about communication, control and statistical mechanics, whether in machine or in living tissue" (Wiener, 1948: 19). Wiener drew the term from the Greek word *Kybernètikè*, the art of steersmanship. With its roots dating back to Plato, Wiener was not the first modern scientist to use the term. In the 1830s, French physicist Ampere, devised a classification system for human knowledge, in which he designated cybernetics as a subcategory of diplomacy representing the science of governance, in political science. G.T. Guilbaud recognizes that the term belongs to a larger family of Greek words for arts, crafts, and sciences (*technai*), with etymological implications for the art of guiding men in society, or government (Guilbaud, 1959: 1). In the Latin and French usages of the word, the connotation of social governance is also present.

Cybernetics involves the application of a feedback model to any open system. A system is a group of elements of any kind, considered as an interconnected whole, with this interconnectedness being generated through modes of communication or exchange of information. The central mechanism for these connections which allows the system to learn, or be self-correcting, is feedback. Feedback is a channel along which data on the results of control are fed back into the system. Feedback was heralded as the single-most significant contribution made by the science of cybernetics. "It is due to feedback that cybernetic systems are, in principle, capable of going beyond the limits of actions predetermined by the designer. It is this feature, above all others, which underlies the enormous potentialities of cybernetic systems" (Lerner, 1972: 2).

A number of events took place during and after WWII which launched cybernetics. Different analysts give varying weight to different occurrences as the "founding moment" of cybernetics. I am not interested in determining a single occurrence which gave birth to cybernetics and instead, will describe the three central moments which are most frequently cited. In 1943, Norbert Wiener, along with Arturo Rosenblueth and Julian Bigelow, published an article entitled, "Behaviour, Purpose and Teleology," in *Philosophy and Science*, mapping some of the early ideas of purposeful behaviour, information, and communications. In 1948, Wiener published a book-length work developing his ideas further, *Cybernetics: or Control and Communication in the Animal and the Machine* (hereafter referred to as *Cybernetics*). I discuss subsequently the significance in the public domain of this work; here I note only that it was a substantial contribution to the presentation of the ideas of cybernetics to a wider audience.

Finally, institutionally, cybernetics can be said to have begun in and with a series of multidisciplinary conferences in the United States between 1943 and 1954 supported by the Josiah Macy Foundation, and retrospectively referred to as the Macy Conferences.[3] There, a combination of mathematicians, statisticians, physicists, physiologists, biologists, anthropologists, economists, and sociologists, all considered similar concerns with problems of feedback, communication, systems, and control which led to cybernetics. Notables included Claude Shannon with his theory of information, Warren McCulloch working on neural functioning, Jon von Neumann developing computers and game theory, and "a visionary who could articulate the larger implications of the cybernetic paradigm and make clear its cosmic significance" – Wiener (Hayles, 1999: 7).

Cybernetics has gone through a number of stages of development as a science of control and communication since the 1940s. N. Katherine Hayles offers a dialectical tri-partite periodization of this development, suggesting that the roots of each subsequent period were embedded in the debates of the preceding (Hayles, 1999: 6-7). I found Hayles' periodization very interesting because it recognizes, quite properly, that cybernetics has changed dramatically over the years and that those calling themselves cyberneticists in 1999 are not practising the same science of control and communication as were the Macy participants in 1949. More particular to my project, however, she describes the first period as the one in which cybernetics was institutionalized and dates it from 1945-1960. It is significant to me that Hayles terminates the first period in 1960, as my own research also reveals a major shift in public discourse after 1959. Our periods, although anchored in quite different source material – hers science and mine public media – coincide. This lends credibility to the claims for wider effect made in both my work and hers.[4]

Cybernetics, interestingly, was both an intellectual and public knowledge. As early as 1959, Guilbaud notes that the popular press was not using the term to denote a science so much as the product of a science, a theory of automatic machinery or of "thinking machines" (Guilbaud, 1959: 3). Kelly notes that "[t]he result of Wiener's book was that the notion of feedback penetrated almost every aspect of technological culture" (Kelly, 1994: 120). In 1950, Wiener published *The Human Use of Human Beings: Cybernetics and Society* (hereafter referred to as *Human Use*), an accessible introduction to cybernetics and its potential impacts upon society. Theodore Roszak notes that *Human Use* "...did more than UNIVAC to revise my understanding of information and the machinery that manipulated it" (Roszak, 1986: 9). *Human Use* was reviewed, for example, in periodicals as diverse as *Atlantic Monthly*, *Time*, *The Saturday Review of Literature*, *The Commonweal*, *Science*, *Scientific American*, *Science Monthly*, the *Journal of Philosophy*, the *Journal of Religion*, and a variety of sociology and psychology journals.

So, why did cybernetics have the interdisciplinary and public impact that it did? I will explore attempts to theorize this phenomenon in Chapter 2; however, here I will point to some of the material conditions which facilitated this cybernetic traffic. Wiener published *Cybernetics* to explain the theory of cybernetics to those who were neither scientists nor mathematicians. The book was simultaneously published in France and in the United States and in its first six months went through four printings (Kelly, 1994: 119). After its publication, various members of the Macy group convinced Wiener to publish a more easily consumed introduction to cybernetics. This resulted in the publication in 1950 of *Human Use*. Again, this book was published as a mass-market paperback and it was considerably less mathematical than the original *Cybernetics*. Wiener used it as a forum to offer various political and social commentary on law, politics, ethics, religion, academia, and so on. As Roszak notes: "[f]or the general reading public, this engaging and provocative little book landmarked the appearance and high promise of 'cybernation,' the word Wiener had coined for the new automative technology in which he could discern the lineaments of a second industrial revolution" (Roszak, 1986: 9).

Certainly Wiener's own public profile in the media, which emerged strongly in my research, and is discussed in more detail in Chapter 4, also contributed to the early circulation of cybernetic ideas. Finally, the multidisciplinary nature of the Macy Conferences virtually ensured the institutional dispersion of cybernetic ideas. In his seminal treatment of the Macy Conferences, Steve Joshua Heims recognizes their effect in circulating cybernetic ideas through a number of disciplines (Heims, 1991). Cybernetics quickly found its way into the study of psychological abnormalities (Barrett, 1950), complex social organizations (Cadwallader, 1959), information theory (Shannon and Weaver, 1949), genetics (Kalmus, 1950), and developments in computer technology (see *Time*, 1948, 1950a, 1960). Kelly suggests that Macy Conference participants mobilized their ideas with colourful metaphors, with effects parallel to the current impact that metaphors drawn from science fiction have on science (Kelly, 1994: 452).

These colourful metaphors clearly caught the imaginations of journalists as can be recognized from stories in popular news journals with titles such as "Can man build a superman?" (*Time*, 1950a), "Brain is a machine" (*Newsweek*, 1948d), and "Machines That Think" (*Business Week*, 1949a). Yet it is apparent from these early titles that cybernetics and the computing machine were interconnected, and the computing machine, in particular, made for good copy.

c. The Computer

It was in late World War II and the ensuing period that much work took place on the development of "ultra-rapid computing machines," as Wiener called them, the pre-cursors to analog and digital computers. While it is not my purpose here to offer a history of the development of the computer,[5] I do want to mention a few individuals and historical high points for contextual purposes.[6] I will treat here only the modern computer, leaving to historians the well-known work of Blaise Pascal, Gottfried Wilhelm Leibniz, and Charles Babbage, the triumvirate of inventors most often credited with laying the foundations for the modern computer.[7]

During World War II, the modern computer was being developed simultaneously in England, Germany, and the United States. Yet a certain amount of groundwork was laid prior to the war. In 1925, at MIT, electrical engineer Vannevar Bush and his colleagues designed a large-scale analog calculating machine. In Germany, in 1935, inventor Konrad Zuse first used the binary system in his computer design. Unfortunately, his work was all destroyed during the war. Zuse is also credited with designing some of the first computer programs. The first binary computer was invented in 1937 by George Stibitz, at Bell Laboratories.[8] Finally, Alan Turing published, "On Computable Numbers" in 1936, an article which was subsequently considered to be one of the most important in computer science.

During the war, in 1942, Bush completed his second model of the analog machine which was used to help devise artillery firing tables. Colossus, the first electronic computer, was up and running in December 1943 at Bletchley Park in England, designed by Turing and his colleagues to break the German code, Enigma. Colossus' success is credited as a major contribution to the Allied victory.[9] In 1944, Harvard's Mark I, designed primarily by Professor Howard Aiken, with funding from IBM, became the first fully automatic computer.

Finally, in 1946, electrical engineer J. Presper Eckert and physicist John Mauchly completed the first programmable electronic computer, ENIAC (Electronic Numerical Integrator and Computer), at the University of Pennsylvania's Moore School of Electrical Engineering. Eckert and Mauchly went on to form the first commercial computer firm. In 1949, MIT's Claude E. Shannon (subsequently to go to Bell), built a chess-playing machine called CISSAC; in England, EDSAC (Electronic Delay Storage Automatic Computer) began operations in 1949. But in 1951, Eckert and Mauchly completed UNIVAC (Universal Automatic Computer) for delivery to the U.S. Census Bureau for tabulating the 1950 American census – the first computer designed for commercial usage. It is in 1954 that the first commercial model was actually sold to General Electric Company.

There are a few other interesting moments, I will note in passing in this brief timeline. In 1950, Alan Turing wrote the first program to simulate chess; Kurt Vonnegut wrote about EPICAC, one of the first love stories involving a computer; and the American military began to use computers to simulate operations in war games. In 1951, the first non-specialist magazine, *Computers and People* (originally titled, *Computers and Automation*) came onto the market. In 1952, IBM switched from making only office machines to building computers and John Diebold's "Automation: The Advent of the Factory" catalyzed a series of studies exploring the impact of the computer on employment and leisure time.

There are obviously many more related and significant developments in the history of the computer, but I want merely to provide a brief overview of some of the moments which are lived out in my research. The computer is recognized automatically as a central part of current cyberculture; it is my contention that it is also central to the formation of the cybernetic imaginary. J. David Bolter suggests that the computer is the "defining technology" of our time.

> A defining technology develops links, metaphorical or otherwise, with a culture's science, philosophy or literature; it is always available to serve as a metaphor, example, model or symbol. A defining technology resembles a magnifying glass, which collects and focuses seemingly disparate ideas in a culture into one bright, sometimes piercing ray. Technology does not call forth major cultural changes by itself, but it does bring ideas into a new focus by explaining or exemplifying them in new ways to larger audiences (Bolter, 1984: 11).

We can see, even in the immediate post-World War II period, the computer beginning to function as a defining technology as Bolter defines it. It becomes a vehicle whereby ideas about work, computing, and even cybernetics were communicated "in new ways to larger audiences."

d. The Conjuncture

In the public press in the post-World War II period, there is an inextricable intermingling of computers and cybernetics. The definitions and boundaries of these notions and their interaction are not yet clearly established at that time. Therefore, one has to look at each, at both, and at related and surrounding notions in order to understand their cultural implications. Computers and cybernetics combine to form a *conjuncture* in public discourse, one which arguably continues to define cyberculture. I thus use conjuncture as a way of capturing a combinatory notion which brings together computers and cybernetics in such a way that one cannot say where one ends and the other begins. Traces of this conjuncture are present in discourse now and in the period of my study. For example, David Edge suggests:

> [t]he pervasive metaphors of cybernetics, reconceptualizing the brain and society in terms of the behavior of computers and other electrical networks, offer one striking example [of technological metaphors]: how often do you hear the term 'feedback?' We would do well to explore the extent and the dynamics of this process by which our imagination comes to be dominated by those very devices which we devise in order to dominate and control our environment and human society (Edge, 1974: 136).

N. Katherine Hayles also recognizes the inter-relationship between these elements:

> [i]n the years immediately following the war, the theories that emerged from the research were translated into new technologies, which in turn transformed the culture of highly developed countries in ways both subtle and profound. These transformations stimulated the creation of new methods of analysis for complex systems, for society itself had become a complex system in a technical sense. Thus, the feedback cycle connected theory with culture and culture with theory through the medium of the technology (Hayles, 1990: xiv).

While I resist the somewhat linear transfer from theory to technology to culture and society in Hayles' formulation,[10] I find the bringing together of knowledge (cybernetics), technology (the computer), and culture (public discourse) to be a productive and rich space of transformation and it is certainly one borne out by my research into the public discourse of the years following the war.

While a few scholars recognize the conjuncture and many replicate it, few attempt to account for it. Kathleen Woodward is an exception. In explaining the differences between scientists and the laypublic in their responses to the computer, she notes that a majority of people in the 1950s and 1960s had never operated a computer, nor had many seen one. She adds, "[f]or the most part, knowledge of computers was indirect, mediated by computer print-outs and computer cards, images of the computer in the mass media, and the theory of cybernetics as it filtered into the vocabulary of everyday life (Woodward, 1983: 60-1). Woodward quite correctly implicates the media in the production of the conjuncture. She recognizes that the conjuncture is a discursive phenomenon.

William Kuhns, in his consideration of different mid-twentieth century responses to technology and the future, *The Post-Industrial Prophets: Interpretations of Technology* (1971), supports Woodward's argument, recognizing the media as a site of the conjuncture as well. He notes the relatively tangential connection between Norbert Wiener and the development of the computer, but recognizes that it was Wiener's name that came to be popularly associated with the computer in the 1950s and 1960s. This is borne out in media treatments of the day in my research.

An interesting illustration of the conjuncture takes place in Charles R. Dechert's 1966, *The Social Impact of Cybernetics*, the first edited collection to strongly consider the social implications of cybernetics. Each of the papers in the collection had been presented at a symposium on cybernetics and society held two years earlier in Washington, D.C.. Interestingly, the book is as much about emergent computer technology as about cybernetics *per se*. A number of writers focus on the computer as the measure of cybernetics as a social force.

Robert Theobald makes this explicit, asserting that, "fundamental changes in the socioeconomic system as a whole ... are being brought about through the drives exerted on the whole social fabric by the application of cybernetics in the form of computerized systems" (Theobald, 1966: 39). Ulric Neisser links cybernetics and automation in the first paragraph of his essay and then moves easily to a discussion of computers in the second, without acknowledging a shift or reduction in subject matter (Neisser, 1966: 71). He suggests, "[the computing machine] serves us not only as an instrument, but as a metaphor: as a way of conceptualizing man and society. The notions that the brain is like a computer, that man is like a machine, that society is like a feedback system, all reflect the impacts of cybernetics on our idea of human nature" (Neisser, 1966: 73).

For some authors in this text, as well as in other writing, "cybernation" becomes a short-hand for this combinatory notion of cybernetics and automation through computer technology (for example, McLuhan, 1966 and Theobald, 1964). Finally, in his review of the development of cybernetics, Dechert attributes particular prominence to the computer in the popular comprehension of cybernetics.

> Computers are, of course, of fundamental importance to cybernetics, first because they embody so much communication and control technology, and second because they oblige us to sort out vague ideas and feelings from clearly formulated and univocal ideas and relations if we wish to manipulate them by machine, and finally because once ideas are clarified the machine permits the rapid execution of long and detailed logical operations otherwise beyond human capability (Dechert, 1966: 21).

This conjuncture is reproduced and confirmed in my primary research as well. It becomes impossible to untangle where cybernetics ends and where the computer begins or vice versa. This has obvious implications at the level of methodology. It is this very conjuncture, which I suggest is at the heart of the beginnings of the cybernetic imaginary. The cybernetic imaginary draws much of its power from the movement within the discourse between computers and cybernetics.

3. The Cybernetic Imaginary

> *... feedback loops among theory, technology and culture develop and expand into complex connections between literature and science which are mediated in the cultural matrix* (Hayles, 1990: 3-4).

I name the cultural effects of this conjuncture of cybernetics and computing machines in the public domain the *cybernetic imaginary*. I am borrowing from Teresa de Lauretis,' Andreas Huyssen's, and Kathleen Woodward's usage of "technological imagination" in their collection *The Technological Imagination: Theories and Fictions* (1980). They suggest there has been an artificial separation of technology and the imagination and argue, "the pervasive technologization of everyday life, since the beginnings of this century at least, has shaped and transformed all cultural processes from the ways in which we communicate with each other to the ways in which we perceive ourselves and the world" (de Lauretis, *et al.*, 1980: viii). They coin the term "technological imagination" to suggest that "... technology shapes the very content and the form of the imagination in our time and, further, that the notion of imagination cannot be detached from the discourses and practices, the theories and fictions, in which it is concretely textually inscribed" (de Lauretis, *et al.*, 1980: viii). I do not want to focus merely on literature or film as privileged texts representing what is "culture" in a particular society and I do not want to assume that "technology shapes culture" in a direct or unicausal manner. However, de Lauretis,' Huyssen's and Woodward's suggestion that one cannot separate technology and culture, that it is worthwhile to explore their conjuncture, their interaction, their productivity, is pertinent to me.

Arturo Escobar, as well, calls for more research into the specific site of the popular culture of science and technology, "... including the effect of science and technology on the popular imaginary (the set of basic elements that structure a given discourse and the relations among them) and popular practices" (Escobar, 1994: 218). He does not further define his understanding of the popular imaginary, nor its distinction from popular practices, but he does recognize, correctly I suggest, the significance of popular culture in the study of cyberculture.

By cybernetic imaginary I want to designate the complex relations in public discourse and in the popular imagination between ideas from cybernetics and early figurations of the computer. The cybernetic imaginary names a discursive formation, one which is produced by, and productive of, shifting power relations in the early Cold War period. Certain sites and certain individuals emerge, not as authorial, but as central to its production and circulation; certain characteristics begin to emerge by which it is simultaneously described for public comprehension, and mobilized as a site of power relations. Notions of discourse will be discussed more fully in Chapter 3, but by cybernetic imaginary, I am attempting to capture, not merely the common metaphors through which computers were described, nor the central ideas of cybernetics, but a broader, more nuanced cultural sensibility that is being produced in this time period, not by identifiable agents, human or institutional, but through social interactions. This process can be traced in the public documentation of the day.

To me, our current cyberculture is informed by a cultural sensibility, a way of thinking which can be described as the cybernetic imaginary. This sensibility has become the unquestioned terrain upon which new products are developed, cultural content is produced, and political debate takes place. I want to problematize this invisible background. My thesis is about its construction, negotiation, and effectivity. Thus, while my analysis is located historically, it is motivated by critical questions of the present, critical questions of "the hegemonic exigencies of cybernetic culture."

As I note earlier, to operationalize this objective, in my corpus of public discourse texts exploring the computer and cybernetics in the late 1940s and into the 1950s, I draw out four, what I call "events" or points of contestation. I identify events which both develop as dominant in the historical record, but which also are pertinent notions for unpacking current cyberculture. The four events are *the thinking machine*, *the game*, *the future*, and *information*. It is in the immediate postwar period that these notions come to be distilled, come to take on the meanings which they now seamlessly represent in current discourse. Additionally, they operate both individually and together in complex ways to produce and reproduce the cybernetic imaginary as an emergent form of governance, a governance anchored in questions of coding, science, control, and communication. Through the events, I attempt to unpack the power implications of the discursive conjuncture. I take as my central question how these four events work to produce the cybernetic imaginary and what are the power effects of that process.

4. Mapping the Thesis

My thesis is, therefore, a cultural history of cyberculture, focusing on the ways in which central defining patterns emerge in public discourse, traceable through the print mass media, at the moment of its emergence in the immediate post-WWII era. The processual nature of the analysis is activated through the construction of the four events, and these serve as the primary organizing feature of the thesis.

In Chapter 2, I outline the theoretical debates in which my analysis is located, within cybertheory, the literature exploring computers, cybernetics, and culture. I explore this work and theorize my own project in relation to three central problematics in cybertheory: history, culture, and control. In Chapter 3, I address questions of methodology, articulating my method of event analysis in relation to an overall set of epistemological assumptions about the nature of history, culture, power, discourse, texts, and the media. I detail the construction of my body of material, my reading strategies, and my axes for analysis. In particular, my choice of public discourse as represented in print mass media is articulated against the field of intervention.

I then turn to the construction of the four events: the thinking machine, the game, the future, and information. In Chapter 4, the thinking machine is explored as one of the central metaphors of the emergent computer age. The computer is anthropmorphized for public and market consumption, resulting in an easy equivalence between brains and computers, between humans and machines. This equivalence has implications for defining work in the computer era and the development of automation. Chapter 5 explores the construction of the game, as a central trope figuring machine intelligence. Cybernetics' close relationship with games theory combines with the metaphor of the chess-playing machine to redefine the nature of intelligence, the nature of performance, with particular implications for the treatment of decision-making. The thinking machine becomes the smart machine and rationalism becomes the epistemology of the cybernetic imaginary.

Wiener drew on probability theory extensively in the construction of cybernetics, and the ability of cybernetics, and computing machines, to predict the unknown, rewrites the relation between present and future. In the third event of the future, explored in Chapter 6, prediction and risk management are foregrounded in contexts as diverse as meteorology and business. These shape who is an expert in the public domain and what are the social expectations of them. An historical telos of techno-evolutionism is constructed. Finally, information forms the fourth event, and grounds the analysis in Chapter 7. Much discursive work must be done to shift the quotidian understanding of information from its more meaning-based connotation to the mathematical model of Claude E. Shannon. Once distilled in the public imagination, however, it is the notion of information which facilitates the permeation of the cybernetic imaginary through a multiplicity of institutional and popular sites. Virtually all human processes and activities can be informationalized, or coded, rendering cybernetics a universal science, a universal language, a universal methodology.

Having examined the thinking machine, the game, the future, and information in their specificity in the preceding four chapters, in Chapter 8, I consider the four as they act together to produce and reproduce the cybernetic imaginary. Further, in this analysis, drawing upon the work of Gilles Deleuze on societies of control, I suggest that the cybernetic imaginary is a way to name, describe, and explore the power effects of our society of control.

My thesis suggests that several central aspects of current cyberculture are shared social assumptions which were first negotiated in public discourse in the postwar period. These include, our understandings of the computer as a tool of white-collar work, our methods of decision-making, our understanding of expertise, and the ubiquitous practice of informating, namely rendering as informational content, all human processes and activities. In demonstrating these claims, my thesis makes several contributions to the fields of cyberculture studies, science and technology studies, governmentality work, and discourse analysis. The contributions are theoretical, methodological, and empirical.

My thesis intervenes directly into the field of cybertheory, offering some much needed empirical, historical and media discourse analysis to the field. It theorizes the effects of the cybernetic imaginary, and further explores the boundaries of, and seeks to "flesh out," various treatments of the idea of control as a way to describe the organizational model of power since the mid-century, specifically, the model offered by Gilles Deleuze.

Methodologically, through my development and use of event analysis, I offer a methodology and set of related methods which permit the discursive analysis of things which are in the process of becoming. I legitimate the study of the media as a way to understand, not the movement of technological and scientific ideas to a wider public, but the broader cultural production of shared meanings of which the public, science, and technology are all a part. Further this offers a means to explore history as a series of becomings, rather than a linear inevitability.

Finally, at the empirical level, my study adds to a growing body of work on culture, cybernetics, and computers, but does so by historicizing its analysis, taking culture into account, looking to the influence of cybernetics, and exploring this process in the mass media of the day. If one wants to speak credibly of widespread, shared, cultural understandings, then one must certainly look to the mass media as one of the most reliable sites for the production of public imaginaries.

I hope that the historical and empirical nature of my project allows me to achieve these goals without submitting to the cybernetic delirium described by Stephen Pfohl.

> All around me, inside me, flowing through me, between me and others, it is easy to discern signs of the flexible, mass marketing of cybernetic delirium. This is a delirium associated with both cyber-products and cyber-experience. "Cyber-this" and "cyber-that." Its [sic] hard to do the ritual of the ritual of the check-out line these days, without some magnetic cyber-commodity-connectors wrapping their seductive sensors, cheek to cheek, in feedback loops with yours. Commanding attention. Inviting a try. Not that the effects are homogenous. Nor the possibilities. From cyber-sex-shopping-surveillance, to cyber-philosophy, and even utopian dreams of cyborg revolts – whether for fun, or out of desperation, flaming desire, or for want of more passionate and politically effective connections – the world around and within me appears increasingly mediated by a kind of delirious cyber-hyphenation of reality itself (Pfohl, 1997: 115).

This flood of techno-terminology by Pfohl simultaneously exemplifies, and warns of, a trend in analyses of cyberculture – the tendency to cybernetic delirium, or "cyber-drool" as Dery (somewhat ironically) refers to it. Cybernetic delirium, as I am using it, is the uncritical embrace of the very terms of reference under analysis in this domain, and their resulting reproduction as stylistic, writing, and analytic practice. Examples would include an un-self-reflexive embrace of a cyberpunk sensibility, the use of feedback and entropy as analytic terms, or the reproduction of a model of technological progress. Cybernetic delirium is a manifestation of the seamlessness of information society, of the shared understandings of what technology means, of its link to a progressive future, and of the seemingly unassailable power of information technologies to drive and define all aspects of our lives, while we look on cheering.

A number of scholars have identified this tendency with concern, and debates over technological determinism have a long history (see Roe Smith and Marx, 1994). However, I believe Pfohl is attempting to identify something more particular than mere technological determinism. He is alluding to a tendency which would elide critical distance. Kathleen Woodward suggests that this practice severely delimits the potential for critical reflection.

> In the case of cybernetic modelling, by ascribing the characteristics of our inventions to ourselves, by seeing ourselves in the image of those inventions, the distance between ourselves and those technologies – a distance that is a prerequisite to critique of that technology – is eliminated. How could we argue with an invention that mirrors ourselves and will bring about such an ecstatic revolution? (Woodward, 1983: 67).

She continues, "... the metaphor of the human species, and its culture, as a cybernetic machine does not lead to a critique of advanced industrial society or technology, but rather deadens it" (Woodward, 1983: 67-8).

In addition to the implications of the model of subjectivity at the heart of the thinking machine, I also think that the nature of cybernetic thought, itself, with its key terms -- information, feedback, control, systems, learning and so on – which function as both analytic terms and building blocks in the knowledge itself, complicates the critical terrain. Finally, it is always more difficult to see the nature of the invisible webs of the social organization of power in the era in which we are living. If one is critical of information technology, or cybernetics as its ideology,[11] one is labelled a Luddite – at best naive, at worst, deluded.

Cybernetic delirium is a risk in my analysis, and in all cybertheory, and is one of which I attempted to be vigilantly aware. I hope that in exploring the historical emergence of current cyberculture with an historical and empirical methodology that I have avoided some of the worst risks. Finally, I took inspiration from some words penned by William Kuhns as he considered the disparate work of writers like Wiener, Ellul, Innis, McLuhan, Mumford, and others who have made their work the making-visible invisible assumptions about technology. "If the major environments are invisible, how then can investigators support their interpretations of them?" he asks (Kuhns, 1971: 251). The answer: "Boldly." I hope that the reader finds this thesis, at the very least, bold.

II. Exploring Cybertheory: Theorizing about, and in, Cyberculture

1. Introduction

> *Every particular study is a many-faceted mirror ... reflecting the exchanges, readings, and confrontations that form the conditions of its possibility* (de Certeau, 1984: 44).
>
> ... *we should ask ... what are the diagrams that define the conditions of possibility in the societies of control?* (Hardt, 1995: 35-6).

Cyberculture, cyborgs, cyberspace – hip hybrid terms, "chimerical, condensed word forms ... cobbled together without-benefit-of-hyphen in the hyperspace of the New World Order, Inc., ... communicat[ing] the promiscuously fused and transgenic quality of [their] domains by a kind of visual onomatopoeia" (Haraway, 1997: 3). All fused with that potent pre-fix, cyber. Purely lexicologically, cyber refers to cybernetics, the science of control and communication in organisms and machines. But cyber, as prefix, *means* much more than that. It means speed, it means revolution, it means information, it means computers, it means systems, it means inevitability.

In this chapter, I mark off a domain of scholarship which is working with that prefix in one way or another. I examine and critically analyze a body of work which I call cybertheory, work which theorizes about and in cyberculture. I address three questions in this process: first, into which traditions of thought does my work intervene; second, what theoretical notions and concepts am I using to conduct my analysis; and third, what central theoretical problematic am I trying to address. I am theorizing the intellectual ground for the cybernetic imaginary out of my review and analysis of cybertheory.

The work that I am including in my denotation of cybertheory is diverse and eclectic. There is not yet an agreed upon canon within cybertheory, nor might all of the scholars whom I examine under this label accept this as a way to characterize their work. I am using the term cybertheory to denote research and writing with a shared set of commitments, as I suggested in Chapter 1. First, cybertheory assumes that technology plays, and has played, a significant role in Western society; second, it takes as given that there have been social and cultural shifts coinciding with the production of the modern computer which merit being named, described, and analyzed. Third, cybertheorists share a desire to theorize or account for the relationship between information technology and changes in social and cultural formations. In this way, my work is also, cybertheory.

My critical reading of other "cybertheorists" suggests that there are three major axes which can be used to analyze the fissures and fusions in the field. These can be organized around underlying assumptions made by the authors, assumptions about history, culture, and control. What follows is a process of sifting the scholarship through the sieves of history, culture, and control. This process of discernment does not have as its ultimate goal critique or validation, but rather an identification of central thematics, shared conversations, and points of contention. It is in relation to this process that my analysis addresses several of the gaps in the field of cybertheory and locates itself in relation to what has gone before. Given the nature of this field and the ongoing negotiation of its disciplinary boundaries, my treatment is not comprehensive; it is, necessarily, partial and contingent. I can say, however, that all of these thinkers know that something is going on, something involving computers, cybernetics, and ways of life, something important.

History is the first axis according to which I examine cybertheory literature, suggesting that the writing sifts into three broader perspectives on history: ahistoricity, black box history; and cultural history. Second, I examine the literature through its assumptions about culture, suggesting that the field reflects three broader treatments of culture: as the work of great men, as a reflection of social relations, and as popular literature and film. Third and finally, I examine cybertheory in relation to the assumptions it makes about the nature of social power, in particular, control. Again, three overall treatments of control emerge: machine control, cybernetic control, and social control. These axes of analysis permit me to critically triangulate my project within the broader field of cybertheory.

2. History

History serves as an interesting optic through which to view cybertheory. Analyses range from the ahistorical to the painstakingly detailed. I divide the field into three broad categories according to the assumptions made about the nature of history, at the same time, marking larger trends within the literature. The first is the ahistorical approach of the writing indebted to postmodernism; the second is the grouping of black box historians conducting linear, reverse-chronological histories of bounded objects; and the third, is those writers tracing the historical development of a cultural sensibility – some more generally in relation to technology, some more directly in relation to cybernetics.

a. Cyberpunks and Ahistoricity

As I allude to in Chapter 1, there has been a recent boom in a certain sub-genre of cybertheory, indebted to science fictional aesthetics, postmodern theory, and the Internet.[1] Coming into vogue in the late 1980s and continuing to the present, this stream of writing is primarily the domain of postmodern cultural studies writers and film and literary theory scholars. Its focus is most often on issues of the representation of the human/technology interface and changing modes of embodiment and subjectivity in the late twentieth century. The cyborg has been its (arguably overwrought) icon and inspiration.

It is this writing which is most often associated with the prefix cyber (variously attached to theory, culture, space, bodies and punks) and which has achieved institutional status as its own area of study. It is notoriously ahistorical, however, treating all cybercultural developments as beginning not earlier than the mid-1980s. I suggest that this is, in part, because cybertheory is marked by a simultaneity of its institutionalization in the academy and its discernment of its object of analysis. My research suggests that there are two high-water events which frame the theorization of cyberculture as a field of study: the publication in the *Socialist Review* in 1985 of Donna Haraway's essay, "A Manifesto for Cyborgs" and the publication in 1984 of William Gibson's novel, *Neuromancer*.[2]

These two discursive events are referenced again and again in cybertheory, taking on an ironic originary moment status. Hugh Gusterson suggests that Haraway, "... put cyborgs on the map of cultural criticism" (Gusterson, 1995: 109). Another writer describes Haraway's article as "crucial" (Goldberg, 1995: 244). The editors of *The*

Cyborg Handbook, published on the tenth anniversary of the original publication of Haraway's essay, suggest that "... cyborgology as an academic attitude started with her 1985 'Manifesto'" (Gray et al., 1995: 8) and the collection is launched by her "Foreward." Allucquère Rosanne Stone in her book, *The War of Desire and Technology at the Close of the Mechanical Age*, ends her acknowledgements with, "[f]inally, Donna Haraway. *Ave Mater Gloriosa*" (Stone, 1995: x). Alison Adam recognizes that "[i]t is difficult to overstate the influence of her essay which John Christie ... describes as having 'attained a status as near canonical as anything gets for the left/feminist academy'" (Adam, 1998: 172). Haraway is positioned as a "mother" figure by a variety of other writers as well (for example, Escobar, 1994; Bukatman, 1993; Schroeder, 1994; Featherstone and Burrows, 1995).

If Haraway is the mother, then William Gibson certainly plays the father, with his cyberpunk fiction serving as a starting point for many cyber-analyses (for example, Bukatman, 1993; Tomas, 1992; Foster, 1993; and Biddick, 1993). Just as Haraway is asked to contribute the "Foreward" to *The Cyborg Handbook*, Gibson is asked to participate in *Cyberspace: First Steps* (1992), the landmark cyberspace collection edited by Michael Benedikt. Gibson is liberally sprinkled through the writings in *Flame Wars: The Discourse of Cyberculture* (1993), and is awarded high status in the introduction to Featherstone's and Burrows' collection (1995). The claims made for the influence of this fictional sub-genre are not at all modest.

> The term cyberpunk refers to the body of fiction built around the work of William Gibson and other writers, who have constructed visions of the future worlds of cyberspaces, with all their vast range of technological developments and power struggles. It sketches out the dark side of the technological-fix visions of the future, with a wide range of post-human forms which have both theoretical and practical implications; theoretically

> in influencing those who are trying to reconstruct the social theory of the present and near future, and practically, in terms of those (largely young people) who are keen to devise experimental lifestyles and subcultures which aim to live out and bring about selected aspects of the cyberspace/cyberpunk constellation (Featherstone and Burrows, 1995: 3).

Thus, in the heyday of postmodern cultural studies, Gibson seemed to profer the aesthetic for an age.[3] When the technology to produce cyberspace finally caught up to the literary vision in the early 1990s, the cultural origins of cyberspace were taken to be the mid-1980s. So while Gray et al. are correct that what they label "cyborgology," as an area of academic cultural studies began in the mid- to late-1980s, that in no way implies that the object of analysis, cyberculture, originated at the same time. In fact, it more probably suggests that the academy was responding to ideas already in cultural circulation which had reached enough of a critical mass to ground an institutional identity. A detailed analysis of the aesthetic, commercial and theoretical interrelations between cybertheory, cyberpunk, and cyberculture, while certainly warranted, is beyond the scope of this analysis. I do suggest, however, that the stylistic mannerisms, ahistoricity, and perhaps the lack of empiricism which characterize this stream of thought in the analysis of cyberculture are due, in part, to its mirror-shades.[4]

b. Black Box Histories

A number of cybertheorists do historicize their analyses. Stephen Pfohl traces a history of cybernetics as a knowledge influencing the "hegemonic exigencies of cybernetic culture" (Pfohl, 1997: 115). While his analysis is both lyrical and inspirational, he limits his methodology to considering an intellectual (auto)biography of Norbert Wiener and tracing certain thread of cybernetics in the American social sciences of the 1950s and 1960s. This results from his methodological choice to trace back the thread of cybernetics as a science, rather than as a broad marker of a variety of social production. The exclusive focus on cybernetics as a bounded knowledge and a lack of demonstration or theorization of its relationship with the computer, yields an historical vision which limits the possibility to make broader cultural claims. Clearly Pfohl is talking about something much larger than he is able to demonstrate through the evidence he offers in support of his claims. His arguments are compelling as a diagnosis of current cyberculture, but I am uncertain of the role that the historical analysis plays in their generation.

Chris Hables Gray attempts to recognize the history of the cyborg through including in his collection the original essay coining the term by Clynes and Kline (1995). Again, the analysis, and indeed the whole collection, is limited by Gray's focus on the *word*, cyborg, rather than the cultural construct of a human/machine hybrid. As a result, the term and its particular history within the NASA space program offer too limited an historical focus to ground larger cultural claims. The search for the first technological manifestation of this concept offers little to suggest the rich life that ideas of human/technology hybrids have had, and still have, in American culture.

A final example is the intriguing study by Marike Finlay, entitled, *Powermatics: A discursive critique of new communications technology* (1987), where the social discourses of information technology, operationalized through the computer, are examined from a period spanning the 1920s to the mid-1980s. While the study is ambitious, her use of the discourse of the computer as her historical object results in a lack of recognition that the computer may not have had the same cultural currency in

1948 that it has in 1978; my research suggests the computer as a discursive construct changes radically in that time. Finlay is attempting to assert the development of one continuous discourse from the inception of computers to the present time and the computer functions anachronistically as a result. While I appreciate the diversity of historical materials that she accesses, and her desire to articulate broader cultural patterns, her focus on computers in discourse as a constant moving through time and space limits her analysis.

Carolyn Marvin correctly recognizes the trend in media history, illustrated by the above interventions, that media forms are often treated as artifacts or black boxes and projected backwards in history. She argues that media scholars often "... appropriate categories of discourse from a contemporary world, categories that may not describe even it very well, and project them backwards" (Marvin, 1989: 190). She suggests that often empirical research reveals that a term may "... not appear as a stable descriptor attached to a reasonably constant physical or social image, an 'artifact'" (Marvin, 1989: 191). The computer is certainly not immune from this trend.

The implications of the black box are, *inter alia*, methodological. Conducting historical research of a particular term such as cyborg, the computer, or cybernetics does not yield all of the relevant discussions of the ideas which eventually come to be embodied, later, in those terms. How does one account for their messy interaction, the conjuncture I identified in Chapter 1? How does one account for shifts in meaning over time? The black box approach, while motivated by an historical impulse, offers a static, rather than processual analysis.

c. <u>Histories of a Cultural Sensibility: Analyzing Technoculture and Cyberculture</u>

This points to another approach to the history of cyberculture; one which frames it as a shift in cultural sensibility, a shift in how we think of our selves in relation to our machines. Some of this work is more general, cutting a wider historical swath, attempting to situate cyberculture as one of many moments of evolving/devolving technological culture; other attempts are more specific to my project, examining the impact and sweep of cybernetics through knowledge and culture. The first I describe as concerned with technoculture; the second more specifically with cyberculture.

Technoculture literature theorizes the relationship between technology and culture, and I consider three seminal works each trying to identify a cultural sensibility related to technology, and specifically, the computer. I draw inspiration from their historical vision and breadth, but want to focus on a more particular historical moment in depth. Bruce Mazlish (1993) employs the notion of the *fourth discontinuity*, arguing that Copernicus, Darwin, and Freud were the authors of the first three discontinuities, "... cosmological, biological and psychological blows to human pride" (Mazlish, 1993: 1). He suggests humanity is currently undergoing a fourth shock, namely that "... humans are not as privileged in regard to machines as has been unthinkingly assumed" (Mazlish, 1993: 1). He argues that: "... we are now coming to realize that humans and the machines they create are continuous and that the same conceptual schemes that help explain the workings of the brain also explain the workings of a 'thinking machine'" (Mazlish, 1993: 2). He then explores the work of a number of famous scholars to demonstrate this process.

David Channell also maps the interrelationship between humans and their machines through examining the machine and the organic as symbols in culture, "images that convey 'a special meaning (thought and feeling) to a large number of those who share the culture'" (Channell, 1991: 7). He argues that "[t]he basis of the current tension between technology and organic life does not arise as a conflict between machines and nature. Instead, it must be understood in terms of a tension between the machine and the organic as root metaphors or cultural symbols" (Channell, 1991: 7). He posits that this perceived tension has really been a struggle between opposing world views, with each world view determining the models that people use to understand related technological developments and organic processes (Channell, 1991: 9-10). The emergent model we are experiencing, a fusion of the technical and organic world views of previous eras, he labels the "bionic worldview" which has as its central metaphor, the vital machine, and is governed by "cybernetic ecology" as an ethics.

A third interesting attempt to characterize a technocultural shift in the mid- to late-20th century is that of "Turing's Man" offered by J. David Bolter in his book, *Turing's Man: Western Culture in the Computer Age* (1984). Bolter describes a new model of man which is emerging, as a result of, and in relation to, computer technology. He suggests that his work is a study of the impact of computers on culture, mobilizing the computer as his medium of change. "As a calculating engine, a machine that controls machines, the computer does occupy a special place in our cultural landscape. It is the technology that more than any other defines our age" (Bolter, 1984: 8-9). It is in this role as a "defining technology" that the computer becomes the conduit, medium, and motor of social change. A defining technology serves to focus at first seemingly disparate ideas in circulation within a culture.

He suggests that the computer, as a defining technology, has redefined man's relationship to nature, thereby offering a new definition of man as "information processor" and of nature as "information to be processed." "By making a machine think as a man, man recreates himself, defines himself as machine," in this way becoming a Turing's man, one who accepts an informated model of identity and knowledge (Bolter, 1984: 13-14). Bolter details a history since Classical Antiquity of the human/machine relationship but suggests that there is presently a new "twist" in the era of Turing's men.

> Men and women of the electronic age, with their desire to sweep along in the direction of technological change, are more sanguine than ever about becoming one with their electronic homonculus. They are indeed remaking themselves in the image of their technology, and it is their very zeal, their headlong rush, and their refusal to admit any reservation that calls forth such a violent reaction from their detractors. Why, the critics ask, are technologists so eager to throw away their freedom, dignity, and humanity for the sake of innovation? (Bolter, 1984: 14).

These three technoculture works are bold and compelling; they speak to and motivate my own work, although not overlapping with my particular empirical objectives. Each of Mazlish, Channell, and Bolter addresses a major change in cultural sensibility as a result of our relationships with information technologies. It is with respect to their assumptions about culture that I distinguish my own research, in Section 3 of this Chapter. Further, none of them incorporates notions of cybernetics into their treatments of the computer, however, as does the cyberculture literature.

It is to the recent spate of cyberculture literature which is specifically recuperating cybernetics as interrelated with the computer, and focusing on the period immediately following World War II, that my thesis is more directly indebted. This work details a shift in the social imaginary of the United States, without naming it; I suggest that in different ways, these writers are all writing, in part, about the cybernetic imaginary.

"Closed world discourse" is the way that Paul Edwards, in his seminal work, *The Closed World: Computers and the Politics of Discourse in Cold War America* (1996), denotes the way that the development of the computer functioned as metaphor in Cold War science, politics, and culture. He employs a history of computers, as a central technology of the military, but also as a metaphor in psychological theory during the Cold War period, specifically problematizing the 'grand narrative' of computer histories. He suggests:

> This book is built on an implicit critique of existing computer historiography. Instead of progress and revolution, the plot structure I shall use emphasizes contingency and multiple determination. I shall cast technological change as technological choice, tying it to political choices and socially constituted values at every level, rendering technology as a product of complex interactions among scientists and engineers, funding agencies, government policies, ideologies, and cultural frames (Edwards, 1996: xiii).

He stages his history as a drama played out between "closed-world" and "cyborg" discourses – the enclosure of spaces, the containment of military risks associated with the Cold War, and the central importance of metaphors of minds as computers and vice versa. His study provides its strongest contribution in its framing and organization – Edwards very usefully employs discourse to tell many of the same stories (of great events and the great men that made them happen) in different ways. Again, it is in relation to how to talk about social discourse, the assumptions around culture, and the specific role (or not) of the mass media that my work converses with, and hopefully adds to, Edwards'.

N. Katherine Hayles in both her earlier treatment of science and literature, *Chaos and Order: Complex Dynamics in Literature and Science* (1990), and her most recent exploration of the implications of posthumanity in cybernetics, literature, and informatics, in *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999), breathes new life into the significance of cybernetics as a source of the production of cyberculture. In *How We Became Posthuman*, in particular, she explores three interwoven stories, alternatively through science and literature -- how information lost its body, how the cyborg is constructed, and how the liberal humanist subject is dismantled in cybernetic discourse. In relation to my own questions, her focus is much more on questions of subjectivity, her historical period is much broader, and she understands culture through specific literary texts, but at the same time, there is a stronger sense in her work than that of Edwards, that cybernetics is a central discourse at work in cyberculture.

The "recuperation" of cybernetics, theoretically, metaphorically, and as a key word, in a Williamsian sense, is an identifiable development in cybertheory. This particular stream of thought highlights, among other things: the significance of the notion of information; the "traffic" in cybernetics at this time across fields and disciplines; the propensity towards its universalism, with various explanations for this phenomenon; and the relevance of the immediate post World War II period as a conjunctural moment in which cybernetics and computers come together. Here I consider a series of significant article-length works, in relation to these four issues.[5]

(i) Information

Information emerges as a central trope around which interdisciplinary boundaries are explored, particularly those between computers and biology. Lily E. Kay notes that:

> ... nearly every discipline in the social sciences (sociology, psychology, anthropology, political science and economics) as well as the life sciences (immunology, endocrinology, embryology, physiology, neuroscience, evolutionary biology, ecology and molecular genetics) flirted with the seductive ideas of cybernetics and information theory with different degrees of productivity and commitment (Kay, 1997: 26).

She, as well as Evelyn Fox Keller (1994) and Donna Haraway (1981-2), discuss the movement whereby molecular biology redefined itself as a communications science, mapping the genome as information. Recognizing that this is more a discursive phenomenon than one necessarily anchored in the logic of science, Kay notes that information became a particularly powerful metaphor at this time and that this has power implications for the control of life at the level of controlling information flow, the message, the sequence, and the word (Kay, 1997: 31). Keller concurs, suggesting:

> ... even while researchers in molecular biology and cyberscience displayed little interest in each other's epistemological programs, 'information' – either as metaphor or as material (or technological) inscription – could not be contained. In the real world, there was no stopping the circulation of meaning, no cutting of what Lacan calls the circuit of language. In the sixties, the primary vehicle for this circulation was provided not by material exchange but by metaphor. That is, it was the metaphorical use of 'information' – as it crisscrossed back and forth among these two sets of disciplines, between their practitioners, and between their subjects – that provided the principal vector for the dissemination of meaning (Keller, 1994: 314).

Information could move as a universal medium in part because of the claims to universality made by cybernetics.

(ii) Cybernetics

Cybernetics, itself, is also claimed to have had wide discursive effect, with authors differing on why and how this took place. Steve Joshua Heims (1991) locates this discursive effectivity in the pertinence and universality of its metaphors, as well as the interdisciplinary nature of the Macy conferences.

> The set of ideas that McCulloch, Pitts, von Neumann, Wiener, Rosenblueth, and Lorent de Nó brought to the Macy meetings could be put to many kinds of uses. They served well as metaphors for representing substantive chunks of the world we know. It is not unusual for the concepts used in a scientific theory to be extended beyond its strictly technical domain by means of metaphor so as to try to generate a comprehensive and coherent world view ... (Heims, 1991: 248).

Peter Galison also notes the "traffic" in cybernetics in the social sciences (Galison, 1994: 256). David Tomas makes a related and yet more problematic argument, that it was the very nature of the science of cybernetics itself, which led to its widespread circulation.

> A series of correspondences, analogies and metaphors were used to bridge different domains of knowledge according to a new universal world view or a 'new economy of the sciences' whose apex was no longer to be found, as in the past, in physics. ... New terms of reference such as feedback, message and noise functioned to reduce heterogeneous fields such as telephone engineering and the body's nervous system, the analog computer and the human brain to a common viewpoint originating in control and communications theory and their engineering practices (Tomas, 1995: 31).

He cautions, however, that "[o]n the other hand, there was no obvious guarantee that the adoption of a given metaphor or analogy would automatically lead to a revolution in human thought and perception" (Tomas, 1995: 32). Despite the caveat, Tomas' own analysis does not demonstrate how or why this revolution took place.

Stephen Pfohl (1997) is not so much attempting to account for the traffic in cybernetics as to engage with our present as a moment of social cybernetics. He is seeking to broaden the treatment of cybernetics from science to a wider social concept. What these thinkers make clear, however, is the resonance and pertinence of the ideas of this dead science to current cyberculture. Some look to explain the cause of this cybernetic ubiquity.

(iii) Universality

The universality alluded to by Tomas is examined in greater length by Geof Bowker (1993); he argues that cybernetics functions as a universal discipline and explores the rhetorical tools and practices embraced by cyberneticians in order to win widespread support for their ideas. He suggests that cyberneticians mobilized religious, political, and imperialist discourses, framing these in a universal language, and claiming a legitimacy to speak for themselves. This constructed cybernetics as a language that could speak to all disciplines and be used for all purposes. Andy Pickering agrees, arguing that cybernetics offered itself as a universal metaphysics, a "theory of everything" (Pickering, 1995: 31).

Galison disputes claims like those of Tomas and Bowker that there is something inherent to the science of cybernetics itself, which lends itself to universality, situating cybernetics in its context within World War II and the Cold War. He argues, "[m]ere governors, thermostats, and voltage regulators could not usher in a cybernetic age – weapons could" (Galison, 1994: 264). He suggests that it is the military and combat nature of cybernetics as a science which led to its enduring qualities. "Symbols matter: it counted for a great deal in the reception of cybernetics that its war applications were lethal, or potentially so" (Galison, 1994: 263). He poses the question: "[w]ould cybernetics, information theory, and 'systems thinking' have proved such a central and enduring metaphor without combat?" (Galison, 1994: 263). He suggests that this "ontology of the enemy" and the ultimate victory of the United States, through the use of cybernetic weapons, gave cybernetics a validity and purchase on American military, political, and scientific thinkers.

While Galison offers a much needed perspective on the Cold War context of these developments and Bowker's arguments as well have some purchase on the production of discourse – both perspectives on universality do not really take into account a role of agency for the public or the media. Bowker's arguments are that scientists were in control of their own discourse and Galison's suggests a universal and unproblematic logic to military applications. Both assume, without demonstrating or querying, acceptance by "the American public" of these claims, of this reality. In any claim of the social acceptance of ideas, I suggest that we must take into account the communication process which takes place with a wider public and which necessarily implicates the mass media.

(iv) The conjunctural moment

The period of, and immediately following, World War II is pivotal within this literature. Tying the knowledge to its institutional production, Pickering also locates cybernetics as a smaller part of what he calls the "World War II Regime" which moved into other social spaces, including the workplace. Kay, too, recognizes the significance of the cultural specificity of this moment, suggesting:

> … the conceptual and semiotic impact of cybernetics did not derive so much from its constitutive technical features – feedback, control, message, or information – as from their synchronic meaning, namely from their

> particular configuration within a new knowledge/power nexus: Word War II and the Cold War (Kay, 1997: 41).

These thinkers, as a group, thus suggest, correctly in my view, and contrary to the work of Finlay, that there is something very particular about the specific moment of the immediate postwar period in terms of understanding the circulation of ideas of cybernetics, information, feedback, and computers.

Read together, several questions arise for me out of this literature. While there is agreement that cybernetics had a significant, cult-like impact, not only upon the sciences, but upon the social sciences, and upon broader society, how did this circulation take place? How were its effects produced? Is it the same cybernetics in circulation at each particular moment and in each social space? How does the emergent computing machine figure in its formulation? How can the circulation of these ideas be removed from their sole association with certain great men, certain geniuses of science? How can science be considered as a part of broader society, perhaps a privileged set of social structures and knowledges, but nonetheless part of a wider cultural matrix? Some of the answers to these questions can be attempted when a different understanding of culture is employed.

3. Culture

The hybrid nature of cyberculture, itself, suggests at its heart, a relationship between cybernetics, or cybernetic technologies, and culture. Assumptions about the nature of culture are thus, central. My analysis of the literature suggests three primary understandings of culture are at work in cybertheory: culture as *belles lettres*, culture as reflection, and culture as "pop" culture/literature.

a. *Belles Lettres*: Culture as the works of "Great Men"

A number of cybertheorists trace culture through the works of "great men" in history, with the grounding assumption that somehow the genius of these individuals and their cultural or scientific production permits one to ascertain certain truths. There is often an implicit, or express, distinction made between science and non-science. For example, to establish his claims for the fourth discontinuity, Mazlish examines both "fantasy" and "fact," a distinction he attributes to fiction and science writing, respectively. He then details the work of Descartes, Carlyle, Darwin, T.H. Huxley, Freud, Pavlov, Babbage, and Samuel Butler. There is no mention of the public nor the popular as represented in other sites. These significant men of Western Enlightenment history are treated as authors of their time, individuals through whom cultural shifts are caused and can be measured. Channell, in *The Vital Machine*, conducts two interlinked histories, one of the mechanical worldview, the other of the organic. He explores their respective metaphors, symbols and figures, doing this, in large part, through the work of great literary figures.

This propensity to auteur (social) theory appears to a somewhat lesser degree elsewhere, but remains present. Pfohl (1997) and Tomas (1995), as noted above, both trace a cultural treatment of cybernetics, almost exclusively through the work of Norbert Wiener. It emerges as a striking pattern in virtually all of the other historical analyses of cybernetics' broader social impact (including Hayles (1999), Kay (1997), and Edwards (1996) among others), that while the cast of characters is enlarged to include not only Wiener, but von Neumann, Mead, Bateson, Turing, McCulloch, and a few lesser players, it remains consistent. For those making an argument limited largely to the sciences such as Keller (1994) or Haraway (1981-2), this is somewhat less of a concern, but it is more problematic when an author makes a much wider social claim, implying a cultural resonance in other (usually unnamed) social sites.

While I do not dispute that these individuals were significant in the play of events surrounding computers, cybernetics, the sciences, and social sciences at this time, it is their status as the site of singular historical agency which troubles me. Social ideas are produced in social interaction and do not pop, fully formed, out of the mind of any one thinker. This tendency to locate the source of an idea with one scholar often privileges a certain scientific text without an adequate exploration of its actual cultural impacts. My work is not about the popularization process whereby a pure scientific text moves into popular knowledge, but rather how ideas are produced in the interaction of knowledge sites. This is not to say that certain scientific texts do not have significant discursive effects upon the wider culture, but these should be demonstrated, not assumed. Further, ideas in the public domain should also be recognized as impacting upon science. The accounts of cultural production noted above employ a top-down model of culture, reproducing an implicit high culture/low culture distinction. The media as particular social institutions intimately implicated in the production and circulation of shared meanings through the social are strikingly absent and where mentioned, are not theorized as central in the production of public acceptance.

Claims are made in the name of the public, but are rarely demonstrated. For example, Bowker suggests that when Wiener wrote his "popular" *Cybernetics* in 1948, "the subject became a cult one for a wider audience" (Bowker, 1993: 108). Further, Alan

Newell, attributing the origins of cybernetics to the article written by Wiener, Bigelow and Rosenblueth and published in 1943, argues "[i]f a specific event is needed it is [this] paper ... which puts forth the cybernetic thesis that purpose could be formed in machines by feedback. The instant rise to prominence of cybernetics occurred because of the universal perception of the importance of this thesis" (Newell, 1983: 192). Again, the claim to cult status is not justified in relation to public perceptions, but rather an elite treatment of communication between scientists.

Lily Kay notes that the key process in the widespread circulation and embrace of cybernetics was a process of resignification. "Configured together [feedback, control, message, and information], they acquired new meanings within a new space of representation formed by the intersection of researches in the physical, biological, and social sciences" (Kay, 1994: 41-2). Yet the only space of resignification explored is scientific documentation and exchange. The media are silent. Kathleen Woodward (1983), in her interesting article exploring the notion of cybernetic modeling in culture, is one of the few scholars to concede a role for the mass media in mediating modern computers to an American public, yet proceeds to focus her analysis on literature, scientific writing, and what she refers to as *belles lettres*.[6] Yet again, the media are absent.

This absence reproduces a distinction between science and culture – science and the scientists who author it operate outside of their own culture. This can be contrasted with the claims of other scholars, such as LaFollette (1990), who make a sound case, as I will discuss in Chapter 3, that scientists themselves used media forms as a means of communicating to a wider public, to each other, and to the keepers of the public purse (for research funding). While a number of analysts recognize that science was taking place in a wider network of economic, military, political, and educational contexts, very few recognize that science was also taking place in the context of a public appraisal, public response, and public meaning-making processes. I suggest that the discursive and metaphoric mobility identified unanimously by the cybertheorists examined would not be possible without, and worked in conjunction with, a broader circulation of these same ideas and metaphors (as well as some additional ones) in the public domain.

b. <u>Metaphors Take Root: Culture as Reflection</u>

A second way in which notions of culture in cybertheory are explored is as a homologic reflection of either cybernetics or the computer. The structural qualities of culture reflect those of either cybernetics or the computer through a process not adequately located, problematized, nor demonstrated.

David Tomas, for example, suggests that cybernetics functions as a key word in that there are "an interconnected series of analogies and metaphors *which are authorized in its name*" (emphasis in original; Tomas, 1995: 30-1). While he correctly identifies that cybernetics spread throughout a number of knowledge domains to produce a "new universal world view," he locates the cause of these cultural effects in the internal coherence of the theory itself and its ability to explain matters in relation to mechanical structure.

> [A]s cybernetics extended its power over diverse field or adherents, it extended its temporal hold over them in such a way as to bind them according to a common perceptual space, since perception was, in cybernetic terms, simply a medium for the regulation of active feedback, and the principle of feedback was what allowed cybernetics as a discipline to survive in the world of ideas. Thus, in a specific Williamsian sense, the

word 'cybernetics' encapsulated the special transformation it was created to describe ... (Tomas, 1995: 32-3).

While Tomas is attempting to walk a razor's edge and play simultaneously at being inside and outside of cybernetics, his abstraction, while perhaps poetic, evacuates the materiality of discursive processes, moving them to the realm of magic, rather than traceable processes of communication, located to a significant extent within the mass media.

Less poetically and with more of a reference to the political, military, and economic context, Bowker (1993), who claims the universality of cybernetics, also ultimately relies on many of the characteristics of cybernetics itself as the final resource in, and reason for, this dispersal. While these resources are demonstrated to have been strategically manipulated by certain individuals, their fundamental nature as universal is stated rather than demonstrated.

Bolter offers a parallel, metaphoric reflection model of culture, only his metaphor is the computer. He posits the computer as the "defining technology" of our time. Despite his protestations to the contrary, Bolter's claims are perilously close to a form of technological determinism where the computer is the agent of history, even though the computer is framed as much more than a technological object. What I think can be productively added to Bolter's analysis is an exploration of *how* a particular technology, in this case, the computer, becomes a defining technology.

George Spencer (1996) combines cybernetics and the computer into an amalgam that functions metaphorically as an abbreviation for the sensibility of the information revolution. Again, however, the investment of this discourse object with its universal and powerful qualities it not addressed as an interesting, productive, and necessarily public, process.

While I sympathize that Bolter, Tomas, Bowker, Spencer and others are trying to get at something complex, what I find ultimately limiting about their analyses is that the cultural singularity of the moment is located, not in its processes of cultural formation, but in an identifiable technical, knowledge, or mechanical structure which is then invested, *a priori*, with the cultural characteristics under analysis. The activity of culture is evacuated in favour of a structure of homology. Culture is a static reflection of the structure of social relations, presumably located elsewhere, outside. Again, this process of reflection does not implicate the public. I am not suggesting that there is not something interesting in the argument that our society is operating on a structural model of computer technology – but how and with what effects. Only by asking these questions can we truly engage critically with the phenomenon that these thinkers identify.

(c) Social Science Fictions: Culture as Textual Representation

The third, and most prevalent, notion of culture at work in cybertheory is its location in fictional texts, in particular, literary and filmic science fiction. This serves to further reproduce the distinction between science and culture, as well as obviating other sites of culture. This process is reproduced in the content, as well as the form, of the analyses.

Teresa de Lauretis, Andreas Huyssen, and Kathleen Woodward (1980) critique, rightly I suggest, the technological or cultural determinisms that result from a hard separation of technology and the imagination. They coin the productive notion of the "technological imagination" as a way of recognizing, as I noted in Chapter 1, the interplay between technology, imagination, and the discourses in which they are textually inscribed. However, their own exclusive empirical focus is on literature and film as privileged sites of texts through which to understand the technological imagination.

This privileging of literature is reflected in much other writing (for example, Dery, 1993, 1996; Featherstone and Burrows, 1995; Feenberg, 1995; Mazlish, 1993; Channel, 1991). David Porush (1985) explores cybernetics as a root metaphor in our culture, through science fiction. Escobar suggests science fiction as pertinent source material for anthropological research (Escobar, 1994: 14). Joseph Slade explores Mazlish's fourth discontinuity thesis in relation to cybernetic ideas, suggesting the interesting notion of *cybernetic discontinuity*, but again, demonstrates/discovers this only in American fiction (Slade, 1980). This facilitates a certain aesthetic and style in the writing which manifests in the ahistorical stream of work to which I referred earlier and is understandable in scholars working from the institutional location of literary or film studies. Perhaps it is less appropriate for scholars making wider social claims.

Edwards makes a strong claim to be exploring the production of the closed world and cyborg discourses of the Cold War era in culture. Yet in a number of instances he defines culture as "fictions" and "fantasies," not conceding a role for non-fictional representational practices in an understanding of culture. Finally, he limits his own analysis of things cultural almost exclusively to science fiction films from a time period later than his period of study. These films (*Star Wars*, *The Terminator*, *T2*, *Colossus: "The Forbin Project*," *2001: A Space Odyssey*, etc.) are framed as particularly cogent distillations of cultural moments – and they can be, and frequently have been, represented and analyzed in that way. However, they do not particularly speak to the production of cultural discourses in the time period under examination. Further, they provide no particular insights into the public production of these discourses, located as they are in their historical specificity.

Interestingly, the treatment of culture is also marginalized to a particular chapter in which film is examined. The "cultural texts" are not implicated in, and analyzed alongside, other "scientific texts." Mirroring this structural organization, which I suggest reinforces the separation of science and culture, in analyses which are insightful and productive, Hayles focuses her assessment of the broader impact and circulation of the cybernetic ideas which she identifies in certain landmark pieces of fiction (1990; 1999). Given her location in science and literary studies, this is not necessarily a shortcoming of her analyses, which I find stimulating and motivating, but rather this characteristic suggests to me that other sites of cultural production might also yield interesting insights into how cyberculture is produced.

Across the field of cybertheory as a whole, the focus on fiction and film texts as representative of culture rests upon a limited understanding of culture and reproduces a methodology of textual analysis. There is not a strong notion of discourse in this work. This textual focus opens up questions of what sites, other than literature produce shared cultural meanings? What role do the mass media play in the circulation of metaphors, tropes, images, and ideas? How can we theorize culture as productive and not merely reflective? How can we see an interplay between science as one form of knowledge, with other forms of knowledge in social circulation? How can we take account of patterns across a multitude of texts? These are questions which ground my work.

The primary understandings of culture at work in analyses of cyberculture are those of reflection and representation. Culture is theorized as reflecting social relations which exist, more truly, elsewhere, and culture can be distilled in certain key texts. Somehow, remarkably to me, the public is marginal in this process. The public is assumed, denied agency. I prefer an understanding of culture which foregrounds its public, productive, and processual nature. To do this, I draw upon an understanding of culture drawn from a cultural studies tradition within communications studies for both a more complex conception as well as certain methodological commitments which will be mentioned here and addressed in more detail in Chapter 3.

I first take inspiration from going back to the work of Raymond Williams who offers what continues to be a cogent definition of a theory of culture as: "... the study of relationships between elements in a whole way of life. The analysis of culture is the attempt to discover the nature of the organization which is the complex of these relationships" (Williams: 1961: 46). Williams further suggests that one is seeking to draw out patterns broader than those found in individual texts. "[I]t is with the discovery of patterns of a characteristic kind that any useful cultural analysis begins ..." (Williams, 1961: 47). His notion of a "structure of feeling" as a means of describing an overall cultural sensibility is at the heart of what I am attempting to capture in my notion of the cybernetic imaginary. Finally, Williams' tri-partite understanding of culture and its relevance as a site of power is taken up within the subsequent discipline of cultural studies which his work, in part, inspired.

While I take inspiration from Williams' formulations of structure of feeling and his practical approach to the analysis of culture, I do not share his marxist perspective on the organization of power. My perspective on culture is more located within North

American cultural studies, which while indebted to marxist British cultural studies, has a more dispersed notion of social power and more autonomous role for culture.

North American cultural studies takes as its central problematic and site of intervention, the relations between culture and power. Lawrence Grossberg articulates three levels of contextuality which have grounded cultural studies as a field. These contextual levels influence my analysis:

> [f]irst, the concept of 'culture' in cultural studies is caught between community (social formations), totality (the whole way of life) and aesthetics (representational practices) ... Second, the very significance, not only of culture but of the relationship between culture and power, depends upon the particular space into which cultural studies imagines itself to intervene. Third, the culture 'text' is neither a microcosmic representation of, nor the embodiment of a meaning which is related to, some social other (whether a totality or a specific set of relations) (Grossberg, 1993: 2-3).

I want to draw upon a notion of culture from within cultural studies which empowers a notion of culture in its socio-historical specificity, which looks for the reflection of the social in the text, and which has as its focus the analysis of, and intervention into, the relations between culture and power. As Grossberg argues, "... cultural studies always operates within the ambiguous space of 'culture,' refusing to give it a singular definition and refusing, at the same time, to reduce reality to its cultural representations" (Grossberg, 1993: 2). These commitments are central to my understanding the cybernetic imaginary as a process of cultural negotiation which offers a "structure of feeling" of cyberculture, and which grounds how power is articulated. Too often in cybertheory, social power is attributed to the computer itself and not to our cultural assumptions around it. One cannot move a technology or a science outside of culture to see its effect on culture; they are always, already cultural. For as Haraway argues, " 'Computers' cause nothing, but the human and nonhuman hybrids troped by the figure of the information machines remake worlds" (Haraway, 1997: 126). Thus, in my analysis, it is in the process of cultural production that power is located and reproduced.

4. Cyber-Power: Theorizing Control as Social Power

Cybertheorists, in both their theoretical and writing practices, locate themselves on a continuum between a self-declared avant-garde optimism and a woe-is-us pessimism, both of which are ultimately anchored in determinisms, cultural or technological. There is a recognition that after World War II, in relationship with the computer and cybernetics, that new organizations of power are emerging, organizations of power which require naming, describing and theorizing. I suggest that control is the predominant mode(l) of power at work in these analyses – a notion of control often borrowed unproblematically from cybernetics. Control functions problematically in cybertheory and is sorely underdeveloped as a notion. It is often mentioned in passing because of its historical formulation in cybernetics, but there is much work to be done in fleshing out the concept as a wider understanding of how social power operates in the cybernetic imaginary. Work, I submit, this thesis begins.

In this section, I consider cybertheory through the lens of "control," suggesting it operates in three different orders. For some authors, control emerges from the technology itself; for others it is as a result of the influence of cybernetic knowledge or ideology. I consider these two streams, but also draw upon other resources in attempting to suggest a third level, control as a formation of power, as a power/knowledge effect of the cybernetic imaginary.

(a) Control of the Machine

Control is often framed as the inevitable result of the technological form of the computer. For Bolter, for example, the computer is a technology of control; a technology which exists to control other technologies. Urusula Franklin (1990), in her consideration of "the real world of technology" although not naming the computer *per se*, distinguishes between work-related technologies, which make tasks easier, and control-related technologies, which try to increase control over operations. She describes certain technologies as "designs for compliance" (Franklin, 1990: 23). For Bolter and Franklin, the control implications of the technology are built into their design and are therefore, not negotiable. Andrew Feenberg is not so negative; he describes the "ambivalence" of the computer, however, he nonetheless locates the control in the machine. "[T]he computer can serve as both a control system and as a medium for disseminating knowledge and communication opportunities throughout a fluid network" (Feenberg, 1995: 132).

Bill Nichols in his well-known essay, "The Work of Culture in the Age of Cybernetic Systems," introduces us to the computer as an icon and a metaphor with which we can better describe and understand the shifting notions of what it means to be human in this postmodern world. He then defines cybernetic systems suggesting that "... the computer has come to symbolise the entire spectrum of networks, systems and devices that exemplify cybernetic or 'automated but intelligent' behaviour" (Nichols, 1988: 22). His analysis reflects a late 1980s optimism for the potential of the computer to disrupt the "currently dominant tendency toward control." He suggests:

> Conceptual metaphors take on tangible embodiment through discursive practices and institutional apparatuses. Such practices give a metaphor

> historical weight and ideological power. Tangible embodiment has always been a conscious goal of the cybernetic imagination where abstract concepts become embedded in the logic and circuitry of a material substrate deployed to achieve specific forms of result such as a computer, an anti-aircraft tracking system or an assembly line robot (Nichols, 1988: 38).

Thus, it is through its embodiment in material technologies such as the computer that the social implications of cybernetic systems are both implemented and resisted.

In a comprehensive exploration of the notion of control as it relates to the introduction of information technologies and post-bureaucratic organizations of power, James R. Beniger also highlights the integral relation between control and the computer after World War II. He argues that "generalized control" began to move on to computer technology in this time period, directly affecting the pace of social life. Social change accelerates as computer technology does (Beniger, 1986: 6). Thus, the intimate construction of the computer as a technology of control must form a part of any analysis of control as a mode of power in the cybernetic imaginary.

Control is theorized in different ways by these authors, however. For Beniger, control is "purposive influence toward a predetermined goal," which has at its very foundation a notion of information processing.

> Information processing is essential to all purposive activity, which is by definition goal directed and must therefore involve the continual comparison of current states to future goals, a basic problem of information processing. So integral to control is this comparison of inputs to stored programs that the word *control* itself derives from the medieval Latin verb *contrarotulare*, to compare something 'against the rolls,' the cylinders of paper that served as official records in ancient times (Beniger, 1986: 8).

Thus, in Beniger's understanding, control is neither only repressive nor productive. It is postulated as a largely neutral, and inevitable process, its understanding within cybernetics. Others however, such as Franklin, Nichols, or Bolter are clearly theorizing control as a repressive force arising out of the negative uses to which computer technology can be employed, although they differ on the potential of the human spirit to overcome this.

b. Cybernetic Control

Other authors explore cybernetics as a methodology of control. Cybernetics was originally defined as a science of communications and control, and control plays a central role in its scientific understanding. In fact, Bowker correctly notes that cybernetics becomes a synonymous term with control theory in some scientific discourses (Bowker, 1993: 116). Control here functions as a methodology for the production of order. It is not an acting upon, so much as an effect of, successful feedback systems. This work highlights the desire to recognize the impact of cybernetics on how social power is configured. For the most part, however, these authors do not theorize control as an organization of social power, but rather assume it because of the role of cybernetics. The reader is left wondering what exactly is encapsulated in the concept.

George Spencer considers the control implications of a technology produced from, and embodying, cybernetics, naming his hybrid term "micro-cybernetics" to reflect the imbrication of computers and cybernetics. He suggests that as it grows, it replaces other forms of control (Spencer, 1996: 62). "If appropriate control is the key to technological activity, microcybernetics is the ultimate meta-technology founded on control" (Spencer, 1996: 66).

Others are less pessimistic but still explore control as an effect, almost homologously of cybernetics. Nichols' optimism stems from the potential which he sees in cybernetics for it to be rewritten as a space of resistance and exploration. Donna Haraway acknowledges the "legitimate" history of control of her cyborg in the American military-industrial complex which produced the science of cybernetics (Haraway, 1985: 68). Her suggestion that communications science and modern biologies are constructed by a common move to "the translation of the world into a problem of coding, a search for a common language in which all resistance to instrumental control disappear and all heterogeneity can be submitted to disassembly, reassembly, investment and exchange" (Haraway, 1985: 83) is not as self-evident as she might wish. Kathleen Woodward could well be addressing both Nichols and Haraway when she writes: "we must not go on to assume that the cybernetic model provides us with a different form of social control, a model of collaboration and partnership, as several have indeed asserted" (Woodward, 1983: 68). Thus, these authors firmly anchor the notion of control, as emerging out of, and represented by, cybernetics, as an uncertain form of social control which can both oppress and open possibilities.

c. Control and/as Social Power

Lily E. Kay is one of the few authors who recognizes the movement of control as a concept in the cybernetic conjuncture. She suggests that the movement of cybernetics through various knowledge domains had social power effects; she argues control becomes a wider set of social ideas, a philosophy.

> Configured together, they [concepts of feedback, control, message, information] acquired new meanings within a new space of representation

> formed by the intersection of researches in the physical, biological, and social sciences. Within that space, control was abstracted and diffused: it was not a thing, but a manifestation; not a mode of decision making, but a process pervading the whole system. ... By the late 1940s – in the frenzy of Cold War buildup of guidance and control weapon systems – information processing and feedback control were emerging as a new way of thinking. Beyond their status as a new academic specialty within electrical engineering, control systems were redefining the means of social and biological phenomena (Kay, 1994: 41-2).

Kay's analysis hints at the notion of a shifting mode of power which had broad applicability and heralded a new way of thinking about life in the latter half of the twentieth century, yet she does not go any further than this. Stephen Pfohl, on the other hand, uses "social cybernetics" in a manner similar to how I am employing the cybernetic imaginary, namely "... to provisionally configure the fluid, high speed, and densely layered webs of communicatively driven positive and negative 'feedback' ..." (Pfohl, 1997: 115). For Pfohl, social cybernetics is not limited to cybernetics as a field of technoscientific research; it is integrally involved in shifting paradigms of power. He asserts it is "... a term connoting the most far-reaching of ultra modern forms of social control" (Pfohl, 1997: 115).

While implicated in both cybernetics as a knowledge and in treatments of the computer as a material technology, control thus also operates as a theoretical frame, as a route to naming and understanding the power/knowledge implications of the cybernetic imaginary. Cybertheorists have identified control as an emergent formation of social power in this time period. Yet none articulates effectively what is meant by that control. Part of my examination of the production of the cybernetic imaginary is the consideration of the production, naming, and organization of control as a formation of social power. This conversation takes places necessarily not only with cybertheorists, but with other thinkers who have explored the boundaries and limits of control as social power in other contexts. It is necessary to seek out another level of social theory to begin this process.

I begin from Arturo Escobar's suggestion that Gilles Deleuze's notion of "societies of control" can serve as a point of departure for a more complex theorization of control in cyberculture. Deleuze, in two pieces in the 1990s, described by Michael Hardt as "brief and enigmatic," suggests that societies are in the process of becoming societies of control, rather than of discipline. "[I]n their turn the disciplines underwent a crisis to the benefit of new forces that were gradually instituted and which accelerated after World War II: a disciplinary society was what we already no longer were, what we had ceased to be. What we are becoming instead, are societies of control" (Deleuze, 1992: 3). While the tools of my analysis are more indebted to Foucault than Deleuze, I find Deleuze's suggestion that we are living in a society of control, and his brief sketch of some of its parameters, tantalizing and motivating. Something other than discipline is at work in the postwar era. Deleuze is trying to name and articulate a shift in the operation of power; in my analysis, I attempt to show some of the traces of that operation of power in a site within the public domain. I am attempting to illustrate some ways in which some of the aspects of societies of control are normalized within the cultural domain.

This crisis or shift in governance in the postwar moment identified by Deleuze is also recognized by others.[7] Michael Hardt, interpreting Deleuze, suggests that we are in a "passage in contemporary society toward a new configuration of social relations and new conditions of rule" (Hardt, 1995: 34). He agrees with Deleuze that we need to retheorize current configurations of social relations and new conditions of governance. He suggests that disciplinary structures have not ceased to exist, but rather that the "striae" of power that institutional structures organized have become generalized across society; social space is filled with the "modulations of control" (Hardt, 1995: 35).

Societies of control are characterized, echoing Wiener's claims for cybernetics, by control and communication. "Nous entrons dans des sociétés de contrôle, qui fonctionnent non plus par enfermement, mais par contrôle et communication instantanée" (Deleuze, 1990: 105). Further, both computers and cybernetics are implicated in societies of control. "À chaque type de société, évidemment, on peut faire correspondre un type de machine : les machines simples ou dynamiques pour les sociétés de souveraineté, les machines énergétiques pour les disciplines, les cybernétiques et les ordinateurs pour les sociétés de contrôle" (Deleuze, 1990: 106). Deleuze goes on to add, however, that "... les machines n'expliquent rien, il faut analyser les agencements collectifs dont les machines ne sont qu'une partie" (Deleuze, 1990: 106). Thus, machines are not determinative, but rather are expressive of the very social forms capable of generating and using them (Deleuze, 1992: 6).[8]

Why I find Deleuze's short pieces provocative and motivating is because they recognize at the level of social power formations, a relationship between current social life and the computer, the significance of cybernetics to current cultural organization, and the historical specificity of the postwar period. Whether societies of control are really post-disciplinary, or a mutation of them, is neither my battle nor interest. It is in their enigmatic qualities, however, that his claims for societies of control open up productive possibilities.

While Deleuze does not provide much detail with respect to societies of control, he briefly identifies a number of their characteristics. Societies of control reject the enclosure of institutions such as the prison, hospital, factory, school. Institutions of enclosure function in an independent, analogical fashion; control mechanisms, on the other hand, are not separable and independent, but are rather numerical and continuous. "Enclosures are *molds*, distinct castings, but controls are *modulation*, like a self-deforming cast that will continuously change from one moment to the other, or like a sieve whose mesh will transmute from point to point" (Deleuze, 1992: 4). Thus, institutions of enclosure are being displaced by control institutions, seamless, mutating. To me, Deleuze is suggesting that institutions are losing some of their distinctiveness, some of their structure. They are becoming flexible, and as a result, more difficult to resist. The same modes of being may be encouraged across a range of institutions. We are being integrated into the circuit.

Governance implicates the relationship between the state and its citizenry. Unlike disciplinary society, which Deleuze asserts has two poles of the individual and the mass, in societies of control, "what is important is no longer either a signature or a number, but a code: the code is a *password*" (Deleuze, 1992: 5). "The numerical language of control is made of codes that mark access to information or reject it. We no longer find ourselves dealing with the mass/individual pair. Individuals have become '*dividuals*,' and masses, samples, data, markets, or '*banks*'" (Deleuze, 1992: 5). Certainly the notion of coding is central to the cybernetic imaginary -- the coding of individuals, data, and social organization -- signifying a potential shift in subjectivity in the postwar period as we begin to rethink ourselves in machine terms, in numbers language, as information in a cybernetic sense.

Although very diverse, the authors exploring control as social power suggest, rather than practices of governance which focus on the individual subject, societies of control function through coding, through access to information, through the management of individuals as compilations of risk factors. Thus, as subjects we begin to take on the characteristics of information itself. Robert Castel (1991) suggests that a new mode of governing has emerged which does not implicate individual citizens, but rather seeks to manage "flows of population" constructed from abstract factors determined to be likely to produce risk. Hardt argues, "[i]nstead of disciplining the citizen as a fixed social identity, the new social regime seeks to control the citizen as a whatever identity, or rather as an infinitely flexible place holder for identity" (Hardt, 1995: 40). How does this process take place? What are its implications?

The significant nature of information in societies of control necessarily situates power in those who are able to manipulate it. Those privileged to predict and manage risks are elevated to positions of expertise. Nikolas Rose (1993) suggests that the reformulation of expertise, through new objects, techné, and ethos, is a significant component of advanced liberal societies. A kind of universal legitimacy emerges, as certain expertise becomes generalized (Castel, 1991). Hardt suggests: "[e]laborate controls over information flow, extensive use of polling and monitoring techniques, and innovative social use of the media thus gain prominent positions in the exertion of power. Control functions on the plane of the simulacra of society" (Hardt, 1995: 36-7). Thus, control is in part about monitoring, managing, and reducing risks and doing so through producing new knowledge. "More than the projection of an order than an imposition of order on the given, this way of thinking [population flow and risk assessment] is no longer obsessed with discipline: it is obsessed with efficiency" (Castel, 1991: 295). Here Castel correctly identifies efficiency as a central measure of value in control societies.

A risk in employing a term like control as a descriptor for a mechanism of power is that its repressive implications (noted by many cybertheorists) overshadow its productivity. Although not specifically addressing the question of control, Foucault suggests a productive way to think about all forms of power:

> [w]e must cease once and for all to describe the effects of power in negative terms: it 'excludes,' it 'represses,' it 'censors,' it 'abstracts,' it 'masks,' it 'conceals.' In fact, power produces; it produces reality; it produces domains of objects and rituals of truth (Foucault, 1979: 194).

Steven Spitzer, in his analysis of the role of the economic sphere in current governance, applies this framing directly to control as a form of power.

> Control and constraint are often used synonymously; yet it is clear that in capitalist societies choice may be far more basic to the ordering of social life. From this perspective, any theory of social control must not only understand the ways in which control is exercised through what is prevented or punished, but also through what is allowed (Spitzer, 1987: 51).

Spitzer is locating control in a binary of liberal choice, in a way that Foucault is avoiding; yet he does recognize the enabling quality of control.[9] Although Deleuze is suggesting that control replaces Foucault's discipline as a particular modality of the operation of power, I believe that both Deleuze and Foucault share a productive, and not only repressive, notion of power.

I suggest that the new configuration of social relations being identified by these authors can be fruitfully mapped through the cybernetic imaginary, with the new conditions of rule being those of control. Interestingly, and provocatively for my purposes, Hardt suggests, drawing upon Deleuze, that now the diagram underlies institutional forms of power: "... the anonymous or abstract strategic machine, the unformed or non-stratified schema of power relations. The diagram extends or rather subtends the various institutional assemblages" (Hardt, 1995: 35). Thus, it is possible to "draw" the dispositif, or the organizational formations of power. He argues that we have to conceive of the shift from disciplinary to control societies, not merely at the level of a shift in institutional structures (the level at which I suggest Foucault intervenes), but at what Hardt calls "the diagrammatic level." He poses the question with which I began this chapter: "... what are the diagrams that define the conditions of possibility in societies of control? And then, in what kinds of social assemblages will these diagrammatic forces be consolidated and how?" (Hardt, 1995: 35-6). The events in my research construct the outlines of a diagram to define the conditions of possibility of the cybernetic imaginary and the social power within it. Because these authors are operating at the level of theory, they do not offer an empirical grounding of their ideas. My project seeks to do both; it offers a portrait of a moment of change and distillation, of a society becoming a society of control.

Hardt argues that we can map this process at a metaphorical level. Interestingly, he chooses the metaphor of cyberspace. "The metaphorical space of societies of control is perhaps best characterized by the shifting desert sands where positions are continually swept away; *or better, by the smooth surfaces of cyberspace, with its infinitely programmable flows of codes and information*" (my emphasis; Hardt, 1995: 36). Here Hardt manifests one of the ongoing tensions that I have had to negotiate and attend to within my work, and that is the relationship between cyberculture itself and theories of control; the cybernetic imaginary is, itself, at work in the attempts to articulate theories of control.

In conclusion, I suggest that a review of both cybertheorists and other scholars treating questions of governance in the postwar era more broadly suggests that control is a way to talk about the social power of the cybernetic imaginary. Further, they unanimously identify the period immediately after the second World War as a rupture point worthy of specific attention. This work further suggests that computers and cybernetics are an interesting point of departure of any such theorization.

The cybernetic imaginary offers a means to describe certain social shifts which were taking place in the postwar era, shifts which continue to influence how we understand our experience of cyberculture on the cusp of the next century. Cybertheory is one of the knowledge domains attempting to make sense of these shifts. I am one of those cybertheorists and my notion of the cybernetic imaginary as well as my commitments to history, culture, and control are chosen in conversation with the field. My project is specific and historical, examining a moment in the immediate postwar period where a conjuncture of cybernetics and computers was at play in the public domain. Unlike other studies of cyberculture, my assumptions around the nature of culture insist on an approach which takes into account a stronger notion of the public, particularly as traced through the mass media, and which considers science as a part, and not outside, of culture.

The discursive production of the cybernetic imaginary as a central formation in a diagram of control, is drawn through a series of four media events: the thinking machine, the game, the future, and information. More specifically, the event of the thinking machine, as a metaphor which influenced both how machines were anthropomorphized and humans were considered more machine-like, constructs the space to code individuals as informational and highlights the power of the computer as a technology in the framing of the subject. The game, with its history in games theory, implicates questions of decision-making procedures and the emerging universality of cybernetics across all social games. Further, the epistemology of the cybernetic imaginary becomes rationalism with the reason of the smart machine setting the standard. The future becomes something much closer, as the speed and universality of the techniques of the computing machine and cybernetics redefine our conceptions of past, present and future. It is in this moment that the future becomes accessible, knowable, manageable, and perhaps controllable, so those with the expertise to "predict" it are elevated to significant status, able to reduce and control the risks of the unknown, of chance. An historical telos of techno-evolutionism results. Finally, information, the fourth event, is the medium through which the other shifts are facilitated. Information is redefined in this time period and becomes a central foundation in the construction of the cybernetic imaginary, becoming a universal medium. It ensures the power of the code. Through these four events, I hope to address the question, not of how our culture *is* cyber, an assumption made by many other cybertheorists, but rather how our culture *becomes* cyber, the conditions of possibility of the cybernetic imaginary.

III. Eventful Discourses: Methodology and Method

Knowledge is... generated through a system of ordered procedures for the production, regulation, circulation, and operation of statements. The products of science and technology are sociotechnical; they work because they are embedded not only in material practices, but also in cultural practices that stabilize and naturalize the technologies for producing knowledge (Kay, 1997: 30).

1. Introduction

When I tell people that I am doing a history of cyberculture in the immediate post-World War II period, many say, "there wasn't such a thing back then, was there?" And my answer is, "Um, no, there wasn't ... and yes there was ... sort of." It is in that elliptical response that the central problematic of my methodology lies: how does one study the past of something which exists now, can be named now, but which did not yet exist as a coherence, as a named entity in the past? How to study cyberculture, when it lacked, to borrow Carolyn Marvin's term, its "conceptual edges" (Marvin, 1989: 191). My thesis is about the construction of those conceptual edges, an inherently creative, processual undertaking, requiring a methodology which identifies, describes, and analyzes a process of becoming. This objective has necessary implications at the level of both methodology and method which I discuss in this chapter.

Gay Tuchman suggests that methodology is the study of the epistemological assumptions implicit in specific methods. "[A] methodology includes a way of looking at phenomena that specifies how a method 'captures' the 'object' of study" (Tuchman, 1994: 306).[1] Here I am using methodology as a way of denoting the epistemological choices which underlie my project, and method to describe the set of techniques and strategies which I employed to actually conduct the analysis. In the previous chapter, my review of cybertheory highlighted certain gaps in research, certain patterns in theoretical questions posed, certain tendencies in methodological choices and choices of method. From my analysis of this work and my articulation of my own intervention in the field, I have made certain epistemological decisions which serve as assumptions in my project. These epistemological assumptions are the guiding principles of my use of method.

My six central epistemological assumptions and their implications for my project at the level of method articulate a relationship between discourse, social power, culture, and the media. Following their discussion, I provide a detailed description of the research methods I employed, including an appraisal of their strengths, weaknesses, particularities, and idiosyncrasies. I then combine my discussion of method with the actual corpus of empirical material in order to draw out some of the overall patterns which my research identified and which form a general backdrop to the more specific analysis. Finally, I articulate the method of event analysis in more detail, with specific reference to the construction, justification, and implications of the four events upon which my analysis focuses, the thinking machine, the game, the future, and information.

2. Epistemological Assumptions – Guiding Principles

The epistemological assumptions (methodology) which ground the activity of my research are relational. They construct a set of relations between several concepts central to my research: history, power, knowledge, discourse, text, media, and event. My six assumptions are as follows. First, that history chronicles processes of becoming and is lived as an everyday activity. Second, social power is a network of productive forces, producing and yet also produced by, relations of knowledge. Third, culture is anchored in socially shared truths; truths which do not exist outside of the production of knowledge, but rather which are effects of the operation of power/knowledge relations. Fourth, discourse produces power/knowledge effects which can be mapped through regularities produced in and across texts. Therefore, discourse is of a different order than text. Fifth, the mass media are a key site for the negotiation of new social meanings, a key site in the production of discourse. Finally, I assume that discourse produces the conditions of possibility whereby new objects of knowledge, events, emerge and come to be made normal within society. These assumptions are informed in a general way by both cultural studies and social discourse analysis. In the following section, I discuss each of these assumptions in more detail and then consider their influence on the "how" of my research, on my choice and operationalization of methods.

History chronicles processes of becoming and is lived as an everyday activity.

Given the central problematic of my thesis, namely the production of the cybernetic imaginary in the immediate post-World War II period in the United States, my analysis is necessarily located in the past, and is thus historical. My understanding of history is informed by cultural studies where history is seen as "singular events or 'becomings,' rather than as continuity or reproduction" (Grossberg, 1993: 7). My project offers events as encapsulated, contingent moments of becoming, not mapped onto a chronological timeline, but as processes occurring in time. I am not seeking to determine the cause of certain historical events and in this way I am trying to disrupt the progressive telos of many histories of technology. The six characteristics of my events, which I detail in the second half of this chapter are not chronologically related, but rather are treated as interrelated but not determinative occurrences, elements in a process of becoming.

I also draw upon Raymond Williams' notion of structure of feeling or "the culture of a period" (Williams, 1961: 48). He suggests that "[t]he most difficult thing to get hold of, in studying any past period, is this felt sense of the quality of life at a particular place and time: a sense of the ways in which the particular activities combined into a way of thinking and living" (Williams, 1961: 47). The way of living and thinking which this project articulates is the cybernetic imaginary, the structure of feeling of our cyberculture.

It is this acceptance of becomings and recognition of combination which disrupt the "black-box" or "media artifact" approach to media history identified by Carolyn Marvin as problematic and discussed in the previous chapter. To describe an historical process, *as a process*, requires a method which is flexible, adaptive, and which is not predetermined by a terminology of the present. In concrete terms, it is not possible to employ "cyberculture" as a research term, given its temporal specificity in the 1980s and 1990s – another means must be found. I offer "event analysis," which I discuss in greater detail below, as a means to explore singularities and becomings. Rather than attempting to assert a continuous chain of influence from the postwar period until the present, I employ this method to better understand a particular historical moment which informs the present.

Events are inherently public, produced in the mass media, and necessarily negotiated. They are points of rupture in the flow of normalized discourse. They mark the appearance of something new and the transition of the newness to something shared, common, normal. These processes take place in and around us, in our everyday lives.

Cultural studies usefully speaks to this. It speaks to where we find history. Tuchman suggests: "... we all live history, and not merely in the grand sense of wars, recessions, and political transformation. Rather, we live out the assumptions of our époque in the most mundane aspects of our daily lives" (Tuchman, 1994: 313). I share this assumption and unlike several of the scholars discussed in the previous chapter (for example, Mazlish, Channell, or Hayles), I do not focus upon the exemplary individual or singular cultural artifact/product. I focus on the ordinary, on the everyday. At the level of method, this means that the mass media, with their role in daily life, become indicators of the "assumptions of our époque," epochal assumptions such as the cybernetic imaginary.

Social power is a network of productive forces, producing, and yet also produced by, relations of knowledge.

My understanding of social power, its operation, and its relationship to the production and circulation of knowledge and discourse is influenced by the work of Michel Foucault. His framing of social power as productive, and not merely as repressive, as I note in Chapter 2, is particularly cogent in a project of re-thinking control as a modality of power/knowledge productive of certain effects, particularly given its colloquial signification as repressive.

> What makes power hold good, what makes it accepted, is simply the fact that it doesn't only weigh on us as a force that says no, but that it traverses and produces things, it induces pleasure, forms knowledge, produces discourse. It needs to be considered as a productive network which runs through the whole social body, much more than as a negative instance whose function is repression (Foucault, 1980: 119).

Further, power is inextricably bound up with the production of discourse.

> In a society such as ours, but basically in any society, there are manifold relations of power which permeate, characterize, and constitute the social body, and these relations of power cannot themselves be established, consolidated nor implemented without the production, accumulation, circulation and functioning of a discourse. There can be no possible exercises of power without a certain economy of discourses of truth which operates through and on the basis of this association (Foucault, 1980: 93).

For my project this implies that a means to understanding power is the exploration of the production of "new" knowledge. This complex interaction producing new objects of knowledge, such as cybernetics or the computer, takes place in discourse, which I discuss in more detail below. Discourse thus becomes a significant notion within my project as a means to understanding the organization of power. These power/knowledge relations produce realities, domains of objects, and rituals of truth (Foucault, 1979: 194), which brings me to my third assumption.

Culture is anchored in socially shared truths that do not exist outside of the production of knowledge, but rather, are effects of the operation of power/knowledge relations.

Culture, including what we call cyberculture, can be said to be "defined by a particular 'ordering of things' which then becomes structuring of the knowledge we have and hold about ourselves" (Allor and Gagnon, 1994: 37-8). Thus, there is at the heart of the notion of culture, shared notions which are taken to be true. Yet, how is this truth produced? Again, I draw upon the work of Foucault. For Foucault, truth does not exist somewhere outside of human interactions. Truth cannot be discovered, it is rather, produced in socio-historical particularity.

> Each society has its régimes of truth, its 'general politics' of truth: that is the types of discourse which it accepts and makes function as true; the

> mechanisms and instances which enable one to distinguish true and false statements, the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true (Foucault, 1980: 131).

Thus truth is produced in the movement of discourse and can be studied and "... understood as a system of ordered procedures for the production, regulation, distribution, circulation and operation of statements" (Foucault, 1980: 133).

For me, this means that the task of the researcher is not to discover the truth and falsity of particular statements, nor to offer a "better" truth, but rather to examine how certain discourses come to be valued as true, and implicitly, others rejected as false. In this way, culture operates as an "... arena in which codes and rules for messages are contested" (Marvin, 1989: 189). Culture is a zone of negotiation, of competing truth claims. At the level of method, this motivated me to develop events as a means to capture the contestatory nature of culture. Events begin when a contest appears and terminate when the contest is resolved, when a meaning has become normalized, shared, true within the public domain.

Contestation between regimes of truth also implicates questions of expertise – at the levels of discourse, institutions, and individuals. What or who is privileged to make truth claims at any given historical conjuncture? Lily E. Kay recognizes this implication in her treatment of the dispersion of information as a notion through a series of knowledge domains in the 1950s.

> Discourse establishes cultural efficacy through regimes of signification. These refer to the body of practices and representations that a society at a particular historical period accepts and validates ... and to the mechanisms enabling one to distinguish true and false statements and the means for their sanctioning. ... Regimes of signification also refer to the techniques and procedures accorded value in the acquisition of knowledge ... and to

> the status of those charged with saying what counts as true (Kay, 1997: 30).

This implies that in my study, notice must also be given to the institutional sites of knowledge production, who is privileged to speak, about what, who is silenced, how those who have expertise are framed. This is, necessarily, a public process whereby the production of truth, and the expertise by which it is bolstered, legitimated and through whose avenues it is circulated, link culture to the production of discursive formations.

Discourse produces power/knowledge effects which can be mapped through regularities produced in and across texts.

Discourse is a useful notion in my project for a number of reasons and I want to articulate it in more detail. It is important to define discourse given that discourse analysis has come to mean all, and therefore, nothing, in much social analysis. I appreciate Foucault's treatment of discourse for a number of reasons. First, it rejects a notion of ideology (in all its multiplicitous incarnations) as, among other things, reproductive of a true-false knowledge binary; second, it seeks patterns (of appearance and absence) across a diversity of texts from various institutional sites. Third, it acknowledges the productivity of discourse as its own domain. Fourth, Foucault uses discourse, not to determine the meaning of an individual text, but rather to identify the effects of texts, their *how*, the impact of their being said, at that particular place, at that particular time – what they permit or enable to happen (Foucault, 1981).

Discourse is always taking place within, and is always productive of, shifting matrices of power. The power of discourse is not in its meaning; discourse is always, already within power relations.

> Le type d'analyse que je pratique ne traite pas du problème du sujet parlant, mais examine les différentes manières dont le discours joue un rôle à l'intérieur d'un système stratégique où de pouvoir est impliqué, et pour lequel de pouvoir fonctionne. Le pouvoir n'est donc pas au-dehors du discours. Le pouvoir n'est ni source ni origine du discours. Le pouvoir est quelque chose qui opère à travers le discours, puisque le discours est lui-même un élément dans un dispositif stratégique de relations de pouvoir (Foucault, 1994b: 465).

Therefore, I am not seeking to fix the *meaning* of the cybernetic imaginary, nor the *real* power relations which it masks, but rather to diagnose its power/knowledge effects – how, at the level of discourse, the cybernetic imaginary is produced within, and is productive of, particular kinds of knowledge, particular regimes of truths, which have effects and effectivity in culture.

Foucault insists that any analysis of discourse takes place in its historical specificity of occurrence. It is within this moment of historical specificity, that discursive formations, or regularities in the production and circulation of discourse emerge

> Whenever one can describe, between a number of statements, such a system of dispersion, whenever between objects, types of statement, concepts or thematic choices, one can define a regularity (an order, correlations, positions and functioning, transformations), we will say for the sake of convenience, that we are dealing with a *discursive formation* (emphasis in original; Foucault, 1994c: 38).

He suggests that the task is to determine the group of relations that discourse must establish in order to speak of this or that object, in a particular way at a particular time.

My analysis names and describes a discursive formation, the cybernetic imaginary, a particular ordering of discourse which has effects – effects upon how information comes to be defined; upon how concepts such as learning and memory come to be applied to a technological device and social organizations; upon how the "thinking" machine comes to frame sets of debates around labour and automation; upon how the anthropomorphizing of the computer within an evolutionary discourse gives scientific legitimacy to technological change and progress; upon how the objectives of social governance shift from addressing social problems in the present to management of the risks of the future.

Yet, how, at the level of method as technique, rather than methodology, does one study discourse? How does one "do" discourse analysis? Discourse is produced in the ordering of statements within texts, texts which can be analyzed. Foucault's work is less useful in the consideration of texts and so I turn to the work of others. Raymond Williams recognizes that once the people in an historical period die, the closest that we can come to that period is in the documentary culture left behind. "The significance of documentary culture is that, more clearly than anything else, it expresses that life to us in direct terms, when the living witnesses are silent" (Williams, 1961: 49). Lily E. Kay suggests: "[d]iscourse refers to statements (and tropes) that in a particular historical period come to be consistently figured together ..." (Kay, 1997: 29). Discourse is supported and can be identified through series of metaphors, techniques, and technologies which are found in texts (Edwards, 1996: 34). The question then emerges, which texts does one examine to consider the historical emergence of cyberculture?

In her treatment of the normalization of television as a household commodity in the 1950s, and echoing Williams, Lynn Spigel asks a question pertinent to anyone doing historical analysis, namely, how can we understand how people felt and thought about something 30 years ago. "How can we discover a history of everyday life that was not recorded by the people who lived it at the time?" (Spigel, 1989: 339). Spigel suggests the mass media of the day, in her case, popular magazines in particular, offer intertextual insights into the cultural concerns of that period (Spigel, 1989: 339-40). If culture is necessarily a public zone for the negotiation of shared meanings and discourse can be mapped across texts through the regularities which emerge across them, then the mass media are implicated in this process, leading me to my fifth epistemological assumption.

Mass media are a key site for the negotiation of new social meanings, a key site in the production of discourse.

The mass media are deeply implicated in the cultural processes in and through which we come to know and understand social occurrences. The mass media are one of the central institutional locations in which shared social meanings are produced. The study of the mass media reveals the negotiations at the heart of the production of shared social truths, of culture. The particular framings of culture in the work of many of the cybertheorists discussed in Chapter 2 contribute to the radical understudy of the mass media as a site of the reproduction of cyberculture. It is here that media studies offers some useful guidance to the cybertheorist. Media studies takes as central a relationship between the mass media and culture.

Peter Dahlgren, in his contribution to his and Colin Sparks' collection, *Journalism as Popular Culture*, recognizes the central, yet under-acknowledged role that that the non-fiction media play in the reproduction of culture (Dahlgren, 1992: 3). While noting that they are not contiguous, Dahlgren reasserts the interrelationship between journalism and popular culture. He suggests that this interrelationship is facilitated through the technology of story-telling given that storytelling has epistemological status as a narrative way of knowing the world. He feels there are two ways of relating to and knowing the world through texts: analytic mode and story mode. Analytic mode "... is characterized by referential information and logic, and the latter [story mode] by the narratological configurations which provide coherence via emplotment" (Dahlgren, 1992: 14). Journalism takes advantage of both modes; it "... officially aims to inform about events in the world – analytic mode – and does this most often in the story mode" (Dahlgren, 1992: 14). In particular, for my analysis, the print mass media open a window into culture, into the daily lives of the people who reproduce, accept, and legitimate the ideas and acts authorized in the name of what would become cyberculture.

The significant role of the mass media in the reproduction of culture is also recognized by David Altheide; in particular, he highlights the role that the mass media play in the normalization of that which seems new (Altheide, 1996: 44-5). He asserts, based on communications research, a strong relationship between how people make sense of their world and the definitions, scenarios, images, metaphors, and so on they encounter in the mass media.

> What we call things, the themes and discourse we employ; and how we frame and allude to experience is crucial for what we take for granted and assume to be true. Simultaneously, we experience, reflect on that experience, and direct future experience. When language changes and new or revised frameworks of meaning become part of the public domain and are routinely used, then social life has been changed, even in a small way (Altheide, 1996: 69).

The computer and cybernetics, for example, were both "new" in the late 1940s – how can we understand how new and revised frameworks of meaning become part of the public domain, part of culture? This suggests my sixth and final epistemological assumption.

Discourse produces the conditions of possibility whereby new objects of knowledge, events, emerge and are negotiated, managed, and made "normal."

Scholars have employed a number of means and terminologies to attempt to capture the appearance of something new in a particular historical moment. I use the notion of "event" to simultaneously recognize the singularity and the constructedness of certain moments in discourse and to disrupt the black box of media-artifacts. I want to examine the processes through which something new becomes normalized within culture in and through discourse, the process by which the central ideas of the cybernetic imaginary take on their conceptual edges.

Others have also used event, but not exactly as I do. Foucault understands discourse itself, as an event:

> ... non des codes, mais des événements : la loi d'existence des énoncés, ce qui les a rendus possibles – eux et aucun autre à leur place ; les conditions de leur émergence singulière ; leur corrélation avec d'autres événement antérieurs ou simultanés, discursifs ou non (Foucault, 1994a: 681).

What I take from Foucault is his sense that events produce the conditions of possibility of certain shared truths. Further, he suggests that an event "... has its locus and it consists in the relation, the coexistence, the dispersion, the overlapping, the accumulation, and the selection of material elements" (Foucault, 1981: 69). It is in the six characteristics of the event which I discuss subsequently in this chapter that I address the simultaneity and the materiality of events.

Drawing upon the work of Foucault, Martin Allor and Michelle Gagnon also employ a language of events, asserting that "statements are the 'events' of discourse; they accomplish the elaboration of positions within the systems of regularities of the discursive field" (Allor and Gagnon, 1994: 35). My understanding of event is broader, than the statements suggested by Allor and Gagnon. Events for me mark moments of discontinuity in discursive flow, potential moments of leakage where something distinct must be incorporated into, or negotiated with, existing patterns of discourse (and power).

As I am specifically studying media discourse, I turn to McKenzie Wark's attempts to theorize media events as productive nodes of meaning making. Wark's work is particularly useful for adding the element of normalization into the concept of event. He suggests that media events occur when singularities erupt in media flow that must be "captured and interpreted in an acceptable narrative framework" (Wark, 1994: 27). Events occur when "... noise from the system overwhelms or breaks through the codes and narrative strategies intended to contain it" (Wark, 1994: 20). The point of departure for an event is always, therefore, the "failures of narrative seamlessness" (Wark, 1994: 23). Wark's approach highlights the nature of newness and contestation in media discourse, the notion that some things happen which do not already have established cultural and media contexts, do not fit into already existing patterns of discourse. What happens with that particular event, how it comes to be framed, where it is located, is a crucial and interesting process of negotiation.

What I find limiting about Wark's approach, however, is his focus on spectacular events which take place outside the media and which are then recreated, regenerated, revealed, in media discourse. While his analysis is an interesting treatment of certain notable media events, his focus on the spectacular ultimately reproduces a separation of the inside and outside of discourse which I do not wish to replicate. The effect of his method is that the Gulf War, for example, happens in its material reality (outside discourse) and then is represented in the media (inside discourse). My conception of event disrupts that boundary between text and context, inside and outside discourse, suggesting that the event is already discursive. For my purposes, events only occur within public discourse; they are a means to knowing shifts in cultural understanding. They may or may not be in a direct or causal relationship to other kinds of occurrences, events in a colloquial sense.

As a result, I fully concede that events, as discursive conjunctures, are constructed, not discovered. "We must conceive discourse ... as a practice which we impose on [things]; and it is in this practice that the events of discourse find the principle of their regularity" (Foucault, 1981: 67). As well, as I note previously, I am also assuming that culture is lived in the ordinary, and not only in the extraordinary, events of our time.[2]

What is striking to me in my research is that there is not a single moment, no solitary spectacular occurrence, which is represented in the media treatment of cybernetics and computers, but rather a series of ongoing attempts to deal with new ideas, objects, notions. It is this process of presentation, dispute, and eventual normalization that produces media events within my framework. Certain objects, terms, and ideas come to be linked, come to be prominent – not because they were events or event-like elsewhere and then articulated in the media – but as products of media discourse. I suggest that cybernetics, the computing machine, and more importantly, their messy conjuncture, were singularities in public discourse at this time, bumps in the graph of regular media flow. A language had to be found to describe them, to fit them within acceptable narratives and frames, to admit new frames and narratives within acceptable truth boundaries. Certain metaphors emerge, therefore, as more cogent than others, certain terms are redefined, certain notions come to be linked in discourse for the first time, certain parameters are established in which debates around things cyber begin to be framed. This is simultaneously a process of inclusion and exclusion, of choices, of meaning-making.

As I discuss in more detail below, once the events I identify become regularized, defined, and established as about certain things, representable by certain imagery, they cease to be events. Rather than seeking to map along the surface of discourse all of the regularities which arise, I want to pull out and analyze in more depth, certain moments which function, not only as patterns, not only as metaphors, but as markers of cultural contestation, moments where the struggle over meaning is traceable in the mass media texts of the day. This provides insights into how questions of power enter into and become normalized within, the cybernetic imaginary. For as Wark suggests, in admittedly rather hyperbolic language,

> [i]n the flash-gun glare of the event there is a moment in which to peer through the rent in the fabric of the spectacle, to glimpse unexpected and powerful relations between things that the division of labour would normally consign to different patches of the crazy-quilt of knowledge (Wark, 1994: 28).

3. Description of a Research Process

> *Finding and assessing primary historical data is an exercise in detective work. It involves logic, intuition, persistence, and common sense* (Tuchman, 1989: 319).

Given the preceding epistemological assumptions about the nature of history, social power, discourse, culture, texts, and events, a certain methodological terrain is already defined. Specifically, drawing upon the understandings of discourse and its relation to power and knowledge formation detailed above, I construct and examine a series of events, which emerge as regularities from my material. These events are instances of a process of cultural negotiation whereby certain central truths about cyberculture are being contested and normalized, where the cybernetic imaginary is being produced. It is in the moment, and in the process of this negotiation, that the power relations currently rendered as true, become visible as constructed, as only one possible option in a field of possibilities. In this section, I describe the methods by which I selected, organized and analyzed the documents which ground my four events: the thinking machine, the game, the future, and information.

David Altheide suggests a method for an interpretive, discursive, textual analysis which he calls, ethnographic content analysis.[3] This offered me some general guidelines to describe the methodological steps which I followed and an overall sensibility towards historical media research. I did not begin with Altheide's model; my approach was more intuitive than that. In many ways, my overall approach to research and to being a researcher draws inspiration from C. Wright Mills' seminal essay, "On Intellectual Craftsmanship," in *The Sociological Imagination* (1961). Mills encourages a sensibility towards research and writing which is simultaneously brave and modest; it is about ideas and their formulation, about the use of process to serve ideas, not the reverse. In terms of particular research activities, however, upon reading Altheide, I realized that what he offered was a language to describe quite accurately what I had actually done. According to him, his approach,

> ... follows a recursive and reflexive movement between concept development-sampling-data, collection-data, coding-data, and analysis-interpretation. The aim is to be systematic and analytic but not rigid. Categories and variables initially guide the study, but others are allowed and expected to emerge throughout the study (Altheide, 1996: 16).

He articulates twelve separate steps in the research process,[4] but organizes them into five larger stages: finding and accessing documents; protocol development and data collection; data coding and organization; data analysis; and writing up the report. While Altheide uses a language which is more indebted to positivist approaches than I would choose, he offers a constructive framework through which to present my own research process.[5]

a. Finding and Accessing Documents

Altheide suggests that one should develop a topic for investigation, become familiar with the process and context of the information sources, and explore possible sources of information (Altheide, 1996: 23-4). Interestingly, the initial research process itself, led me to change the naming of the very problem that I was investigating. For example, in my quest to better understand the roots of cyberculture, I began an intellectual history of cybernetics in public domain documents. I found, however, while conducting research that often articles about computing machines were very much about cybernetics, even though cybernetics, itself, was never mentioned. I discovered the reverse was also true. Clearly, more was needed than an intellectual history of the notion of cybernetics. Eventually, I opened up the topic, *itself*, to a conjunctural notion, simultaneously researching several "topics" in order to comprise the overall confluence of ideas which I wanted to analyze, which comprise the conjuncture.

I wanted to study the circulation of these ideas in the public domain and so needed to identify routes into knowing the public imagination at this time. I decided to begin with the print mass media for a number of reasons. First, it is indexed in a comprehensive way through a variety of periodical and bibliographic indexes. Second, it is more accessible than radio and televisual materials in terms of resources available to me. As well, television was in its very earliest stages and did not as a result, have a lot of pertinent content. Third, film did not prove to be a major site in this time period and so could not ground a significant part of the project. Fourth, my research into the few other analyses exploring mass media at the time indicated that print mass media, such as books, newspapers and magazines, were more significant in the circulation of new cultural ideas than other media forms (for example, LaFollette, 1990 and Spigel, 1989).

To define the time period of study, because I was studying the appearance of certain ideas in the public imaginary, and because the print mass media were my measure of its boundaries, I drew heavily upon the categories of periodical indexes to monitor the appearance and development of certain central ideas. For example, having developed my search terms through an ongoing process of trial and error, I found that the earliest moment of appearance of calculating machines and cybernetics was in the early 1940s; by the late 1950s and early 1960s the language was shifting again from thinking machines, cybernetics, and calculating machines to computers, information theory, artificial intelligence, and bionics. I read this shift as the end of a period of meaning negotiation.

Altheide calls this process "tracking discourse," namely "following certain issues, words, themes, and frames over a period of time, across different issues, and across different news media" (Altheide, 1996: 70). He suggests that this is greatly aided by computer databases! My project is evidence that it is possible to do the same thing, "the hard way," namely without computer databases. It should be noted, however, that this produces a daunting amount of material from a very wide diversity of sources; factors which pose additional methodological considerations.

My primary search tools for locating documents were a variety of indexes (of periodicals, newspaper, films, novels, book reviews, authors, etc.). I was also led to pertinent documents through secondary source references, topical and selected bibliographies, intertextual references in primary documents, and random sampling in materials of the period. I supplemented library research with computer searching where available and searches in the periodical and book collections of second-hand bookstores. This resulted in an incredible amount of material; I collected and used close to 400 periodical articles, approximately 50 print advertisements and images, 10 mass market books, and approximately 15 pieces of fiction.

As the last step in "Finding and Accessing Documents," Altheide suggests that one become familiar with a sample of texts in order to develop preliminary categories of analysis (Altheide, 1996: 24). This was a very fruitful process for me. I selected approximately 30 documents, allowing me to determine that magazine articles were to be my primary unit of analysis, with mass market non-fiction, mass market fiction, print advertisements, and photographs within articles becoming secondary units of analysis. This was as a result of the richness of the material, its coherence across genre and institutional location, and its stylistic content, namely the treatment of analytic information in story mode, as noted by Peter Dahlgren above.

Having conducted a preliminary sampling, I then moved on to the larger work of collecting a more comprehensive body of material.

b. <u>Protocol Development and Material Collection</u>

Altheide suggests that one should use a protocol as a tool in what he calls data collection. "In general terms, a protocol is a way to ask questions of a document; a protocol is a list of questions, items, categories, or variables that guide data collection from documents" (Altheide, 1996: 26). He suggests that one list several items or categories to guide data collection and then draft a protocol which includes, at a minimum: the medium, date, location, length, title, emphasis, focus or main topic, sources, or themes. He then recommends using the protocol and revising it as necessary (Altheide, 1996: 25-6).

I first developed a protocol for document collection and then a further protocol for document recording. My search protocol was constituted by the specific terms and concepts for which I searched in my research in periodical indexes, computer databases, topical bibliographies and encyclopaedia, and so on. This protocol was revised several times throughout my collection stage for three reasons that derive from my research process. First, as I read through the articles collected to date, I would sometimes find new central ideas that could be also used as search terms. Second, as the nature of how these issues were treated in the media shifted over time, old search terms fell out of use, new ones were adopted, and there were many periods where several terms were in use at one time to describe something. For example, "computers" does not appear in the *Readers' Periodical Index* as a coding category until the late 1950s, and even at that time, one is referred to the section on "Calculating Machines." Other search terms to address computers, alone, included: calculating machines, electronic brains, computing machines, information, artificial intelligence, and bionics. Third and finally, different journals employed different key word categories for similar concepts and so appropriate adjustments had to be made depending upon the source being examined.

In terms of my protocol for recording documents, I included the type of media (magazine, fiction, popular non-fiction, etc.), the genre of media type (for example, with respect to magazines, categories included science, popular science, women's, business, general interest, news, etc.), the author, the subject matter, the date, the search term under which it was located, and the key notions in the particular piece.

At the stage of collection I took an inclusive, rather than exclusive approach, making photocopies of all available articles, books, and stories, or obtaining originals of the documents, when possible. I should also note that throughout this process I kept a journal of "field notes" wherein I noted patterns and idiosyncrasies which became visible as I collected the material. I noticed, for instance, that after the mid-1950s, *Scientific American* seemed to shift from a focus on machine sciences to biological sciences; as well, notwithstanding that I anticipated that *National Geographic* would have addressed the development of the computer or cybernetics, it did not do so in this time period.

The popular magazines that I examined included: *Time*, *Newsweek*, *The Atlantic Monthly*, *Harper's*, *Scientific American*, *Popular Mechanics*, *Business Week*, *The Economist*, *Saturday Evening Post*, *Nation*, *The American Mercury*, *The Commonweal*, *The Saturday Review*, *Fortune*, *The New Yorker*, *Science*, *Science News Letter*, *Life*, *Nation's Business*, *New Republic*, *Collier's Weekly*, *Aviation Week*, *American Scholar*, *Popular Mechanics*, and *Mind*. As well, I examined a variety of psychology, sociology, and anthropology academic journals. My search terms included: cybernetics, computing machines, calculating machines, electronics, information, Norbert Wiener, John von

Neumann, thinking machines, Alan Turing, artificial intelligence, and computers. My treatment of periodicals was limited to those available in Montreal libraries and to those items which appeared significant enough to obtain from elsewhere. I feel that I was able to obtain a reasonable and representative cross-section of the media treatment of these issues in the relevant time period.

There were a number of mass market publications of non-fiction in this time period which played a role in the circulation of key ideas, including Wiener's *Cybernetics* and *Human Uses*, William Ross Ashby's *Introduction to Cybernetics*, John von Neumann's and Oskar Morgenstern's, *Theory of Games and Economic Behaviour*, and less famous works such as *Automation: Servant to Man* (1959) and *Psycho-Cybernetics* (1960). Fiction publications included the stories collected in *The Metal Smile: 12 Battles of Wits Between Man and Machine* (Damon Knight, ed.), all originally published between the years 1953 and 1963; references to, and descriptions of, stories in secondary sources focusing on science fiction literature; and Kurt Vonnegut's, *Player Piano* (1952). There was one mainstream Hollywood film, *Desk Set* (1957) made in this time period which I employ in my analysis.

I ultimately chose not to use newspapers because they are local and not national in circulation, unlike the other media in my study. Further, each individual item tended to be shorter and therefore less rich for the purposes of analysis. Finally, my initial review of articles in *The New York Times* suggested that the analysis of newspaper articles would not necessarily add anything which would not be found in the magazine treatments of the same issues.

While my research focus was on North America, there is a preponderance of American sources. This is largely as a result of the dramatically fewer number of pieces in the Canadian context, and the less significant treatment of the issues in what was available. My research revealed nothing at all in the periodical literature prior to 1951, with one short piece in that year, a few in the early 1950s, and the majority from 1957-1959. Further, a significant majority of Canadian sources appeared in *The Financial Post* and tended to be shorter and more financially focused than items in general interest magazines. Some Canadian pieces have been included in the analysis, but they are very much in line with patterns already established in the American media, at least five years previous.

Having collected this overwhelming amount of material, it needed to be organized.

c. Organizing the material for analysis

In this preparatory stage, Altheide recommends arriving at a sampling strategy, coding the data, and organizing it. He suggests using codes which are conceptually motivated but which are decided in advance as a result of the previous sampling. He recommends keeping the original documents intact, but also entering the data into a format more suited to easier and quicker searching, finding, and coding. Finally, he recommends that at the half-way point one re-evaluate the data to allow for the emergence of new categories, or the refinement or collapse of existing categories (Altheide, 1996: 32-7).

In order to arrive at my "coding categories," I first "immersed" myself in the documents, to borrow a term from Bruce Mazlish. In dealing with the challenge of analyzing a large and diverse body of work, he describes his process:

> [t]he task is to immerse ourselves initially in the far-flung materials themselves. Out of such an immersion I have formulated the theses advanced in this book.... These theses did not generally lie nicely separated or even labelled in the original texts. Though I have had to treat them discreetly for the purposes of exposition, I have also tried to preserve something of the messy connectiveness found in the originals (Mazlish, 1993: 9).

Stuart Hall describes this as the "long preliminary soak" (Hall, 1975: 15).

Obviously then, the first step was reading all of the texts collected. To this end, I specifically read across genres, across institutional locations, across authors, to look for new notions, sites of contestation, where certain metaphors, images, or representations come to stand in for a process of negotiation at last resolved. In my preliminary reading, I arrived at five categories: information, the thinking machine, the future, the game, and miscellaneous. I then reviewed all of the documents again, coding them as one (or more) of these five categories. I kept a list of additional coding terms and monitored for additional notions appearing repeatedly, possibly suggesting other patterns. Other repeated notions included the second industrial revolution, brains, control, and evolution. As well, once I had done a preliminary review and coding of all documents, I pulled out all of the documents coded miscellaneous and read them again to determine if other categories were appropriate.

My second reading and coding review confirmed the legitimacy of the five initial categories and I was able to make choices between the five original categories, with the four events, and other potential categories through my own motivations in the present for conducting this project. In addition to being central categories that emerge across the material, these categories have a conceptual pertinence as events in current cyberculture. The thinking machine, the game, the future, and information clearly spoke (albeit possibly in different ways) in the 1950s and speak again and still in the 1990s. This pertinence strongly motivated my selection as this was not an exercise in empiricism, but an attempt to use history as a tool to better understand the present.

d. Analysis of the Material

Altheide suggests that the three steps in the data analysis stage are to refine the coding of the data, reading the data and one's notes repeatedly and thoroughly; to compare and contrast "extremes" and "key differences" within each category or item, making summaries for each category; and pulling out typical cases as well as extremes. He suggests identifying clear examples for each case study, and recommends noting surprises and curiosities in the data as well (Altheide, 1996: 41-2). He notes that the documents function both as representations, and as social products in their own right. For my material, this meant paying special attention to authorship and location for certain key documents that contribute substantially to a particular event.

At the stage of analyzing the material, after coding every piece, I then sorted it into its five categories. Certain key pieces had pertinence for more than one event. For example, I pulled out and read all of the pieces coded the thinking machine – either because they used that language, implied it, or used other key words which I came to group as part of the thinking machine. Then I read through the documents for that event. It was quite thrilling to watch the event emerge through that process. A beginning and an end could be identified, certain personalities emerged, as well as key texts, and watershed moments. I could see uncertainty in framing, contrasting ideas, notions which appeared once, never to be seen again. I could see what other notions were facilitated by the assumptions embedded in the event. "The goal is to understand the process, to see the process in the types and meanings of the documents under investigation, and to be able to associate the documents with conceptual and theoretical issues. This occurs as the researcher interacts with the document ..." (Altheide, 1996: 43). It was in the interaction with the documents that my four events became solidified and began to take on conceptual power, suggesting certain power implications which could then be addressed through specific theoretical concepts.

e. Writing the report, or in this case, the thesis

The actual writing up of the "data" is not addressed extensively by Altheide, and yet it strikes me as an important, and not entirely self-evident, area. I strongly agree with Laurel Richardson who suggests, "[a]lthough we usually think about writing as a mode of 'telling' about the social world, writing is not just a mopping-up activity at the end of a research project. Writing is also a way of 'knowing' – a method of discovery and analysis" (Richardson, 1994: 516). Two issues arose for me in the task of writing which merit attention here. First, the role of the researcher in discourse analysis and second, the question of credibility, or when is enough enough.

The discourse analyst has a responsibility in presenting her analysis because the methodological signposts are not as clear as in other types of analysis such as rhetorical, narratological, or semiotic. Discourse analysis does not offer one single, well-accepted method. It is an interpretive exercise based on extrapolation of broader patterns from a limited core of documents. The researcher is always open to the accusation that she is finding what she wants to find. This is particularly the case when the research is historical, yet motivated by questions from the present. For me, it is only in the writing of the thesis, that I can address some of these potential critiques. The nature of the claims in relation to the "evidence" which can be summoned must be modest and appropriate, claims about historical continuity should be avoided unless clearly demonstrated, counter-examples should be as honestly presented as strong examples, and again, it should be made very clear throughout that discourse analysis is an act of construction, not of discovery. It is not without foundation, but it is motivated by attempting to reveal the construction of truth, rather than truth, itself.

Questions of credibility arise in the interplay between texts and discourse. While it is important not to reduce discourse to individual texts, in relation to the conduct of the analysis, recourse must be had to individual texts for illustration and example. Various authors recognize this dilemma. Elfriede Fürsich and E.P. Lester, in their analysis of the journal *Science Times*, suggest that one draw out certain articles as exemplars of larger trends recognized across the body of research. They caution, however that "[t]he interpretation of the chosen article is always done in the context of the complete reading. This ensures that any interpretation made from the smaller sample does not reflect a coincidental account but a prevalent discursive strategy" (Fürsich and Lester, 1996: 29). Given the magnitude of the primary periodical literature, I offer in my appendices a breakdown of how I used certain periodical material directly in each event, and the larger body of articles which informed the overall analysis (see Appendix I-VI).

It is a difficult judgement when enough is enough to make credible the claim for a broader discursive pattern. One has to balance variety and sufficiency with not collapsing the analysis through the weight of its own examples. I hope that I have struck a credible balance. Important to me was the provision of the opportunity to the reader to engage somewhat with the material himself or herself, and to allow some of the spirit, some of the vitality, of the texts to emerge. At the same time, that presentation is always mediated by the purposeful analytic use of examples for a broader purpose. Hopefully those serve as guides not strictures.

4. Patterns in the Material

Preliminary patterns in my data fall into two major categories: patterns in the construction of the body of material and patterns in the material itself, which do not pertain directly to the construction of the four events. The first issue I want to address is the major pattern in the construction of the body of material, the strong focus on popular magazines. I made this choice because the American popular magazine is such a rich source for considering how cybernetics, computing machines, electronic brains, and other central tropes of the cybernetic imaginary circulated in public culture in the postwar era.

As Marcel LaFollette argues in her very interesting study, *Making Science Our Own: Public Images of Science 1910-1955*:

> American popular magazines interpreted scientific facts and explained scientific issues; they described events and people, providing repeated images of institutional organized science – how research was conducted, who scientists were, what scientific research produced for society, what role it should play in the future. What was said in their pages found its way into the general political discourse of the era, as well as reflected prior debate (LaFollette, 1990: viii).

She argues that until the rise of television in the late 1950s scientific representations in popular magazines in the 1920s to late-1950s were particularly vivid, accessible to millions of readers, simultaneously, across the country (LaFollette, 1990: 3). Echoing Peter Dahlgren, she suggests that the magazines aimed to inform, but to do so in an entertaining way; science was able to accommodate both needs.

She looks exclusively at popular, general interest magazines, deliberately excluding popular science magazines. This may well be appropriate in her study as her object of analysis is how science was represented in this type of magazine during this time period; my goal is more broad and thus, I did not limit myself to the type of magazine, but rather to the ideas in circulation. The type of magazine is relevant at the stage of analysis, but did not serve as a selection criterion for the construction of the corpus of material. By this I mean, obviously I realize that *Aviation Week* has less of a purchase on the public imaginary than *Time* magazine, but I still found it interesting to see that many of the same metaphors were being used to "sell" computing machines to aviation specialists and to the general public. This confirms the presence of a cybernetic imaginary in formation.

Interestingly, several of the patterns identified by LaFollette as beginning in her time period, are solidly in place and demonstrable by the time of my analysis. For example, she suggests that scientists began to pay attention to their media images in the period from 1910 and into the 1950s; certainly that is borne out in my research with a number of scientists and mathematicians publishing in popular science and humanist magazines. Related to this is the phenomenon of the "visible scientist," a notion which LaFollette borrows from Rae Goodell (1977), to describe scientists who were newsworthy subjects in themselves, but also skilled at public communication (LaFollette, 1990: 50). Certainly Wiener is one of the foremost examples of a visible scientist as will be illustrated in Chapter 4.

LaFollette notes the "translation" function that magazines played in the popularization of certain scientific ideas. This style of presentation of articles is present in my material as well.

> These media descriptions played an unusually important role in shaping cultural attitudes because science was actually quite segregated from ordinary life. ... The magazines' intimate format, however, allowed readers to 'observe' mysterious experiments or to 'overhear' scientists' conversations – all while sitting safely at home. The journalists could visit the scientists' lairs and bring back accounts of what was going on, could even translate for the inhabitants. The social separation of the work of science, as well as the technicality of the language, magnified the importance of these media accounts (LaFollette, 1990: 3-4).

She feels this distancing between scientist and citizen takes place through the use of metaphors and similes.

> One expository technique that science writers frequently used to enliven their prose – metaphors and similes – further contributed to this sense of isolation. Comparative devices, which were quite common in magazine articles on science and which the writers (and their interview subjects) may have intended as helpful, inadvertently supported the impression that scientific concepts were being translated from a foreign language and they contributed to the sense that readers and scientists lived in different worlds (LaFollette, 1990: 145)

While this may be accurate in her analysis, I think that the use of metaphors and similes as expository technologies have a number of other discursive effects which I will explore in my treatment of the thinking machine and the game, in particular.

LaFollette suggests that due to subscription rates, mass market magazines were an effective mechanism of feedback in tracing out the responses to certain scientific events and issues (LaFollette, 1990: 20). While I hesitate to trace such a direct line between subscription rates and content, and find her assumption problematic within media studies, my research certainly reveals an attempt to frame "new" things in a language with which readers would be already familiar. She argues the task became to fit science, a "weird knowledge," into the experience, knowledge and belief systems of readers and for that reason, major changes were slow (LaFollette, 1990: 22-8). This is not entirely borne out by my research. While certain appeals are made to existing belief and value systems, during the period of the late 1940s until the late 1950s, some radically new ideas came into cultural currency very quickly.

The patterns of legitimation and expertise noted by LaFollette are also present in my research. She suggests a "myth of differentness" was constructed in the popular press which empowered both science and scientists. Scientists were frequently represented in one of four roles: wizard or magician; expert; creator/destroyer; and hero.

> As popular culture increasingly linked social progress to science, scientists found their intelligence and knowledge to be unchallenged and their opinions in great demand ... journalists touted scientists as the ultimate experts and pestered them for statements on every conceivable public issue, scientific and non-scientific alike (LaFollette, 1990: 100).

In my research, under the guise of commenting on the future of the computing machine, physicists, engineers and mathematicians were invited to make grand pronouncements on the future of all aspects of social life. An additional role which scientists were attributed in my material was the "prophet," which will be discussed in more detail in Chapter 6.

5. Four Events

In my analysis of the material I gathered, I have drawn out four central regularities: the thinking machine, the game, the future, and information. Two of these are metaphoric, two are not. Each is a significant set of concepts around which certain ideas come to be centred, communicated, legitimated, and normalized. Each functions as an event in that it is produced in a series of discursive moves which operate in very different ways. There is a period within the media discourse in which a certain idea is introduced as "new." It must be named and framed within certain pre-existing modes of understanding. It is at this moment that other definitions can be traced in the discourse; other possible framings, presently invisible, become visible on the surface of the discourse. There are stakes in these different understandings and winners and losers in the outcome of the contestation.

I suggest that each event is comprised of six characteristics that typify it. These are neither linear, nor chronological; they do not look the same, nor work themselves out in the same manner in each event. The characteristics do not have the same value nor valency within each event; nonetheless, they are ways of delimiting and telling the story of the event. The six characteristics of my events are as follows. First, the naming and framing of the event, where certain terms are identified as significant, and the new idea, concept, or object is positioned, usually within existing or acceptable patterns of discourse. Second, in all of the media events, certain public personalities emerge as central to the construction and propagation of the event; they emerge as "spokespeople" of sorts, for that event. Third, there are certain key moments which serve as watershed points in any event, be they texts, occurrences, crises. They take on particular cogency for detailing the key issues associated with that event and serve to constrain its possible meanings. Fourth, certain figures (metaphors, similes, tropes, etc.) are produced and reproduced in the circulation and development of an event. Eventually these take on almost mythic status, coming to stand in for a whole series of larger issues. They become the language and set of shared meanings by which the event is most commonly discussed. Fifth, events are not static; they move, circulate, and sometimes mutate into other discourses. It is in this way that events make connections to other events and take on more discursive power. Part of any event analysis must be the acknowledgement of this movement. Finally, the sixth part of any event is its resolution – the point at which the event has changed from being new to being "old news." This is the end point for an event.

I use my variant of event analysis to capture four moments of cultural uncertainty and contestation – in other words, events last as long as, within the media, there is still uncertainty, debate, and contradiction in their framing, while they are still disruptive in the flow of media discourse. In practical terms, it is difficult to mark the beginning and ending of a media event.[6] For me, an event is over when a set of accepted significations have come to be associated with that particular notion, when those shared meanings are well established in public discourse, when they are normal.

My four events which play themselves out in public discourse – the thinking machine, the game, the future, and information – were selected in light of two primary considerations. First, they were chosen as a result of their overwhelming appearance in the primary data; and second, they were chosen because they seemed productive ways to talk about power relations at the time, but also about some of the ongoing patterns which continue to this day. They resonate with current manifestations of the cybernetic imaginary. I am not saying that the chess-playing machine of the Bell Laboratory in 1950 is the same as the one which beat world chess champion Garry Kasparov in 1998, but I do suggest that there are some significant implications to the incredible endurance of that metaphor. Ultimately, however, the events must speak for, and convince the reader, themselves.

Anchored in my epistemological assumptions which frame issues of power, discourse, culture, texts and history, my method seeks to capture something which is in motion and to do so in an understudied site of cultural production, the mass media. I assume that history is about becomings and quotidian life; that social power is related to the production of knowledge; that culture is about a process of producing shared truths; that discourse produces power effects which can be mapped across texts; that the mass media are a central site for the production of discourse; and finally, that discourse allows new objects and new ideas to be managed, normalized, and controlled within a given society.

I conduct an extensive analysis of a significant body of print mass media texts from the period of 1944-1959, organizing my texts in relation to the construction of four events. Events are processes which can be traced in the media, processes of a public coming to terms with something new. It is a process of negotiation which results in the production of shared meanings; it is in this negotiation, however, that social power can be drawn out and recognized. One can see the choices that were made, and those that were not. I structure my telling of each event through the six characteristics so that it forms a narrative of sorts; each event is a story, the story of an idea. The following chapters are the stories of the thinking machine, the game, the future, and information. Taken together, these stories begin to show us the shape of the cybernetic imaginary.

IV. The Thinking Machine

> 'I believe that at the end of the century,' wrote [Alan] Turing, 'the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted.' Here lie the seeds of a formidable semantic revolution, and others did not wait until anywhere near the end of the century to declare the birth of the thinking machine (Hanson, 1982: 67-8).

Cover Stories

***Why** magazine, Winter, 1997 8 features a beautiful woman's face, half covered in computer circuitry. The headline on the cover reads, "The Human Computer" and predicts, "Thinking computers will change your life – what you need to know now." Inside, a senior editor considers the issue of "Thinking computers – a dream come true or our worst nightmare?" Imminent revolution is predicted, information is a universal medium, and computer scientists are seen as undisputed experts in the field.*

***Discover** magazine's June 1998 cover features half of a woman's head, a digital overlay plays over her face. The headline reads: "The Darwin Chip: Evolving a conscious computer." The table of contents promises: "... When it comes to the design of living organisms, evolution devises ingenious solutions to hard engineering problems. Perhaps it can do the same for a thinking computer." Computer scientists are the sole experts featured, evolution is applied to technological developments, neurons are equated with electronic components, and behaviour is the measure of consciousness.*

***Time** magazine, April 1, 1996, features a third woman's head, disembodied, again overlaid with computer circuitry, gears floating around her. "Can Machines Think?"*

queries the headline, suggesting an answer: "[t]hey already do, say scientists. So what (if anything) is special about the human mind?" Chess playing is proof of intelligence and machines that act like humans provoke the question, are humans also, only, machines. Robots computers are scientists' "babies," scientists are visionaries, and a revolution is brewing.

1. Introduction

These popular magazine covers, striking in their similarities, indicate a certain fascination in current culture with questions of thinking machines, conscious computers, and evolving machines. They also map some of the parameters of this discourse, some of the central signifiers, metaphors, tropes, and imagery which have come to be associated with thinking machines – evolution, revolution, science expertise, information, chess, heredity, gender, and so on. This is not a new issue; some scholars have traced the human concern with machine-human hybridity back to classical antiquity (for example, McCorduck, 1979).

It is in the 1940s and 1950s, for the first time, that the question of whether or not "man" could build a machine which was not only like him physically, but mentally, became technologically convincing with the advent of electronic calculating machines. Hubert L. Dreyfus and Stuart E. Dreyfus note that "[i]n the early 1950s, as calculating machines were coming into their own, a few pioneer thinkers began to realize that digital computers could be more than number crunchers" (Dreyfus and Dreyfus, 1988: 15). It was not only a few pioneer thinkers who began to dream of electronic brains, however. My research indicates that the public becomes fascinated with these issues in this same time period as evidenced in the media. Pamela McCorduck notes, in her intriguing history of artificial intelligence, that it was in the 1950s that the notion of "giant brains" caught the public's imagination (McCorduck 1979: 64). Marcel LaFollette's research also indicates that the popular press in the early 1950s was asking the question of whether or not humans could be replaced by machines, not only in physical labour, but in mental processes (LaFollette, 1990: 106).

The "thinking machine" is the first and favoured trope of the cybernetic imaginary, the single most common framing device for the particular conjuncture of cybernetics and computing machines in the period I am studying. The thinking machine comes to be framed as a "do they or don't they" issue. Binary positions emerge, each with their scientist spokespeople, yet both positions share certain underlying assumptions about the nature of thinking, of machines, of human intelligence, of how to measure it, and of the utility/validity of posing such a question. The computer is anthropomorphized; the human is technologized. The discursive effects create a performative equivalency between humans and machines which has particular impacts upon work and how the computer, as a technological tool, moves from its military/industrial location to commercial and social applications.

What begins as a simile, human brains function like computing machines/what computing machines do is like some kinds of thinking, becomes metaphor. The human brain is a computing machine/computing machines think. In this process of equivalence, certain distinctions are lost, certain debates are silenced; homology takes on explanatory power, always in both directions. Terry Winograd suggests that in asking the question, can machines think, we engage in a kind of projection – projecting an image of ourselves onto the machine and then of the machine back onto ourselves.

> But these projections are like the geometric projection of a three-dimensional world onto a two-dimensional plane. We systematically eliminate dimensions, thereby, both simplifying and distorting. The particular dimensions we eliminate or preserve in this exercise are not idiosyncratic accidents. They reflect a philosophy that precedes them and that they serve to amplify and extend (Winograd, 1991: 220).

It is this process of elimination and preservation, and the philosophies which it amplifies and extends in public discourse that I explore in this chapter. This chapter marks a particular process of negotiation with certain effects, namely the discursive construction of the computing machine as a thinking machine, and its production of a functional equivalence between machines and humans.

2. The Thinking Machine as Event

I trace the thinking machine as an event produced in the activity of its six event characteristics. As I note in the previous chapter, I am not suggesting that the thinking machine, as it appears in discourse, can be evaluated chronologically. Its temporality is bounded at either end by its appearance and resolution in public discourse (for this event, 1944-1957), but within the event itself, there are six characteristics which mark its passage.

Again, these characteristics are: naming and framing; the cast; key moments; central figures; circulation; and resolution. First, the newness of the event must be named and framed within existing understandings. Naming is the process whereby the event is first spoken within the discourse. Framing is the related process whereby the "new" idea or notion is situated in relation to what has come before. It anchors the "new-ness" to already familiar discourses or processes, permitting its easier cultural negotiation. The analysis of these processes also makes visible other possibilities that are foreclosed, framings which are rejected or which fall quickly out of public circulation. Once the possibility of this zany notion is named – the thinking machine -- its newness is first framed in a dichotomy of the wondrous and the monstrous. The question of how to make sense of this becomes framed as the question: can machines think? This dilemma, ripe for media discourse, then is situated at the centre of a "false" debate, which establishes the thinking machine as reality. The computer is equated at the levels of first structure and then performance with the human brain, facilitating the fuller anthropomorphization of the computer as I discuss later in the chapter.

Second, given the nature of media discourse, an event has a central cast of characters, individuals who are seen as expert, who become informal spokespersons for particular positions. Certain scientists emerge as the architects of the thinking machine, as a discursive phenomenon, if not a material one. The central spokesperson for the thinking machine quickly becomes Norbert Wiener. The framing of his authority has effects on the legitimation of the thinking machine and its impact in public discourse.

Third, certain moments catch the public attention, have cogency for framing the issue and thus take on increased explanatory power in the discourse. Discussion of them reflects a microcosm of the larger event. It is also interesting to consider what potential "event-like" occurrences do not become moments within the discourse and to consider why. Several potential moments around the thinking machine do not come to discursive significance; instead, in conjunction with his framing as a visible scientist, Norbert Wiener's *Cybernetics*, forms a key moment.

Fourth, central images, metaphors, figures, or tropes can be identified in significant texts, and are picked up in advertising, covers, accompanying visuals, and titles of the day. These reinforce certain central aspects of a wider contested zone and create certain discursive openings and moves within the logic of the event. The event of the thinking machine is both mobilized through, and marked by, two central metaphors: the machine is human; the human is a machine.

Fifth, events move and circulate through different types of media, for different audiences, resulting in a further process of negotiation as ideas are more widely employed across disciplinary, institutional, and social boundaries to become broadly accepted, shared cultural meanings. Interestingly, the circulation of the thinking machine is simultaneous through a variety of knowledge domains, but one central effect begins to emerge: the movement of the computer from military and industrial domains to a broader commercial applicability, from blue- to white-collar work.

Sixth and finally, any event comes to a resolution, in that the ideas, debates, and conflicts which it represents come to be abbreviated, represented, by the single idea; in this case, the thinking machine. It is at this point, that the event opens up conditions of possibility within discourse; it enables other issues to be framed within an already accepted framework of understanding in the public sphere. The central notion made possible through the negotiation of the thinking machine is automation.

3. The Battle of the Brains

> *Whether or not machines can think is the stuff of which dreams and nightmares are made* (Hughes, 1989).

> *Everybody knows by now about the machines that think, or seem to think* (*NY*, 1950b).

a. Fact and Fantasy

On Saturday, February 16, 1946, the morning newspapers were invited to the first public showing of ENIAC (Electronic Numerical Integrator and Computer) in Philadelphia, where it demonstrated its ability to solve a number of ballistics problems. Louis N. Ridenour, a commentator on the event notes, "[s]ome papers did not run the story; most cut it considerably. Editors, obviously, were not convinced that the portents of a new era were at hand" (*F*, 1949: 108). My research suggests that Ridenour is correct; until after 1947, there were very few references in the media to calculating machines at all; when present, they tended to be in science news journals, and the machines tended to be described as robots or calculators. The occasional article makes reference to the calculating machine in terms of its capacities as a "brain" (for example, "Superbrain" in *Nation's Business*, 1944).

It is during and after 1947 that a language of brains and thinking machines takes off, with such eye-catching titles as: "Custom-Built Genius" (*New Republic*, 1947); "The Logical Maniac" (*New Republic*, 1947); "The Brain is a Machine" (*Newsweek*, 1948d); "In Man's Image" (*Time*, 1948); "Machines that Think" (*Business Week*, 1949d); "World of Robot Brains" (*Science Digest*, 1949); "Mechanical Brains" (*Fortune*, 1949); "Can Man Build a Superman?" (*Time*, 1950a); "The Machine in Man's Image" (*The Saturday Review of Literature*, 1949a); "Brains and Calculating Machines" (*American Scholar*, 1950); "Here's how 'brain' operates" (*Financial Post*, 1952), and "Do they really think?" (*Scientific American*, 1950). And the trend continues throughout the mid-1950s. I am not suggesting that article titles in periodicals tell the whole story, but they do indicate snapshots of how issues were being talked about. The diversity of magazines exploring the thinking machine is also telling. Clearly by the late 1940s the thinking machine was news.

What was catching the public's (and the journalists') imagination was the fact that this machine was not like other machines. It seemed unique in its abilities. As J.H. Shera notes in 1956,

> [u]ntil very recent years, we have thought of machines almost exclusively in terms of their potentialities for the extension of man's physical power. Then, in the late 1940s it became apparent that it was possible to construct a partial counterpart of the human brain in the form of the electronic computer (*SR*, 1956b: 70).

But how to talk about this "new thing?" Initially, a sense of wonder played out through the public discourse. The thinking machine – was it fact or fancy, magic or monster? LaFollette suggests that this is in part because the development of electronic computers posed issues only addressed previously in science fiction. Journalists were describing machines perceived to be similar to the humans and human processes they mimicked (LaFollette, 1990: 106). She also finds that there is a dual framing of this possibility as potentially monstrous and/or wondrous. Norbert Wiener, himself, suggests in *Cybernetics* that in the computing machine there are "unbounded possibilities for good and for evil" (Wiener, 1948: 37). *Life* magazine suggests calls them "strange and awesome machine[s]" (*L*, 1954: 109); *New Republic* remarks that, "[t]he newest monster in the world of calculating machines thinks with the speed of light, complains when it is ill, makes mathematicians obsolete" (*NR*, 1947: 14); and *Newsweek* proclaims, "... the fabulous electronic brain machines have been credited with the power to predict weather, compute salary payments, replace minor executives, and produce synthetic 'emotions'" (*N*, 1949b: 52).

While LaFollette implies a predominance of representations of thinking machines as monstrous, Frankenstein-like aberrations, she does not sustain this claim in her examples, nor is it supported in my research. While there are occasional references to Frankenstein (for example, *SA*, 1952i: 68), hyperbolic language tends to be reserved for positive attributes, with adjectives such as "amazing," "huge," and "lightning fast."

The "brain" becomes the central term to refer to calculating machines. The popular press abounds with references to "mechanical brains" (*N*, 1955c); "electrical brains" (*N*, 1947b); "electronic brains" (*NY*, 1955; *F* 1952); "big brains," and "giant brains" (*F*, 1952). This usage is given fuel by the public work of Norbert Wiener (1948; 1950; *SA*, 1948) in which he suggests an overlap in operations between human brains and calculating machines, certain parallels, certain common elements of structure and functioning. He writes, "... it became clear to us that the ultra-rapid computing machine, depending as it does on consecutive switching devices, must represent an almost ideal model of the problem of the nervous system" (Wiener, 1948: 22). He continues, suggesting that problems in interpreting memory in animals have parallels to those in artificial machine memories (Wiener, 1948: 22). A writer in *Scientific American* suggests that the use of the term "memory" as a technical term by scientists and mathematicians bolstered the analogy to the brain (*SA*, 1950i: 32).

Wiener feels the mutual study of human and machine brains will help the understanding of each. He is careful to remain at the level of simile in his written work. However, his press profile is more metaphoric. For example, "[a]s men construct better calculating machines, explains Wiener, and as they explore their own brains, the two seem more and more alike. Man, he thinks, is recreating himself monstrously magnified, in his own image" (*T*, 1948: 45). What happens is that the structural similarities of brains become functional similarities within the discourse. A further movement takes place whereby the similarity becomes identity. What begins as the computer is *like* a brain becomes, the computer *is* a brain.

What begins as a fanciful metaphor in periodicals, colourful language for the public, is quickly legitimated as scientific reality as computing machines are framed by reporters as truly "beginning to act like genuine mechanical brains" (*T*, 1948: 45). A reporter in *American Scholar* notes in 1950, that the term mechanical brain has been around for a while because it made for good headlines, "[b]ut the brain-computer analogy makes more sense today" (*AS*, 1950: 22). "The popular term electronic brain is not so very fanciful" (*SA*, 1950c: 43). Thus, it does not take the media long to endorse this language, removing the quotation marks and normalizing the brain as a way of denoting the computer.

What inevitably follow are easy comparisons between the two kinds of brains – human and machine -- often at the expense of the human element. "Man can build an electronic 'brain' more intelligent than himself" (*SNL*, 1956b: 277). "[T]he machines that above all others deserve the title of 'brains' are the electronic computers which easily solve problems so intricate and laborious that they stagger the most patient mathematician" (*SA*, 1950b: 29). "[W]e now have the concept of a super-brain, a robot brain, which will help the poor human brain come to its senses" (*SR*, 1950a: 26). The comparison of brains and computers in terms of efficiency, capacity, and so on is often colourfully quantified: "... if a calculator were built to fully simulate the nerve connections of the human brain, it would require a skyscraper to house it, the power of Niagara Falls to run it, and all the water of Niagara to cool it" (*SA*, 1950c: 29).

Once the computing machine is named as a brain, defined as fact, not fantasy, it becomes time to frame it within a larger social context. If the computer is a brain, one might ask, what do brains do? The answer might well be, brains think. But can machines think? It is in this process of "debating" that question that the computing machine becomes the thinking machine.

b. The False Debate

Scientific American notes in 1950, "[d]uring the past decade several large-scale electronic computing machines have been constructed which are capable of something very close to the reasoning process" (*SA*, 1950a: 48). In addition to previsioning reasno as the type of thinking which is privileged, the implications of which I discuss in Chapter 5, this question foregrounds the closeness at the heart of the shift from computing to thinking machine. It is this closeness which leads to the central framing question of the event of the thinking machine, present in every major treatment of the conjuncture of cybernetics and the computer: can machines think?

This question works to frame what I describe as a "false debate" about whether or not machines can think. I do not mean false in the sense of not true, but rather in the sense that the debate is constructed within two key constraints: first, positions represented as opposing share central assumptions which predetermine similar answers; and second, the overwhelming propensity in public discourse is to answer the question affirmatively through re-defining the question (and hence the discussion) in machine-terms. It is not my intention to take a position on whether or not machines did, do, or should, think. Rather, suggesting this debate is false illustrates the absences and assumptions at work in the discourse and allows me to unpack the social power of one of the central questions of computer development in the last half of the twentieth century.

The debate around the question of whether or not machines can think is mobilized through competing views of scientists presented in the media. Expert opinion is divided on the issue -- "some experts say yes, some say no" (*T*, 1950a: 55). The experts include nameless "scientists," as in *Fortune* magazine; "[i]nevitably, machines of such abilities invite comparison with the human brain. People have loosely called them 'thinking machines.' This designation is rejected by many of today's scientists" (*F*, 1949: 112). They also include scientists with significant profiles; Howard Aiken of Harvard is frequently cited as rejecting a language of "brains" and "thinking" to describe computing machines.

This issue is scripted most vividly in two high-profile articles, one in *The American Mercury* (1953), the other in *Time* (1950), where Howard Aiken and Norbert Wiener are cast as protagonists and combatants, pitting their "superhuman cerebral mechanisms" against each other, along with their respective thinking machines (the Mark IV and the Whirlwind, respectively), in the "Battle of the Brains," as Fliegers in the *Mercury* dubs it. And the stakes are high.

> These two giant electronic computing machines – known commonly as electronic brains – are competing in a race that has so far produced a new science, "Cybernetics" and the promise of another industrial revolution, a revolution that may affect our civilization more profoundly than the steam engine or the atomic bomb (*AM*, 1953: 53).

Aiken is the general of the army rejecting the notion of the thinking machine; Wiener commands the counter forces.

> When an unsuspecting reporter inquires about the "thinking machine,"
>
> Professor Aiken, a tall distinguished looking and relaxed gentleman, snapped out of his seeming lethargy. Pounding his right fist against his left palm, he explained emphatically: 'This is not an electronic brain or a thinking machine. It is merely a computer – fast, accurate – but nothing more than a slavish automatic device designed to help us solve mathematical and mechanical problems' (*AM*, 1953: 54).

Wiener does not reject the thinking machine outright, but notes that while lower functions of thought can be duplicated, the brain itself cannot, because the machine would be too hot. Thus, the problem is technical, not semantic nor ethical. Yet while Aiken does not agree with the language of thinking, he is not included among the detractors, who always remain unnamed. Further, notwithstanding that Aiken has tried to make his position clear, the article concludes that, "[b]oth men – temporarily abandoning their academic feud – agree that, if rightly handled, electronic 'brains' may bring an economy of plenty and a life of increased leisure" (*AM*, 1953: 61). The metaphor of the electronic brain is recuperated, evoking and accepting, for both sides of the debate, the notion of the thinking machine.

A similar textual recuperation happens in the presentation of the same debate, with the same protagonists in *Time*. While recording Aiken's opposition, the article protests that Aiken does admit that the computer shows behaviour "like thinking." Aiken is quoted, " 'These humanitarian terms are unfortunate,' he says severely. But he does admit that they work more or less like fast narrow-minded brains" (*T*, 1947: 48) Further, when Aiken uses the word "live" in relation to the computer, the journalist notes in parentheses, "Aiken, the conservative says 'live'" (*T*, 1950a: 56). One has a sense that an investigative journalist, who already knows the truth, is catching up the scientist who is only playing semantics.

Other presentations as well, while purporting to present two positions, ultimately make assumptions which reproduce an acceptance of the language and the idea of a machine that thinks. For example, while asserting that there is only an analogy between human brains and computing machines, at the level of organization, *Fortune* (1949) magazine goes on to note that what distinguishes the school boy from the electronic computer is speed, nothing more fundamental. *The Atlantic Monthly* sets up the issue as a contest between man and machine, implying a certain parallelism: "[t]he uneasy, half-embarrassed rivalry between man and machine has reached a peak with the thinking machine" (*ATM*, 1954: 62).

Negative positions in the debate are also recuperated. Even though a scientist at IBM is reported to concede that there is no evidence that these machines can do creative thought, this is not treated as a sign of a lack of thinking, but rather is treated as modesty on the part of the scientist (*NY*, 1955: 17). One reporter suggests that "[t]he big shortcoming of the brain ... is that it doesn't know the first darn thing about creating alternatives and then choosing between them" (*SR*, 1953: 22). Thus, the language of the brain is accepted, while some forms of higher thought are denied. Often, in an article presenting a debate, the title will apparently resolve the issue in favour of thinking machines. Further, there is the repeated mention that scientists do not like to call these machines brains, but then the recuperation of that within the text through the subsequent use of the terminology and the repeated assertion of behaviour like thinking, often by those very scientists (*N*, 1955c; *N*, 1947b; *N*, 1948d; *T*, 1947).

Therefore, while the journalistic format requires an even treatment of both sides of an issue, and upon face value, this is taking place in the press, the assumptions underlying the presentation of the debate are such that the thinking machine is already an accepted terrain. The debate is one of semantics, rather than substance. The argument is more about the limitations on the thought possible than about the acceptance of the idea of the thinking machine.

The second pattern which contributes to the "false debate" present in the framing of the thinking machine is the reworking of the question -- can machines think – in order to render meaningless the question or predetermine an affirmative answer. For example, the May 1950 issue of *Scientific American* turns the question on its head. "To the question, 'Do these machines really think?' one can get various semantic interpretations of the words 'really' and 'think' including the rejoinder, 'How much do people really think?'" (*SA*, 1950b: 29). The question changes to accommodate the machine. Kemeny, in another *Scientific American* article, notes "[i]f we agree that machines are not alive, and if we insist that the creation of life is an essential feature of reproduction, then we have begged the question: A machine cannot reproduce. So we must reformulate the problem in a way that won't make machine reproduction logically impossible" (*SA*, 1955e: 64).

Troll in the *Atlantic Monthly* defines thinking as activities which the machine can do, resolving the issue for the reader, self-evidently.

> Here we find not only electric eyes that see and sensing devices that feel, but also memories that recall and logic sections that classify, arrange and select. These machines can make choices, comparisons and decisions, learn from past experience, and reach logical conclusions on the basis of premises. It may no longer be denied: these machines can really think (*ATM*, 1954: 62).

At the same time, it is clear from the above that in defining what the machine does as thinking, thinking itself is being redefined in relation to the machine. Thinking is defined as what the machine can do. The redefinition of thought and intelligence will be played out more fully in the event of the game on a playing board of rationalism, but note here what constitutes thinking: making choices, comparisons, decisions, learning from past experience, and reaching logical conclusions.

Finally, a related strategy in the discursive framing of the false debate is to deny the validity of the question at all. Claude E. Shannon is quoted as arguing that considering whether or not computing machines think will "...force us either to admit the possibility of mechanized thinking or to further restrict our concept of thinking" (*SA*, 1950b: 29). The *New Republic* mocks readers for even posing the question. "Fears of mechanical calculators are, of course, nonsense. However brilliant the future of the electronic calculator, it will remain, except for specialized talents, a zany in comparison with a half-witted boy of eight" (*NR*, 1947: 18).

The most well-known example of both denying and rewriting the question is the seminal intervention into the debate made by Alan Turing, when he suggests his own test for a thinking machine – a test which has become "a canonical thought experiment" (Adam, 1998: 50). In his 1950 article published in *Mind*, he considers the question "can machines think" and rewrites the question, concluding that in fact computing machines can do many of the tasks of a human computer. "The original question, 'Can machines think?' I believe to be too meaningless to deserve discussion" (Turing, 1950: 442). Again we can trace the slippage between the statement that the machine can think, as Turing's test is interpreted for the next 40 years, and his concession that the machine can do many tasks of a human computer. The thinking machine as an event thus works with the game as I will demonstrate to elevate computation to a form of higher thought.

So after such a long and fruitful debate, "... we are forced to concede that machines think in a very real sense of the word" (*AS*, 1950: 25). While the debate may have been neither long nor fruitful in the sense of exploring the issues, it is highly productive of the significance and existence of a thing which can make a legitimate claim to being called "the thinking machine," something which rapidly takes on a powerful presence through its triumph in the debate. This process of framing, however, brings several absences and gaps to light. There are very few moments in the print media where the thinking machine is seriously challenged as a notion, where someone questions the effects of framing a new technology in this manner. Thus, from its inception, it is treated as a technology which parallels the human brain – elevating it to a unique status in human history, I suggest. Cybernetics becomes the science of the thinking machine. The humanizing also contributes to the "untouchable" nature of the technology in terms of its critical framing – a critique of the thinking machine is also a critique of the human. Negative imagery is for the most part confined to science fiction literature, with its dystopic vision of cybernetic totalitarianism – serving to reinforce the distance of the negative implications of the technology from "reality."[1] The only dents in the armour plate of the thinking machine are discussions of whether or not the computer can create, or can take decisions. While the creativity question is still open in current framings of the computer, the decision-making nature of the thinking machine is resolved in this time period through the event of the game. Finally, as with any metaphor, the effects go both ways; the thinking machine rewrites both the computer and the brain, both the machine and thinking.[2]

4. The "Brains" Behind the Brains

A significant part of the negotiation of an event is the claims to authority which are made within it. Often claims are legitimated through appeals to higher authority – in this instance, almost exclusively to scientists. My analysis reveals some interesting patterns in who is referenced as expert, and who emerge as spokesperson for the thinking machine. While a number of key scientists are noted throughout the literature – Claude E. Shannon, Warren McCulloch, John Mauchly and J. Presper Eckert, John von Neumann, Norbert Wiener, William Ross Ashby, Howard Aiken, Alan Turing, and Vannevar Bush – it is Norbert Wiener who emerges as the media darling, a visible scientist as discussed in Chapter 3, one who both uses the media and who is considered newsworthy by the media. Von Neumann is a distant second in terms of numbers, types, and significance of references. While the press certainly concedes that it is a team of individuals working on these machines, and on the development of cybernetics, stylistically, it wants a charismatic person to interview who speaks in laypersons' terms, and who is both personable and provocative. This they found in Wiener.

Their choice manifests in his representation as animal, as magical, as human, and as genius. Ironically, in being constructed as more approachable, more familiar to the reader, he is also marked as "different" within the discourse – not only from us, but from his fellow scientists, a definite twist on Marcel LaFollette's "differentness" (see Chapter 3). Wiener's notoriety stems no doubt in part from his seeking of the role of public intellectual, through his own self-promotion (including two autobiographies),[3] through his accessibility to the press, but also in his publication patterns, which I will discuss in the following section in more detail. Regardless of the reasons, Wiener emerges as somewhat mythical in the thinking machine, ultimately a non-scientific figure who can serve as translator of the immensely complex ideas and technologies to the layperson.

This manifests in a repeated noting of Wiener's physicality, a phenomenon strikingly absent in references to other scientists, and is also reflected in the overwhelming percentage of photographs of him accompanying articles. In the "battle of the brains," Howard Aiken is described as "generous and personable" (*AM*, 1953: 54). In marked contrast, Wiener is noted as having books of philosophy, mathematics, biology, and politics, as well as a few "cheap mysteries" in his office. He is described as a "genius," "ebullient," "barrelchested," "with a handsome Vandyke beard and quick, humorous eyes" (*AM*, 1953: 54). *The New Yorker* describes him as "an authentic human brain with a real beard and a vast knowledge of mathematics" (*NY*, 1954: 105). He is distinguished as someone who will consider the possibility of machines thinking and who is also "bustling," "bearded," and a "scientific matchmaker" who "got into the brain business at an early age" (*N*, 1948d: 89). "Short, round, bearded and kindly, he looks like a Quiz Kid grown into a Santa Claus – and that's about what he is" says *Time* in 1948 (*T*, 1948: 45).

It is in part his appearance that marks him as different, however. *Fortune* suggests he "… is unusual among professors in looking exactly like one" (*F*, 1949: 118).

"Professor Wiener is a stormy petrel (he looks more like stormy puffin) of mathematics and adjacent territory. A rarity among scientists, he is willing and able to talk intelligently on almost any subject" (*T*, 1950a: 55). *Newsweek* distinguishes him, noting that most scientists "squirm" when asked if machines think, but he dutifully considers the question (*N*, 1948d: 89).

Wiener emerges early as a spokesperson, a friend to media and reader alike, and a guru of cybernetics and computing machines. This is strikingly evidenced in his mention by name in Kurt Vonnegut's 1952 novel of cybernetics and computing machines, *Player Piano*. In fact, it is in treatments of Wiener that the thinking machine emerges as not only the computing machine, but a conjuncture of cybernetics and the computer. "Professor Wiener, as the originator and apostle of the theory that machines might approach some form of thought, is the central figure of the new cult of 'Cybernetics'" (*AM*, 1953: 60). *The NewYorker* notes that the future is painted as possibly an SF nightmare unless people like Wiener are in charge, casting Wiener as non-threatening. "No one who has listened to him will ever forget this small, bearded, vivacious man who looks like a singularly benign, humorous, and intelligent gnome" (*NY*, 1950b: 139). Therefore, even though the notion of the thinking machine, itself, might be threatening, the expert at the heart of it is not.

Through this role as spokesperson, Wiener's expertise is recognized on matters outside of mathematics and cybernetics, in part because he addresses these topics in his books.

> Granted that our new ability to perform complicated computations rapidly will have a profound impact on science, including social science, and on large scale management in business and government: are other results to be expected? Norbert Wiener, an MIT mathematician whose interest in

> the social influence of technological change is keener than most scientists' thinks so (*F*, 1949: 117).

The general role as expert which Wiener comes to play as the première visible scientist, helps mark scientists in this time as a category of experts as social commentators. As well, the interdisciplinary nature of the representation of Wiener himself, arguably contributes to the perceived general applicability, or universality, of his ideas.

Pamela McCorduck notes that all of the various scientists I mention at the beginning of this section were connected, through professional and personal networks, and all were doing important scientific work. She also recognizes that "... with the exception of Wiener and perhaps von Neumann, none has had the renown one might expect in proportion to his effect on our lives now and in the future" (McCorduck, 1979: 69). More than renown, none of them had the discursive impact upon how the thinking machine was framed that Wiener did, through his profile as its visible scientist.

5. Cybernetics, 1948

The fact that Wiener was seen as the translator or mediator of the thinking machine to a laypublic works in conjunction with his text, *Cybernetics*, first published in 1948, to form a key discursive moment. I have already discussed to some extent in Chapter 1, the historical impact of this text, but in this section, I want to consider its significance as a moment in the event of the thinking machine. I contend that the large increase in media treatment of cybernetics and the computing machine, as well as their treatment in a language of brains, was activated by the publication and public circulation of *Cybernetics*.

There are suggestions in the media to support this; for example: "[i]f these existing machines already showed frighteningly human qualities, Wiener's concept of feedback started and epidemic of 'mechanical brains'" (*AM*, 1953: 59). Furthermore, *Cybernetics* is recognized intertextually within the discourse as significant, marked as an event, in and of itself. *Time* in December, 1948, suggests *Cybernetics* is having an impact across the sciences that is "intensely exciting" (*T*, 1948: 45). One author enthusiastically suggests that *Cybernetics* is important, not just to many sciences, but "to all humanity." The reasons are important, however; it is because the work transcends scientific jargon and serves as a linking text, the same function which Wiener himself, plays, discursively within the thinking machine as event (*SR*, 1949a: 22). In a significant *Business Week* article in 1949, Wiener's book is featured as a central catalyst of the thinking machine; the author takes care to note that in six weeks *Cybernetics* sold out of its first printing and was into its fourth print-run at the time of the article (*BW*, 1949a).

Because cybernetics as a knowledge is associated with, and located in, the publication of Wiener's book, its institutional and multi-author history is denied. Cybernetics appears as though a *new* science has *suddenly* appeared, named and authored by one lone genius. Fliegers is not alone in claiming that, "Wiener set to work and soon perfected a theory whose full importance has not yet been realized" (*AM*, 1953: 58). Because cybernetics is a new word to introduce to the public, the person who is recognized as coining its modern usage is referred to in virtually every article mentioning cybernetics, giving Wiener an authorial status and *Cybernetics* founding text status within the discourse. The representation of Wiener as founding father continues to this day.

The treatment his book receives provides Wiener additional status as an authority. In a *Time* article in 1950, Wiener is described as originally a "long-hair," but now that *Cybernetics* is a classic, "Wiener is a prophet who is listened to by short-haired, hardheaded businessmen" (*T*, 1950c: 66). This role as universal expert also fuels the conjuncture (confusion) of cybernetics and computing machines and is facilitated by the treatments of his text. He is constituted as an authority on computers as well as cybernetics. This link is made express in a number of articles (for example, *SA*, 1955c), although its material link is not necessarily well established.

It is interesting that *Cybernetics* emerges as a significant moment within the event of the thinking machine, while other moments which have event-like potential do not. For example, the first unveiling of UNIVAC, as one reporter notes above, fell flat and did not result in an explosion of attention. Further, the two elections where UNIVAC accurately predicted the outcomes were not the large media events they could have been, given their high profile subject matter. Instead, against expectations, a small, badly edited, confusing little book talking about a "new" science of communication and control emerges as the moment which mobilizes the thinking machine. I agree with the *Business Week* reporter who suggests: "[i]n one respect, Wiener's book resembles the Kinsey Report: The public response to it is at least as significant as the content of the book itself" (*BW*, 1949a: 38).

6. Mind-Machine Metaphors

The thinking machine shifted from being a simile to a metaphor, constructing an equivalence between the human brain and the computing machine, and not merely a parallelism. As with any metaphor, discursive effects are felt on both the primary and secondary realms.[4] Understandings of both the computing machine and the human mind change through their metaphoric usage. In this section, I trace out both the effects and effectivity of the thinking machine as it is produced and reproduced through two central figures. Specifically, I examine two metaphoric processes, the anthropomorphization of the computing machine and the technicization of the human. The computer's behaviour is humanized and human behaviour is technicized.

a. The Anthropomorphization of the Computing Machine

> *To put it bluntly, we are now coming to realize that humans and the machines they create are continuous and that the same conceptual schemes that help explain the workings of the brain also explain the workings of a "thinking machine"* (Mazlish, 1993: 4).

The computing machine is anthropomorphized both physically and psychologically within the discourse, with different effects. Physically, the primary anthropomorphic technique is the use of the notion of 'brain' itself, which I have discussed above. The use of a language of the brain serves to bring certain activities of the computing machine within a human(ized) language – namely reading, writing, listening, remembering, and interestingly, eating (for example, *BW*, 1956b). Computing machines eat equations, "as quickly as small boys gobble up peanuts" claims *Time* (*T*, 1947: 48). "It has 'memory;' it complains when it gets out of order; engineers speak of its 'communication organs,' its 'anatomy' and its 'pathology'" (*NR*, 1947: 14). If computers have brains, then they must also have bodies. "A machine of this kind obviously needs three things: an 'ear' to 'hear' speech, a 'brain to interpret it, and 'muscles' to carry out the appointed task" (*SA*, 1955c: 92).

And if they have bodies, they must also have genders, at least in some representations where the computing machine is personified, for example, SARA, Audrey, Bessie, Mark, and so on. It is interesting that there is not a clear pattern of gendering the machine either masculine or feminine established in this time period.[5] However, the simultaneous anthropomorphization of the computing machine, namely a recognition of its embodiment, with the disembodying of information with the computer, as recognized by N. Katherine Hayles (1999), raises an apparent paradox. I suggest that Hayles is correct and that in regard to my own project, there is an overall move towards the disembodying of knowledge within the cybernetic imaginary. How then to account for the embodiment of the machine? I suggest that what is taking place in the assignment of names, genders, and certain limited body parts to computers within the event of the thinking machine is not so much a process of embodying as humanizing. This is a process which takes place on the exterior, but not the interior. This is why one finds occasions where the computer is named a gendered name and then referred to subsequently as "it." Calling the computer he or she would be more of a terminology of identity, whereas, the physicality attributed to computers functions as a disarming gesture within the discourse, as a trope of containment -- one more way that they are like us.

Discussions of the material physicality of machines often balances the textual anthropomorphization, suggesting that the effects of the discursive bodies of computing machines are to render them comprehensible within existing frameworks of understanding. Computing machines are demystified and rendered simultaneously friendly and familiar within this figuration. *The New Yorker* describes two IBM machines as "handsome," and as resembling "twins" with different mental characteristics. Their scientist creator is described as "like a doting father" (*NY*, 1955). They are often rendered as children, thus, inherently innocent and non-threatening. This process of familiarization and familialization is present even within science journalism. "Giant electronic 'brains' are growing up. They no longer have to be spoon-fed their information but are being equipped with automatic devices to feed themselves" (*SNL*, 1956b: 277). They are simultaneously children, and yet a force to be reckoned with; powerful, yet controllable. "Dr. Wiener sees no reason why they can't learn from experience, like monstrous and precocious children racing through grammar school" (*T*, 1948: 45).

Interestingly, rarely is the computer animated in its representations in advertising and imagery accompanying articles. Perhaps this would have been too frightening to readers, raising the science fictional spectre of smart robots. There are occasions within the text where the term robot is used loosely as a descriptor for the computer. This is likely part of a process of normalization – robots were already a part of cultural currency. However, robot, as an inaccurate term, falls fairly rapidly out of the discourse. On the other hand, perhaps it is a reflection of the focus of the anthropomorphization, not of the whole body, but most frequently on the part associated with the brain, the head. Again, this suggests that the most important part of the body is the head, both for the machine and the human and heralds the overall move towards a focus on mind over body.

The "minds" of computing machines are anthropomorphized psychologically; they are attributed moods, whims, tempers, and attitude. In some instances, this is used as a humanizing and disarming gesture; in other instances, however, I suggest that it works to begin a process of offering the computing machine as a superior worker.

Computing machines hold "... arbitrary and stubborn opinions" (*SA*, 1956e: 175); they are "[f]ast, flexible and faithful" (*SNL*, 1956c: 296); and can be "smug" (*T*, 1952a: 42). In an article entitled, "Friendly Machine," *Scientific American* describes a computer as the most "versatile, gregarious and good-natured collection of vacuum tubes ever assembled;" in addition to getting along well with other machines, this computer "gets along nicely with people too" (*SA*, 1954d: 75). Often computers are humanized in the ways that they communicate with each other and with humans. They are friendly and ready to work with their human masters.

The psychological characteristics of computing machines are ultimately recuperated for work purposes, however. While framed in positive terms, *Newsweek*'s treatment of "This Week's Newsmaker," the MANIAC computer at Princeton, softly makes clear its superiority to humans. "MANIAC, oddly enough, [is] the nickname of one of the world's most impressive thinkers. This keen yet modest intellect boasts cerebral attainments which earlier mathematicians thought unattainable" (*N*, 1955c: 71). *Scientific American* manages to simultaneously humanize the machine while devaluing the human worker: "... in spite of the fact that the machines are more reliable than human brains, they have temperaments and moods" (*SA*, 1950e: 40). The pattern is repeated elsewhere. In *The Reporter*, there is a defensive gesture -- the computer may be able to do certain tasks better than humans, but it has no taste (*R*, 1956: 4). "Though certain men at certain times perform superlatively in controlling machines, the over-all performance of a satisfactory automatic control system is likely to be preferable, since a machine cannot be frightened, distracted, bored, or unionized as readily as a human operator" (*F*, 1949: 117).

In part due to references made by Wiener where he notes that the parallels between the brain and the computing machine suggest new and valid approaches to psychopathology and psychiatrics (Wiener, 1950: 168), a further psychological anthropomorphization takes place. The computing machine is subject to psychiatric problems. Again, this is not only an anthropomorphizing, but a humanizing, the rendering of the machine as fallible, as vulnerable, like us. Further, "[t]he cures administered to psychotic calculators are weirdly like the modern cures for insanity" (*T*, 1948: 45). The parallel between rest, shock treatments and lobotomies as means of treating human nervous conditions and rest, electrical charges and removal of parts with which computer scientists "treated" computers with problems becomes oft-repeated (*C*, 1949; *T*, 1948; *SNL*, 1953b; *T*, 1950a). Again, I suggest that this has the effect of demystifying and humanizing the machine.

The state of technical knowledge about computing machines was such that scientists could not always explain why breakdowns occurred. This lack of control over the machine suggested hugely complex and partially incomprehensible machinery. It is clear in these psychiatric parallels, however, that the computing machine is no more complex a brain than the human brain and that, even though we do not fully understand it, we can treat it. There are obvious risks if the machine makes errors that we cannot recognize. Failsafes are built into the technology so that it will stop or blink its lights if it finds an error. In this way, the risks of errors can be contained. The thinking machine is still within (and under) our control.

b. Technicization of the Human

> *By making a machine think as a man, man recreates himself, defines himself as machine* (Bolter, 1984: 13).
>
> *By continuously embracing technologies, we relate ourselves to them as servomechanisms* (McLuhan, 1964: 55).

In its enthusiastic humanizing of the machine, the event of the thinking machine is also simultaneously technicizing the human being. If machines are like humans, then humans must be like machines. This manifests particularly clearly in advertising imagery. The equivalence is operationalized at the level of behaviour and easy comparisons can then be made on that basis. In this section I explore how the technicization of the human resulted in a new measure of performance being defined – efficiency – which reflected a measure of quantity in proportion to number of errors. Humans are compared to machines by a quantitative measure of information management efficiency, particularly in relation to the workplace. There is an abundance of dire (and some not-so-dire) predictions about the inefficiency of the human as an information processor in relation to the computer. Human mental labour is reduced to its carrying power, its computing speed, and its memory capacity. On this basis, the two thinking machines can then be compared, in machine terms.

While the machine was not often humanized in visual representations, the human is often represented as computer or computer-like in drawings in advertising in the early 1950s. I suggest that this is in part because a visual image of the computer, at this point, offered very little explanatory or recognition value to the consumer. Most people had not yet seen a "real" computer. The Ramo-Wooldridge Corporation features a man's head with a distended cerebrum revealing a computer inside (*SA*, 1955b: 22). A robotic, angular, stylized human head with a large vacuum tube inside represents the reliable electronic memory of Remington Rand (*SA*, 1953a). A professor figure with gears and a smoke stack in his head is featured with the copy, "Some people are born with a mechanical brain, but today business and government need the PRINTING calculator" (*BW*, 1951). Finally, a profile of man's head containing machinery and flow arrows leading in and out of his mouth area advertises Schrader's automated calculating machine, with the claim, "The Machine that breathes" (*SA*, 1953b: 21). Clearly the human thinks like the machine; our brains are a type of computer. But what type?

First, a numerical basis for man-machine comparison is established through the extremely common trope of comparing the length of time it takes each of a machine and human computer to do a given mathematical task. This both privileges the machine and foregrounds its speed as one of its primary attributes. A sense of wonder is generated specifically in relation to the speed of the computer and the size of the numbers it can manipulate. Examples abound (*NY*, 1950a; *T*, 1950a; *T*, 1952a).

> Some of the new machines under development will have the basic ability to carry out the multiplication of two ten-digit numbers in approximately a thousandth of a second. The same task would take five minutes (about 300,000 times as long) for a man with pencil and paper. The machine is equivalent to about 25,000 operators of desk computing machines (*SA*, 1950b: 30).

Von Neumann is an authority for the numbers game: "[a] human computer with a desk calculator can multiply together two numbers, each having 10 decimal digits, in about 15 seconds; a modern machine will do the same problem in less than one half a thousandth of a second" (*F*, 1949: 114). The formulation takes a variety of forms but has the same discursive effect. "Mark III, it seems, was in the process of writing a book of mathematical equations. It would complete the 300 page book in about three days. A skilled mathematician, working twelve hours a day, 7 days a week, would take more than a year to accomplish a similar task" (*AM*, 1953: 54). The figures are extreme, the differences spectacular, confirming the obviousness of the superiority of the machine to all readers.

The numerical comparison of machines and men also takes place as a measure of the number of neurons each sports (*F*, 1949: 112). For example, ENIAC only has 18,000 electronic circuits which are its neurons, "about as many brain cells as a flatworm" (*ATM*, 1954: 65). Yet even with this numerical advantage to the brain, the machine is clearly superior in speed of computation. "Whining like a spoiled child, the machine went about its work. Yet five minutes later, for all its complaining, it had performed 500,000 additions, 200,000 multiplications, and 300,000 other mathematical operations – a job that would have taken an expert mathematician many months" (*N*, 1949d: 51). Thus, clearly in terms of speed and quantity, the machine is the superior worker. But what about quality?

This is where the concept of learning from cybernetics contributes to form the second half of the efficiency equation. The ability to modify behaviour on the basis of information is what distinguishes systems like the brain and the computer from other systems which do not have feedback mechanisms. According to cybernetics, all thinking machines must not only have feedback mechanisms, they must be "learning systems." By learning, cyberneticists mean that a system has a feedback loop whereby it can measure its intended action against its actual action and thereby correct errors (Wiener, 1950: 84). Learning is thus reduced to the development of adaptive mechanisms to correct errors in behaviour.[6]

Wiener describes a "learning machine" in the following manner:

> An organized system may be said to be one which transforms a certain incoming message into an outgoing message, according to some principle of transformation. If this principle of transformation is subject to a certain criterion of merit of performance, and if the method of transformation is adjusted so as to tend to improve the performance of the system according to this criterion, the system is said to *learn* (emphasis in original; Wiener, 1964: 14).

He makes the behaviourist measure of learning even more express: "[c]ybernetics takes the view that the structure of the machine or the organism is an index of the performance that may be expected from it" (Wiener, 1950: 79). Learning is consistently defined in the cybernetic sense as equivalent to self-correcting behaviour (*SA*, 1952i: 27; *ATM*, 1954: 64; *N*, 1950; Turing, 1950: 454).

An equation is established in the press between learning as defined by a measure of self-corrective performance, and thinking, itself. For example,

> [t]he human brain, some computermen explain, thinks by judging present information in the light of past experience. That is roughly what the machines do. They consider figures fed into them (just as information is fed to the human brain by the senses), and measure the figures against information that is 'remembered' (*T*, 1950a: 56).

Learning and thinking become purposeful, ends-oriented activities, and they can be measured by exterior instances of behaviour. Thinking is thus measured by behaviour.

> [a]n amazing similarity exists between purposeful, teleological machines and the human being. In both, the respective purposes are achieved by teleo-dynamic and teleostatic mechanisms and their combinations. There is also a parallel of the elements and their functions of which these mechanisms are composed (Barrett and Post, 1950: 9)

Several observations can be made of this type of claim: the equation of "past experience" to "information" in the cybernetic sense; the reduction of "learning" to rational decision-making processes; the assumption that all learning is goal-driven and measurable by performance in relation to that goal; and the belief in the possibility of the reduction of sensory perception to quantifiable figures.

It is this capacity to compare the human, as worker, with the computing machine, as worker, which permits the measurement of their performance according to the same standards. The logical choice for management is to choose the most efficient performer. *Time* magazine tells its readers:

> [t]he human brain and machines speak basically the same language: the simplified language of binary arithmetic. When a stenographer, for instance, listens to her boss's dictation, her ears catch sound waves ... and turn them into the yes-or-no signals that her neurons demand. Then her neurons send instructions to her finger muscles that result in shorthand scratchings. There is no reason, say the computermen, why a machine cannot do the same thing (*T*. 1950a: 59).

In its article querying "Will Machines Replace the Human Brain?" *The American Mercury* is quick to eliminate clerks. "No secretaries or typists in this office of tomorrow, just a machine that reads letters by means of a photocell scanning device, delves into its automatic files for the information requested, and then automatically types out a reply" (*AM*. 1953: 55). Wiener's 1948 prediction that the computer will devalue the human brain and that the average human will have nothing left to sell in the labour bargain gained much press and was mentioned in many of the reviews of his book (for example, *T*. 1948: 45). The relevant human behaviour is being defined as work, not play, creativity, interaction. The primary role assigned to humans is as worker. This has the effect of valuing certain human activities, while devaluing others.

The resulting fear is of mass unemployment.

> It [the mechanical brain] holds out in one hand relief from toil; a permanent vacation for the masses, and in the other hand a period of transition before the machine monster takes over in which millions may starve or kill themselves or each other as the result of the universal frustration and all the miseries that come from confessed ineptitude and uselessness (*SR*, 1949a: 22).

Extraordinary efforts are made in the press to control the fear around mass unemployment. Yet this is not an easy task. The lack of empirical evidence on automation at this time in order to back up claims for or against mass unemployment, makes this a loose field of debate. Increased discursive power is given to the spokespeople as they are the current authorities and there is no research with which to dispute their claims. *The New Yorker* reports Dr. J.R. Killian, President of MIT:

> He was encouraging about the new technology, saying that he doesn't think that the onslaught of these machines will result in heightened unemployment. On the contrary, he believes that, as in the past, new technology will mean more and better employment for human beings, and that a new breed of engineers will be required to cope with the machines (*NY*, 1954: 106).

Fortune notes in 1952, "There are two extreme views – both probably wrong – about what all this will mean to society. One holds that it will mean a decimation of office staffs and technical unemployment on a scale heretofore unseen. The other holds that everything will work itself out fine, as in the past, without human intervention" (*F*, 1952: 118). By 1955, *Time* magazine can describe unemployment as the "perrenial fallacy," and can suggest credibly that the contrary is true (*T* 1955: 82).

The technicization of the human thus facilitates an easy comparison with the computing machine in the domain of work performance, on terms pre-figured to favour the machine. Efficiency, as a ratio of performance (measured by speed) to errors, would seem to dictate the choice of the computing machine over the human worker. Yet having created this situation, the spectre of mass unemployment arises. Discursive moves are taken within the thinking machine event in order to reduce the negative implications of this risk. As will be discussed further in Chapter 7 in relation to the rise of programmers and systems engineers, while it is conceded within the cybernetic imaginary that certain drudge tasks will be automated, another level of expertise is simultaneously being created and valued, one anchored in the ability to manage information.

7. The Computer as White Collar Worker

Unlike some other events, the thinking machine emerges in a wide range of media sources and institutional sites at the same time. The very metaphors which scientists are alleged to have rejected pepper popular science texts and science journalism as well as more general interest media. In this section I want to allude to a related discursive movement which the thinking machine facilitates: the normalization and promotion of the thinking machine as a tool in business. This is only treated briefly as it is, in a sense, a tendril of the thinking machine that links it with other events in the formation of the cybernetic imaginary. It functions here, as another place, another domain, where the thinking machine can think.

The central movement enabled by the thinking machine is the normalization of the computing machine as a tool, not only for military/industrial applications, but for business applications. This is apparent in the boom of advertising for computing machines in magazines such as *Business Week* and *Fortune* which occurs in the mid-

1950s. In fact, the "new" applicability of the computing machine to the commercial domain is addressed expressly in the advertisements.

First, it is important to keep in mind that even until the early 1950s, all computing machines in the United States had been underwritten by some branch of the military (as I discuss briefly in Chapter 1), and that time on these machines was rented to scientists, engineers, and industrialists with complex mathematical problems to solve. The first computer for commercial sale was not built until 1954. Even in the early 1950s, however, the shift from military to industrial to commercial applications appears in advertising.

In the September 1952 special issue of *Scientific American* on automatic control, advertisers were out in full force. An advertisement for the Ultrasonic Corporation reads: "These Theories on Automatic Feedback Control are Interesting ... but ... When can I use them in my plant? (*SA*, 1952: 40). An IBM advertisement in the same issue suggests that businessmen, engineers and scientists can all use business machines to do valuable calculations (*SA*, 1952: 32). Remington Rand, in an advertisement in *Scientific American* in October 1953, portrays computers at use in an oil refinery and in an airline flight desk. In 1954, IBM was selling a " 'Giant Brain' that's strictly business;" calculating machines could now be used for "payrolls, billing, manufacturing and inventory control, cost allocation, manpower scheduling, fiscal accounting" (*SA*, 1954d: 103). " 'Giant Brains' for Business and Industry?" asks the Ramo-Wooldridge Corporation in 1955 (*SA*, 1955d). Automatic Electric in *Time*, March 7, 1955 proclaims that "Businessmen, too, Profit" with "Brain Cells ... for electronic thinking" (*T*, 1955: 76). Finally, Remington Rand conducted an advertising blitz in 1955 when it began to market the UNIVAC. One headline reads "Remington Rand UNIVAC. Not on the Drawing Board, Not 'On Order' ... IN ACTUAL BUSINESS USE!"

As early as June 1955, the magazine *Computer and Automation* offered a special issue entitled, "Computer Directory and Buyer's Guide." Clearly computers were now products to be sold to industry. Within the industrial economy, computers were a normal part of doing business. This is reflected in a movement away from some of the more colourful and hyperbolic language to describe the machines. For example, in an article in *Business Week* entitled, "The Computer Age," April 7, 1956, in a long and extensive discussion, there are only two brief references in passing to brains. The computer is treated as an industry tool, and its commercial production is analyzed (*BW*, 1956a).

What this normalization facilitates, however, is the notion of automation, particularly as it could be applied, not only to the factory, but to the white-collar office. "Automation is the making of tools to produce more efficiently ... It's progress" (*T*, 1955: 82). Tom Watson, Jr., the new president of IBM at the time is quoted as an authority on how automation will impact upon American society.

> 'Our job is to make automatic a lot of things now done by slow and laborious human drudgery. A hundred years ago, there was an industrial revolution in which seven to ten horsepower was put behind each pair of industrial hands in America. Today we're beginning to put horsepower behind office hands, electric energy in the place of brain power' (*T*, 1955: 81).

Automation is thus a part of the white-collar, and not only the blue-collar, workplace. *Newsweek*, in a special report in 1956, considers the question of whether automation can balance the U.S. budget. The lead reads: "[a]utomation has invaded the U.S. Government. Its agents are the giant computers that specialize in the bureaucrat's specialty: Paper work" (*N*, 1956a). The various information services operated by the

American federal government and the implications of their automation are considered at length. In late 1955, *Business Week* offered a special report and cover story on "Automation: The Facts Behind the Word." A fourteen page story explores automation from the perspective of business and politics.

> At first it [automation] was just a word, a handy tag for a single engineering concept. But there was excitement in the air – a sense that something new and revolutionary was being born. In the laboratories and the factories. The word is becoming a focus for the excitement. Now it's agitating businessmen, unions, politicians. And it means something different to each. In this special report *Business Week* appraises the facts behind the word and behind the excitement (*BW*, 1955l: 74).

The article reports that a radio poll in Detroit found that the thing that people feared most, after Russia, was automation! Within the piece, automation is named as something frightening only because the public does not have all the facts. Gradually as the article unfolds, the reader is presented with those facts until reaching the tempered conclusion: "[t]he future will probably bring automation – with moderation" (*BW*, 1955l: 102). A certain narrative begins to emerge, the story of white-collar automation, the story captured effectively in *Desk Set*.

8. Desk Set

An efficiency expert, played by Spencer Tracy, is hired by a media company to implement an "electronic brain" (patented by Tracy's character) into its research library, staffed by women, and managed by none other than Katharine Hepburn, aka Bunny Watson. Head researcher, Bunny, has her memory tested by Tracy and proves to be a very smart woman with an incredibly accurate memory. Nonetheless, EMERAC, an electronic brain is placed in the workplace. The staff fear that they will be laid off.

displaced by a machine that can do their jobs more efficiently than they can. They are already familiar with IBM's "electronic brains." (Interestingly, IBM is the only computer company mentioned by name in the film and thanked in the credits, having already established its dominance of the commercial computer market by 1957). One researcher notes that the implementation of a thinking machine in "accounting" resulted in widespread unemployment because the machines were so much more efficient at calculations.

Indeed, when "Emmy," as she is affectionately (or not-so-affectionately) known, is installed, she excels at a difficult calculation involving gargantuan numbers set for her by Hepburn's character. It quickly becomes apparent though, that Emmy is only as good as the information that she is receiving. Due to operator error (incidentally, the operator is played by a machine-like woman), both Emmy and the Operator suffer "nervous breakdowns." Tracy must fix the machine (ironically with a hairpin from Hepburn). Seemingly inevitably, the research department "girls" all receive their pink slips and are vacating the office when the efficiency expert informs them that they have not been fired. Emmy is merely there to work for them, and with them, not in place of them. She is there to do menial tasks to free them up for more creative work. The film ends, with Tracy and Hepburn of course uniting despite all obstacles, but also with Hepburn giving Emmy a friendly pat and accepting "her." *Desk Set* was directed by Walter Lang and was released in 1957.

I suggest that this film heralds the end of the thinking machine as an event. In part, the thinking machine had clearly entered mainstream popular culture if it was being represented in a film with two stars of this stature. As well, while clearly "cutting edge" in terms of its representations of computers on film, the cultural capital in the American population had already been established such that the film was a mainstream romantic comedy, not science fiction. Further, most of the major tropes of the thinking machine are present in the film. Emmy is huge, but is personified and given a gender. Efficiency is clearly the measure of value of "her" work. The film tackles head-on the fear of unemployment as a result of the thinking machine and resolves it with the affirmation that computing machines are tools designed to free up smart human beings to do other more important work. Echoes of this resolution are present in other media as well.[7]

This resolution is a fundamental part of the automation of office work as discussed by Shoshana Zuboff in her ground-breaking book, *In the Age of the Smart Machine: The Future of Work and Power* (1988). Zuboff notes that traditionally, the implementation of computers into office work has been viewed as a process of deskilling, parallel to that taking place in the industrial sector. She calls for a more complex formulation, recognizing the specificity of mental labour and the shifts technology causes throughout an organization and upon all work processes. She suggests: "[i]nstead, the routinization of clerical work can be viewed as the result of a continual extrusion of middle management activities as they became subject to further rationalization through the introduction of new technologies and new techniques" (Zuboff, 1988: 113).[8] She notes that with automation, office equipment could be operated by people with far less training than the knowledge which had previously characterized the clerk. A vast number of women were employed to fill the new positions (Zuboff, 1988: 115). This is reflected in my research, particularly in visual imagery where women are pictured at computers in office settings, signifying their ease of use for business, whereas, scientific computers virtually always feature a male operator.[9]

Zuboff makes a distinction between "acting with" and "acting on" as a means of distinguishing between executive and clerical functions in work. Executive personnel work with information, with others. Clerical staff work on office machinery, their positions having been denuded of the tasks of working with information. She notes that

> [t]he new concept of clerical work tried to eliminate the remaining elements of action-centred skill related to *acting with* (that is, interpersonal coordination and communication) in favour of tasks that were wholly devoted to *acting on* (that is, direct action on materials and equipment) (Zuboff, 1988: 119).

Yet this process is always one of movement where one level of the work hierarchy has acting on functions pulled out of their jobs and pushed further down the line. This is what we see in *Desk Set*, and in the resolution of the thinking machine.

There is clearly the fear that automation will result in rampant deskilling and instant unemployment for large sectors of the workplace; yet there is also the continual recognition (which will be discussed more fully in Chapter 7) that a new need for higher level expertise is also being generated. Bunny and her colleagues fear that they will be deskilled and terminated; in fact, what happens is that the clerical functions in their jobs are automated and their jobs become more about acting with, rather than acting on. The executive content of their positions increases. The film, not surprisingly, does not deal with the level of employee who will conduct data entry for the machine over the long-term, the new clerical worker. In this way, the intervention of the computer into the workplace, automation, can be viewed as a friendly process – in fact, one's work will become more interesting because one will have more time to do more creative tasks and less time will need to be spent on the mundane.

Clearly by the late 1950s, the meanings of the thinking machine had been negotiated and established. No longer were there significant questions about whether or not machines could think – that question had been answered, strongly, in the affirmative. Further the major implications of thinking machines for the relationship between humans and machines were also established. The thinking machine had now ceased to be an event, a site of contestation, and instead, was a well-established cultural fact, the parameters of which were familiar to a wider population.

9. Machina sapiens

> *Futurologists have proclaimed the birth of a new species, Machina sapiens, that will share (perhaps usurp) our place as the intelligent sovereigns of our earthly domain. These "thinking machines" will take over our burdensome mental chores, just as their mechanical predecessors were intended to eliminate physical drudgery. Eventually, they will apply their "ultra-intelligence" to solving all our problems. Any thoughts of resisting this inevitable evolution is just a form of "speciesism," born from a romantic or irrational attachment to the peculiarities of the human organism* (Winograd, 1991: 198).

This new species, *machina sapiens*, described by Terry Winograd is born in the late 1940s and 1950s in the pseudo-debates which construct the computing machine as the thinking machine. Yet what Winograd does not recognize is that there are two new species, *machina sapiens* and *homo machina*.

It is this dual-effect process which is played out in the event of the thinking machine. On the power of the discursive parallel established in *Cybernetics* and other cybernetic writing between brains and electronic computing machines at the level of structure, computing machines are described by scientists, science journalists, and the mainstream press, as brains. And what do brains do? They think. Can what the machines do be described as thinking? The debate unfolds, but the answer is always yes, the machines can do the same thinking as a human computer.

This conclusion then establishes a number of equivalences in the discourse which move far beyond the computing machine. Computing is equated with thinking. As I discuss more in the following chapter, this also limits the conception of thinking to notions anchored in numbers, logic, reason, and ultimately a model of rationalism. The end product, the correct answer, is more important to thinking than the process whereby the answer was determined. The brains of computers are equated with the brains of humans. Computers have a similar structure to brains; they compute, and they produce similar results to humans in some activities described as thought. Through the emphasis on brains, rather than minds or thought more broadly, thinking is disembodied. In both human and machine, only the brain is valuable. Thus, on the basis of a behaviourist test, computers not only can think, but they are us.

What is then produced in the thinking machine as a whole is the effective equivalence of the human and the machine. There are countless ways in which a new technology can be framed: as a window onto a new world, as a tool, as a further development of other technology, and so on. When the question is posed: how do we or should we think about this new machine – the effect of the negotiations within the event of the thinking machine offers a clear answer – we should think of computing machines as ourselves.

Any new technology is potentially threatening to society, to the status quo, to certain interest groups. The computer is no exception. Its framing as us, its humanization (through its psychological and physical anthropmorophization), helps to reduce that risk and make the public more comfortable with the new machines. At the same time, however, this humanizing of the machine and technologizing of the human reduces the critical distance necessary to critically evaluate the technology. Any criticism of the computer becomes a criticism of us.

Furthermore, at the same time that the computer is entering public discourse, it is also entering the private-sector economy for the first time. The computer is fixed solidly within an economy of industrial, and eventually knowledge, labour. Yet the computer is not merely a tool for work, as the calculator and adding machines were before it. The computer is constructed as worker in public discourse; the computer is a useful agent. It is an agent without motility which moves through time, rather than space, with its amazing capacity to manipulate data at lightning speed. This notion of useful agency, defined by speed and efficiency, comes to mark work more broadly and sets up an encounter in the workplace between the human and the machine, an encounter the human will lose.

Yet within the entry of commercial computing machines into the marketplace, many of the potential effects of automation (positive and negative) have been worked out already. The story has already been told. While some routinization is inevitable, most people will be freed up to do even more interesting and creative work as computers take over only the menial tasks that no one wants to do anyway.

Thus many debates are resolved in the thinking machine. Yes, computers can think. Yes, humans can be represented in machine-language. Yes computers are superior workers to humans in all forms of work involving data management. No, we needn't be afraid of the computer because it is a friendly tool with a stable personality. No, it is not perfect; it is fallible (just like us).

And I can't help but wonder as I flip through the October 1999 issue of *Discover* magazine which features Kismet on the cover, "a giant step closer to Robots that walk, talk, think – and have feelings" at the resiliency of this equivalence. The face of Kismet has features which express rudimentary "emotions" based on its logical responses to situations … again the head is anthropomomorphized. Clearly though, the question of thinking is passé; robots clearly think. The text in bold red, heralding the next challenge, is "and have feelings." Clearly emotions are the next step in the equation between human and machine; the event for the 1990s is the emotion machine. Yet before the emotion machine, comes the smart machine, as the event of the game will detail.

V. The Game

> They were interested in intelligence and they needed somewhere to start. So they looked around at who the smartest people were, and they were themselves, of course. They were all essentially mathematicians by training and mathematicians do two things – they prove theorems and play chess. And they said, hey, if it proves a theorem or plays chess, it must be smart (Wilensky in Adam, 1998: 35).

Checkmate

February 1996, Philadelphia, Garry Kasparov, world chess champion, master player, human, squares off against, Deep Blue, the latest in a long line of chess-playing computers from IBM (and a team of computer engineers), in the match of the century. Kasparov was playing for you, for me, for the human species. He was trying, as he put it shortly before the match to "help defend our dignity." The game was, of course, well-covered in the press and even broadcast live over the WWW. It was framed in the media as a "duel," as an "icon in musings on the meaning of dignity had human life." This might be "humanity's last stand."

Then Garry lost the first game in the best of five match. The buzz began ... was this the beginning of the end ... of us? Kasparov himself admitted "I could feel – I could smell – a new kind of intelligence across the table." Thankfully (for all of us, according to the press), Kasparov won the best out of five in typically human fashion.

Langdon Winner in Technology Review jokingly wrote: "Somewhere in this favored land, monitors are shining bright. Soundboards are playing somewhere, bits travel at the *speed of light. Somewhere nerds are laughing, somewhere programmers shout. But there's still some joy in Mudville: mighty Kasparov did not strike out."*

Again, in Kasparov's words: "So although I think I did see some signs of intelligence, it's a weird kind, an inefficient, inflexible kind that makes me think I have a few years left."

...One to be precise.

February, 1997, Kasparov and Deep Blue play again. Same man; upgraded machine. Same stakes – human dignity, the pride of the species, and all that.

So, again somewhere in this favoured land, monitors are still shining bright. Soundboards are still playing somewhere, bits travel at the speed of light. Somewhere (computer) nerds laugh and somewhere (IBM) programmers shout (for joy). But there's no joy left in Mudville because mighty Kasparov struck out.

1. Introduction

Since Hungarian inventor Wolfgang von Kempelen astounded Europe in the 1800s with a device known as the Maelzel Chess Automaton, touring Europe to large audiences, only to be revealed later as containing a human chess master concealed inside, chess-playing machines have been more than mere parlour tricks for Western society. As early as 1914, Spanish inventor L. Torrès y Quévedo built a device that could play an endgame of king and rook against king. The machine played with the king and the rook and would force checkmate in a few moves, regardless of how its human opponent played. When asked if his machine thought, he answered, "[t]he limits within which thought is really necessary need to be better defined ... The automaton can do many things that are popularly classed as thought" (in *SA*, 1950a: 51).

A computer playing chess, master chess, apparently is the ultimate test as to whether a machine is as smart as a man. Not just a test of thinking – more than the thinking machine -- but a direct contest, one-on-one, a direct measure of intelligence. A definition of intelligence. Chess-playing was one of the few cerebral tricks we had left in our hat. But chess is not the only game in town. The historical development of the computer is replete with a series of different games which the machine progressively added to its repertoire, and games theory plays a key role in early computer programming, in cybernetics, and in the production of the cybernetic imaginary.

Pamela McCorduck asserts that game-playing is a fundamental element of human society and culture. She argues:

> [g]ames are deep in the heart of us. In the streets of London today, schoolchildren play a game that can be traced back to the time of Nero, and popular books declare that interpersonal behaviour can best be expressed as the games people play. From solitaire to the Super Bowl we're nourished on games, those abstract expressions of real life where we know the rules and can test our wits against an opponent or against chance, or watch our agents do it for us. Real life, of course, is never that tidy. Games let us work up to life (McCorduck, 1979: 146).

While I am not sure that I accept that games operate at the level of deep structure, as McCorduck seems to suggest, I do accept that they are a longstanding part of human culture. They are understood as defined by their rules, by the notion of contest, by the pitting of wits, and often they are seen as microcosms of the battles and contests we face in our daily lives. These assumptions certainly underlie and are reproduced within the movement of the game as an event.

McCorduck attributes the early interaction of computers and games to this deep-seated tendency to gaming, rather than to what she describes as Alan Turing's playfulness or the influence of von Neumann's work with Oskar Morgenstern and his subsequent role in American computer development. While I have no basis to comment on Turing's "playfulness," certainly the publication of *Theory of Games and Economic Behaviour* by von Neumann and Morgenstern was significant in the way the game played out in the public imaginary. In fact, it is with that text that I begin the game as an event.

2. The Game as Event

In this chapter, I explore the game as an event, again as produced with and by six characteristics. Within the discourse, two types of games are defined, games of chance and games of strategy. Here, I explore the games of strategy; games of chance are addressed in the analysis of the future in Chapter 6. Initially games theory is named in terms of strategic behaviour following upon the work of von Neumann and Morgenstern. The game is then framed in two ways, apparently paradoxical: as machinic IQ test and of no importance in and of itself. It becomes evident that this apparent contradiction is not merely jest nor inconsistency, but is integrally connected to the framing of rational intelligence as goal-oriented, as a zero-sum game, and the containment of the risk of the smart machine.

In the second characteristic, namely key persons and personalities whose expertise and reputation help to shape the event in question, John von Neumann and

Claude E. Shannon emerge in the public discourse as the key players. Von Neumann offers expertise on the abstract concepts; Shannon is the man of action, speaking widely about actual chess-playing machines being built at the Bell Laboratories. Each causes his own effects as a media figure; each emerges a visible scientist.

Interestingly, in the third characteristic, the key moment, the most significant in the game are non-moments. More specifically, a direct contest between a human player and a computing machine, staged for the press, would have been an obvious promotional tool for any computer manufacturer or researcher of the day. This did not happen during the time period of this event. Past contests, elsewhere, are mentioned in passing, but no large media stunt is held. This serves to contain the potential threat of a direct combat between man and machine; if there is no game, there can be no losers. It is, in fact, within a contest which finally takes place that I locate the resolution of the event.

Fourth, the major figures or tropes through which the event is mobilized in public discourse consist of a series of different games: trivial pursuits (tic-tac-toe and checkers), chess, the imitation game, and economics. These games increase exponentially in complexity and abstraction, but all are subject to games theory; all become linked in their "game-ness." Because of their shared (and accepted) game-ness, all of these different games can be located on one continuum, rather than treated as discrete problems. This facilitates the treatment of economic problems, in particular, in a language of games. Fifth, and related to this, the game circulates as a language and the rules (ideology) with which to play other games, in particular war and business.

This leads to the sixth and final characteristic, the resolution of the game, by 1958. At long last, a man-machine game is staged and featured in the media. By this time, artificial intelligence is becoming its own domain of study; business management has taken up games theory as a central part of its education; and the public discourse is comfortable with the notions of games theory informing decision-making practices throughout a variety of domains.

In addition to imposing a zero sum games model on a number of social forms and organizations, the event of the game produces the smart machine. The thinking machine establishes that machines can think, but it is the event of the game which suggests how smart the machine is when it thinks. The smartness which inheres to the machine is a very limited model of reason. The smart machine is the ultimate reasoning mind, far superior (far smarter) than that of the human. The acceptance of the triumph of reason leads to the location of the issues surrounding these new machines, their applications, and their social impacts within an epistemology of rationalism. The epistemology of the cybernetic imaginary accepts that "... reason is, in and of itself, a source of knowledge, independent of the senses" (Avis, et al.1979: 916).

3. From Thinking Machine to Smart Machine

> *Naturally, von Neumann's picture of the player as a completely intelligent, completely ruthless person is an abstraction and a perversion of the facts. It is rare to find a large number of thoroughly clever and unprincipled persons playing a game together. Where the knaves assemble, there will always be fools ...* (Wiener, 1948: 159).

An advertisement for a spectrometer in the February 1955 issue of *Scientific American* features several chess pieces on a board in the foreground, with a photograph of an operator and computer in the background. The caption inquires "[c]an you plan your company's future position?" (*SA*, 1955b). Among other things, invoked in this advertisement are the computer, the game of chess, and the notion of dealing with uncertainties in business. These notions, and their interrelations, are at the heart of the game as it was named and framed within public discourse.

The game-playing computer emerges as a common visual device, and certainly one which was featured frequently in media headlines. Computing machines are named as game-playing in *Science Monthly* (1952b) and *Science Digest* (1959), and as gamblers in *Scientific American* (1954b). Games credited to the machine ranged from gin rummy (*Science Illustrated*, 1949) to poker (*Newsweek*, 1955a), to the most common, chess (*Science News Letter*, 1948 and 1950; *Science Digest*, 1951; *Scientific American*, 1958; *New Yorker*, 1957). Again, while titles can illustrate the popularity of certain eye-catching metaphors, they indicate only a preoccupation, not a process of treatment within public discourse.

Within any discussion of games, a preliminary distinction is necessary between two types of games: games of strategy and games of chance. This event concerns itself with games of strategy, rather than chance. Games of chance, like games of strategy, involve addressing uncertainties, such as the factors involved in planning one's companies' future position, but they do so through the science of probability. I consider in Chapter 6 some of the ways in which the cybernetic imaginary attempts to come to terms with chance. In this event, I am concerned with games of strategy. While addressing games of strategy (against an opponent of some sort, rather than against the odds), the game comes to represent, as suggested by the advertisement above, not only actual game playing machines, but also ideas about game playing, ideas which begin to frame how decisions can be taken, and ideas about who or what can be "smart."

It is games theory which names the game, and makes a language of gaming, strategy, opponents, and so on relevant to these issues. Occurring at the same time within the discourse, and often interconnected with games theory, it is the game-playing machine, which serves to frame the event. Chess emerges as an instant mechanical IQ test, and yet the whole issue of a game-playing computer, contrary to its cogency in public discourse, is framed, as of no importance at all. It is this lack of consequence which works to contain the threat of the smart machine. Finally, what emerges from the smart machine is a wider identification of intelligence with rational behaviour.

a. Rational Behaviour: Games Theory

The naming of the "game" is mobilized within public discourse through games theory. Through the naming process, a certain priority is attributed to rational behaviour and certain problematics are defined as identical. This early identification, most notably between zero-sum games and economics, offers the game as both an epistemology and a method. In the preface to the first edition of their seminal book, *Theory of Games and Economic Behaviour* (hereafter, *Theory of Games*) in 1944, John von Neumann and Oskar Morgenstern, note:

> [t]his book contains an exposition and various applications of a mathematical theory of games. ... The applications are of two kinds: On the one hand to games in the proper sense, on the other hand to economic and sociological problems which, as we hope to show, are best approached from this direction (von Neumann and Morgenstern, 1967: v).

And so it begins. Drawing upon ideas that von Neumann had developed in the 1920s, it was the publication of this text which launched the ideas of games theory into public discourse.

Wiener recognizes the book as important and cites it in both *Cybernetics* and *Human Use*. He describes it as "great" in *Human Use* and suggests that it made a profound impression on the world, especially in Washington (Wiener, 1950: 178). *Newsweek* calls it a "monumental book" (*N*, 1955a: 63). Given its initial publication during the war and its incredible mathematical density, it was not likely a favourite of the general reading public, but is frequently cited in other media texts, lending it a significant role within public discourse as an authority. Commentators note that it had a major impact upon mathematicians, economists, scientists, and bureaucrats, and by 1953 it was into its third edition. Significantly, Morgenstern was asked to prepare a much more non-mathematician-friendly summary of the ideas for *Scientific American* in 1949, a text much more accessible to the layreader in both content and circulation.

Von Neumann and Morgenstern define a game as the totality of the rules which describe it. This implies that interaction, outside of the bounds of rules, cannot be seen as a game. Play is the particular instance in which the game is played from beginning to end and a move is a choice between various alternatives made by one of the players. Finally, strategy consists of a plan regarding making choices in which the player considers all possible situations, in relation to all actual information possessed, and in accordance with the patterns of the games determined by the rules (von Neumann and Morgenstern, 1967: 79). The authors distinguish, however, between the rules of the game and the strategy of the players. Each player selects freely his or her own strategy, the general principles governing her or his choices. "The rules of the game, however, are absolute commands. If they are ever infringed, then the whole transaction by definition ceases to be the same game described by those rules" (von Neumann and Morgenstern, 1967: 49).

Thus the game marks a discursive border between what is within the rules and what is outside, what is legitimate and what is illegitimate. The game demarcates a field of play; action within that domain is always already strategic. There is choice within a game, but that choice is always constrained by the rules of play. This becomes more significant as the game is offered as a broader model of social relations, based in rational, goal-driven behaviour.

In *Theory of Games*, the authors suggest that the methods of strategic games can be applied to sociological and economic questions because they involve the same central problematics: "... parallel or opposite interest [on the part of participants], perfect or imperfect information, free rational decision or chance influences" (von Neumann and Morgenstern, 1967: v). The discursive possibility opened by *Theory of Games* is more than terminological. Von Neumann and Morgenstern are doing much more than asserting that a language of games can be applied effectively to other domains. Rather, they claim a fundamental identity of the underlying problematics of games and economic and social questions. For all intents and purposes, they are the same thing and economic and social questions can then be viewed as rule-bound(ed) activities, with self-interested players working towards a zero-sum result. This identity is not seriously questioned in the press of the period.

In elaborating the economic applications of the theory for a more mainstream audience, Morgenstern explains:

> [t]he theory of games defines the solution of each game of strategy as the distribution or distributions of payments to be made by every player as a function of all other individuals' behaviour. The solution thus has to tell each player, striving for his maximum advantage, how to behave in all conceivable circumstances, allowing for all and any behaviour of all the other players (*SA*, 1949a: 22).

Time magazine notes in 1954 that "Von Neumann's theory of games was developed as part of an effort to understand the economic behaviour of individuals in buying-selling and other operations" (*T*. 1954d: 20). In illustrating a "popular misunderstanding" about games theory von Neumann and Morgenstern deny the possibility, "... according to which the purpose of social effort is the 'greatest possible good for the greatest possible number.' A guiding principle cannot be formulated by the requirement of maximizing two (or more) functions at once" (von Neumann and Morgenstern, 1967: 11).

Thus, game playing is about rational behaviour as reflected in decision-making; smart behaviour is rational behaviour. One considers all available information, all possible options when faced with a choice, and the assumption is, one can take the best decision, the right decision, in any particular situation. That decision is, of course, the one which suits best the interests of the individual player. Economic and social behaviour can be mapped directly onto this understanding of strategizing and game playing, not by analogy, but by identity. The initial focus of games theory, as applied to social phenomena, is on the rational behaviour of the individual. Because the only cooperative action permitted within the game is contingent coalition-building, where strategic interests temporarily converge, social and economic questions are thus to be rendered within a logic of rationally determined individual gain and loss.

b. IQ Test for a Machine

The June 1955 cover of *Scientific American* features a small yellow canary sitting on a checked board, pushing a checker across a square. The title reads: "Reason in the Canary" (*SA*, 1955). Yet, how does this cover represent reason? It is clearly doing so through the act of playing of a game, in this instance, checkers. How does game-playing become an instant abbreviation of reason, and eventually of intelligence in the machine? Gaming is established within the public discourse as a test of reasoning ability. This reasoning ability comes to stand in for a general measure of intelligence. Chess-playing, in particular, emerges as the IQ test of the machine.

The thinking machine was coming into cultural currency, and the game worked as its material proof. "If one could devise a successful chess machine, one would seem to have penetrated the core of human intellectual endeavour" (Newell, Shaw, and Simon (1957) in McCorduck, 1979: 160). As I note in Chapter 4, the question of whether or not computing machines can be said to think is a significant concern in public discourse at this time. Through the event of the thinking machine, the computing machine becomes the thinking machine. It is through the game-playing machine, that the thinking machine becomes the smart machine. In many articles, the fact that a machine can play a game is quick and casual proof of its intelligence (*AM*, 1953: 59; *SD*, 1951; *SM*, 1952; *NY*, 1957). Claude Shannon suggests that it is their ability to play "a fairly strong game" which raises the question of whether machines can think. Even in situations where the thinking ability of the machine is put into question, it is chess that emerges as the proof, as the test of intelligence quotient. In *Human Use*, Wiener recognizes that the learning required to play good chess is beyond the learning being exhibited by thinking machines at that time (Wiener, 1950: 177).

This embrace of the game as a necessary and sufficient test of "intelligence" constitutes the result, rather than the process, as the measure of intelligence. This narrows the understanding of intelligence to a functionalist, zero-sum understanding.

The measure of intelligence becomes strictly functional, strictly instrumental; value associated with meaning, creativity, process, aesthetics, emotion, humour, ethics, are elided from the measure of what constitutes machine (and human) intelligence. Efficiency in achieving a pre-determined goal, checkmate, becomes the measure of a good player, a smart player.

So, why chess? Why not another complex game of strategy such as poker or others which von Neumann and Morgenstern use as examples? Is there something to the claim by BobWilensky, the scientist I quote at the beginning of this chapter? I suggest it is likely a combination of factors. First, chess was already located within a meaning matrix of intellectualism, whereas poker, for example, had an unsavoury taint of gambling and saloons. Second, from the secondary historical literature, it would appear that most of the cast of characters involved in developing early computing machines did play chess, although interestingly, many not particularly well.

Marvin Minsky, in an interview with Pamela McCorduck, describes Norbert Wiener's chess prowess, or lack thereof.

> 'Norbert Wiener used to sit in the Faculty Club at MIT and play chess with other MIT people, and he'd usually lose. He wasn't very good at it and he complained that the trouble with chess was that you musn't make any mistakes. He had much better plans, he thought, for how to take all his opponent's pieces away, and get his king, but Wiener would always make a mistake and lose his queen or something early in the game, so he couldn't carry out these plans' (Minsky in McCorduck, 1979: 49-50).[2]

However, rather than attempting to find the reason why chess became the strategic game of choice (an impossible task), it is of more direct interest to me to examine the consequences of that trope, which I do later in this chapter. Suffice to say, within the public discourse, chess becomes the game of choice because smart people play chess. *The New Yorker* reports, in 1957, that an IBM advertisement for computer programmers contained the appeal, "[t]hose who enjoy playing chess or solving puzzles will find this work absorbing" (*NY*, 1957: 18). In other words, smart people play chess. Computers can be made to play chess. Computers are smart (people). "Smartness" thus is proved through the behaviour of game-playing. So, more than thinking machines, we now have intelligent machines.

c. Of No Importance in Itself

The smart machine is the stuff of science fiction; it raises the spectre of the surpassing of the human by the machine. What does it mean if the machine is smarter than us? The smart machine poses a risk to the intellectual supremacy of the human being. This risk is effectively contained in the discourse through the framing of the game and the game-playing machine as of no importance in itself.

In the summer of 1947, Arthur Samuel proposes building a checkers-playing machine in order to raise money to build a large computer for the University of Illinois. Samuel's own recollection is that "[w]e would build a very small computer … and try to do something spectacular with it that would attract attention so that we would get more money" (Samuel in McCorduck, 1979: 149). Interestingly, this use of the game-playing machine as (fund-raising) spectacle, echoes an earlier time. McCorduck suggests that Charles Babbage and Lady Ada Lovelace also considered an idea to build and demonstrate a games machine in order to raise capital for Babbage's research (McCorduck, 1979: 27).

The treatment of game-playing machines as stunts potentially threatens the credibility of the machines themselves, and their creators. Wiener himself asks:

> the reader may wonder why we are interested in chess-playing machines at all. Are they not merely another harmless little vanity by which in design seek to show off their proficiency to a world which they hope will gasp and wonder at their accomplishments (Wiener, 1950: 177-8)?

Time magazine describes the mathematician's dream. "The favourite dream project of mathematical thinkers is a chess-playing machine" (*T*, 1951b: 65). Rather than serving as proof of intelligence, in either the machine or its creators, within public discourse, there was certainly a risk that the public would think that game-playing was too trivial a pastime for these wonderful, immense, lightning fast, thinking machines. Further, there was the related risk that the machines would then be viewed as the mere playthings of boyish scientists who should be devoting themselves to more serious pursuits.

The risk of the trivialization of the game-playing machines and their creators is contained by careful framing of chess-playing as a means to other ends. I suggest that what emerges is the framing of the game-playing machine as something which is not particularly important in its own right, but which heralds other more significant developments. In this way, the chess-playing machine emerges as a horizon point for the smart machine.

In a review of *Cybernetics*, Anthony Standen in *The Commonweal* draws out the note by Wiener referring to the potentiality for a chess-playing computer. Standen continues "[m]ore seriously ...," exemplifying that chess is clearly evidence of something, but is not entirely serious in and of itself (*C*, 1949: 176). In the mid-1950s, as a result of all of the press surrounding game-playing research, there was pressure from IBM shareholders to stop investing in game-playing, a silly pastime (McCorduck, 1979:

159). Claude E. Shannon, recognized builder of a chess-playing machine, is quoted in *Newsweek* in 1949 as suggesting, "[b]y studying the theory of using an electronic computer to play chess, we expect to find solutions to the engineering of telephone equipment and the problem of routing telephone calls to circuits that are not busy" (*N*, 1949a: 55). He concedes, in an article about the very subject, that the chess-playing machine "... is of no importance in itself, but it was undertaken with a serious purpose in mind. The investigation of the chess-playing problem is intended to develop techniques that can be used for more practical applications" (*SA*, 1950a: 48). Thus, there is an apparent contradiction at work between the chess-playing machine as an instant proof of rational intelligence, and the denial that this activity is a very significant phenomenon. It is in this contradiction that the notion of the smart machine as threatening and the discursive moves to contain that threat are established.

This complex framing of the game has a number of discursive effects which shape the implications of this particular event. I have already noted above that the use of games theory resulted in a focus on rational behaviour as the desired value in a game system. Here I discuss the unstated, but implied teleology in the framing of the game, the absence of debate as this game theory was applied to the social domain as a quantitative methodology, and the use of game as both metaphor and model. The game heralds both the smart machine and the resulting redefinition of intelligence within a rationalist understanding.

Wiener suggests that "[t]he theory of games is, in its essence based on an arrangement of players or coalitions of players each of whom is bent on developing a strategy for accomplishing its purposes, assuming that its antagonists, as well as itself, are each engaging in the best policy for victory" (Wiener, 1950: 181). Thus, in games, at least zero-sum games, there are winners and losers. Chess, for example, is a zero-sum game, where one player winning, implies that the other does not. So just as in the event of the thinking machine, the use of "brains" as a concept implied thinking, games imply winning (and losing). As Adam notes, "knowledge is defined as rational and rationality is defined in relation to goal orientation" (Adam, 1998: 100). This excludes many other ways of thinking about intelligence which function as absences in the event. Embodied experience is elided; irrationality is rendered illegitimate; and intelligence becomes winning within the rules of the game. Creativity, intuition, speculation are all rendered outside the rules of the game. The resultant conclusion of intelligence as manifesting in goal-oriented, rational behaviour is not debated extensively within the public discourse. This fits well within the academic-economic context of faith in big science.

What I found most striking was the absence of extensive public debates about the extension of games theory. There was at least the appearance of a debate in the event of the thinking machine, when the question of whether machines could think was posed. Some authors questioned the applicability of the same models of understanding for machines and for human beings. Interestingly, in the event of the game, there is a complete absence of a debate as to whether mathematical theory can be applied unproblematically to economic and social phenomena. What results is that the metaphor of the game functions as a model. By this I mean that something which begins as a comparative tool for understanding becomes an attempt to establish a structural identity between two things for the purpose of testing. A model is only incidentally representational and is meant to be functional. A model replaces, whereas a metaphor compares. A metaphor does not purport to represent reality accurately; a model does.

I have detailed above a number of instances where the game-playing machine, chess, or even the notion of the game, itself, functions metaphorically to represent intelligence. Yet Von Neumann and Morgenstern are very clear that games are not *like* economic and social questions, rather they are concerned with identical problems and therefore, the game can serve as a model, and not merely a metaphor, for economic and social behaviour. "For economic and social problems the games fulfill – or should fulfill – the same function which various geometrico-mathematical models have successfully performed in the physical sciences" (von Neumann and Morgenstern, 1967: 31). What this framing implies is that economics and sociology are sciences, or at least should be. Mathematics and science are privileged as the methodologies through which we can best know our world, all of it. Wiener agrees suggesting that while the social sciences are very poor grounds for testing mathematical theories, once these theories are tested in the hard sciences, they should be applied to the social sciences (Wiener, 1948: 18). Science is the methodology, rationalism the epistemology, and smart machines and people are defined and valued in relation to these measures.

4. Two of the Players

While there were once again many scientists, physicists, and mathematicians working with questions of games theory and exploring the potentials of game-playing computing machines, particularly as those applications were being explored in military-backed research, there are two personalities who emerge as central to the construction of the game as an event. They are continually referred to in the position of expert, and through this process, have certain discursive effects within the game. John von Neumann emerges as the theoretical genius, the man who put games on the public agenda, a man with a high profile in a number of knowledge and governing communities. Claude E. Shannon, on the other hand, emerges as the technician, as the man who is actually making game-playing machines, and thus, has authority to speak about them in practice. He offers material proof of the smart machine.

a. The Theoretician: John von Neumann

Von Neumann is presented as intelligent and extremely well respected. Unlike Wiener who was marked as different than his peers, eccentric, a visionary, von Neumann is framed as having the respect of his peers and of mathematical experts and economists. If Wiener is the people's scientist, than von Neumann is the expert's scientist. "Unlike most great mathematicians, whose devotees are mainly other mathematicians, von Neumann's counsel has been sought by physicists, meteorologists, economists, businessman, psychologists and numerous military experts" (*N*, 1955a: 63). His visibility as a scientist is endorsed by the highest authority, other scientists. "By his wit, his intellectual attainments, and his outspoken appraisals of government security inequities, von Neumann has won wide admiration among the nation's scientists" (*N*, 1955a: 63). His theories are described as world-renowned among scientists and economists (*T*, 1954d: 20). We can trust him with our very lives. "People who should know say that von Neumann is eminently qualified to sit across the table from the Russians in the greatest game in the world" (*T*, 1954d: 20).

When von Neumann is appointed by President Eisenhower to the Atomic Energy Commission in 1954, he is casually labelled as one of the "masterminds behind many electronic brains" (*T*. 1954d: 20; *N*. 1955a) and much is made again of his games theory. He is given the lion's share of credit for the ideas in the co-authored text, *Theory of Games*. *Newsweek* call it "his monumental book" (*N*, 1955a: 63). He is distinguished from others by his sheer intelligence. "To be sure, [his] interest doesn't always last that long. Not that von Neumann is fickle or dilettante, but the fact is that he often arrives at solutions before others have had a chance to sit down, light a pipe and think things over" (*NR*, 1947: 14).

Yet his genius is amicable and accessible; he has his very human weaknesses. He is referred to by *Time* in the following manner: "John von Neumann, 50, a cheerful, portly professor with a passion for cookies and ionospheric mathematical problems" (*T*. 1954d: 20). *New Republic* describes him as "a medium-sized, medium-aged, medium-chubby mathematician at the Institute for Advanced Study at Princeton, [with] a disconcerting way of setting the scientific world on its ear whenever he decides to interest himself in a problem" (*NR*, 1947: 14). Von Neumann is a *bon vivant*:

> [l]ike his theories, von Neumann is both intricate and surprising. He has a deep fondness for his flashy Cadillac convertible, but he has no idea how to fix it. ... He likes expensive and exotic restaurants, cocktail parties (for the agitated company more than the drink), anything to eat that's sweet, mathematical dabbling on the stock market, and recreational reading in medieval history (*N*, 1955a: 63).

Best of all, von Neumann is himself a gamesman; his youthful passion for poker is mentioned on more than one occasion.

> Many famous men have passed long hours at the poker table, but their fame was usually achieved in spite of their addiction. A notable exception is Dr. John von Neumann, a grinning, rumpled mathematician who has

> built a youthful love for poker into one of the great new concepts of modern mathematics – the theory of games (*N*, 1955a: 63)

As for his current poker playing, "... he is only a fair-to-middling winner. Steady winning in a friendly game, after all, would be a strategic violation of his theory of games" (*N*, 1955a: 63).

In some ways, von Neumann himself is portrayed as representing the very ideas of his theories: charming, brilliant, and important. He is constructed as a scientist who can legitimately speak across disciplinary boundaries to economists, military experts, government leaders. He has the respect of his peers, and therefore, merits public respect. Thus, the high mobility of games theory across many disciplines and von Neumann's own mobile credibility work together to facilitate the circulation of games theory. Further, the role of the visible scientist as advisor to government and industry, and thus the primacy of science as a useful knowledge, are confirmed.

However, when the discourse wanted to move away from the theory, and talk about "real" game-playing machines, it is Claude E. Shannon who becomes the authority.

b. The Technician: Claude E. Shannon

Newsweek describes Claude E. Shannon as "a thin, dark young man with a nationwide reputation as a mathematician" (*N*, 1949a: 55). More significantly, however, Shannon is repeatedly and consistently framed as *the* foremost authority on chess playing machines (for example, *T*, 1951b: 65 and *T*, 1950a: 50). He is asked to write the definitive article on games-playing machines for *Scientific American* in February of 1950, entitled "A Chess-Playing Machine" (*SA*, 1950a). He is portrayed as modest, competent, and as someone who is able to explain the actual "nuts-and-bolts" of this complex thinking task.

He is both able, and authorized within the discourse, to explain exactly how a computer can be programmed to play chess.

> By assigning numerical values to the king, queen, rooks, bishops, knights and pawns, and to their possible positions on the board, Shannon showed how a computer could explore the situation two or three moves ahead. The result would not be brilliant chess of master calibre but a game skillful enough to interest the average amateur (*N*, 1949a: 56).

In the same article, Shannon concedes that Bell Laboratory's primary purpose is not to build chess playing equipment, but rather to use what they learn from the experience to inform other solutions. It becomes clear, however, that Shannon is speaking not only for chess-making machines but also for the Bell Laboratories.

Interestingly, he is always referred to as, Claude E. Shannon *of the Bell Laboratories*. Thus, in the process of legitimating Shannon's expertise, a commercial laboratory is also simultaneously being framed as a site of authority on smart machines. The public learns to look to Bell for certain computing developments, particularly those surrounding the chess-playing machine. This forms part of the shift from military and industrial applications to commercial applications and the legitimation of the authority which accompanies it. As well, it marks and legitimizes the process of the production of useful knowledge in the postwar period in the U.S. through the operation of the military-industrial-academic complex, with large amounts of government funding supporting research in private corporations.[3]

What is interesting about both men together is that they serve as examples of, not only visible scientists, but useful scientists. Each is producing useful knowledge which can be applied by government and industry to economic, social, and governmental issues. Their credibility emerges from the direct benefits which the public perceives result from their work, and science emerges as a pertinent knowledge in governance.

5. No Contest

The notion of the contest infuses the game as an event. A game is a prime (and primal) opportunity to pit man against machine. If the game is such a fundamental way to demonstrate intelligence, than how better to answer the real question on everyone's mind: who is smarter – man or machine? With this in the back of my mind, I searched my research for tales of mighty contests, of dramatic encounters between man and machine, of Deep Blue v. Kasparov, 1950s-style.

The idea of a man-machine competition begins with early calculating machines, in terms of who is, if not smarter, at least faster. *The New Yorker* reports in 1946 on two competitions which had been staged between a calculating machine and an abacus. Incidentally, the machine lost (*NY*, 1946: 34). However, both are framed as distant from the reader, rather than in the more intense "play-by-play" kind of style of later man-machine contests.[4]

However, what about games of strategy? What about *real* tests of "intelligence?" Much to my surprise, there were no moments in this event, until its conclusion in 1958, where a major competition between a computer and a human was reported as spectacle. There were various references in passing to games being played deep within Bell and IBM Laboratories by computer programmers and their machines, but these are not constructed as moments within the discourse. There are allusions to secret contests deep in corporate laboratories, not yet ready to be shared with the public. No details are given. I was perplexed as I felt that in many ways this was an ideal promotional opportunity missed on the part of early computer companies.

Such a contest was planned by at least one research group. Arthur Samuel, a computer scientist who produced one of the first checkers-playing machines concedes that the original plan of his team was to develop a computer in time to challenge the champion in the world checkers championships, fortuitously about to take place in a nearby town. The computer was not developed in time for the tournament and so the match never happened. Yet Samuel defines his and his colleagues' motivation: "[w]e would build a very small computer ... and try to do something spectacular with it that would attract attention so that we would get more money" (Samuel in McCorduck, 1979: 149).

The potential is there to turn the computer into a spectacle, a performer. Yet this opportunity is not seized. I suggest that the reason that there were not more widespread attempts to stage direct contests between humans and machine, notwithstanding their potential as ideal media events and promotional tools, was as part of risk containment. Inevitably in contests, there are winners and losers. With the newness of the computer, it was still somewhat unknown how people would respond to the results of such a test. The comfort level of the public with these machines had not yet been established; the terrain was still being negotiated. Would the public feel threatened if the machine won? Would it diminish the machine if the human won? The time was not yet ripe.

Other research supports my conclusion. Pamela McCorduck (1979) describes the risk of humiliation if the machine does not win. An inventor, Alex Bernstein (who we will meet again), had developed a chess-playing machine. When he tried it out for the first time, he did so without an audience, perhaps wisely. The machine's opening move was to resign because there was a bug in its program. Thus, had this been a big media moment with much press, his own research, reputation, and potential for funding, might have been dramatically affected. Marcel LaFollette (1990) notes the selective reporting of science's successes, suggesting that as a result, science appears infallible. The implication, though unstated, within her analysis is that this is a result of journalistic practice. I suggest the example of the non-story of the game reveals that scientists were partners in their own construction as infallible.

There were also risks if the machine performed superlatively. As I noted in previous sections, many of the scientists working on game-playing, and other, computing machines in the 1950s, were working in corporate settings, most commonly the Bell Laboratories and IBM. Obviously they had in mind, not only the pure scientific quest of producing a successful game-playing machine, but also the potential of this machine as a commodity form. In the mid-1950s, the marketing department at IBM was afraid that the machine would be too psychologically daunting and so wanted to portray the computer as smart but very limited (McCorduck, 1979: 159).

This brings to mind the story of the Nimatron, outlined by James R. Newman in the *New Republic*, showing the risks or "traumatic possibilities" as he calls them, of a game-playing machine beating a human. The Nimatron was an electronic device designed to play the ancient Chinese game of Nim. Sponsored by Westinghouse, the Nimatron debuted at the 1939 World's Fair. It defeated all of its opponents, with the exception that those with mathematical theory backgrounds were able to eke out a draw.

> Now the worst feature was that the machine not only won, but no matter how long the player pondered over his move, the machine clicked out its reply in a thousandth of a second.
>
> Hundreds of men and women staggered away from the Nimatron daily, dazed, depressed, and defeated. This not being the best way of winning friends, Westinghouse persuaded Condon [the inventor] to introduce 'daily circuits' into the Nimatron's vitals so that it would at least seem to ponder for a few moments after the human player had made his move. There was thereafter a noticeable improvement in the morale of the *Nim* addicts (*NR*, 1947: 18).

A similar cautionary tale with a tic-tac-toe-playing machine as protagonist is reported in *Newsweek*. As the machine played such a perfect game, "[l]est the human opponent become discouraged, Hayle [the inventor] has devised an auxiliary 'poor play' circuit. When this circuit is connected by throwing a switch, the gadget relaxes and guilelessly lets a skillful player win. Thus it becomes the only mechanical brain with a soft heart" (*N*, 1949d: 52). The heart of the computer in an Ambrose Beirce science fiction story was not so soft. After the robot chess-player lost to its inventor, it strangled him (*SA*, 1952a).

A skillful game-playing machine matching talents and minds with a human opponent was not a zero-sum game for computer manufacturers and researchers – they stood to lose regardless of the outcome. The absence of such a moment in the public discourse of the game serves to contain any potential threat that might have been the effect of such a contest. Yet at the same time, the game continues as a horizon of achievement. The only reason there is not a more effective chess-playing machine is because humans have not yet produced the necessary technology; it is possible in theory. The limitation remains human. Further, the unstated conclusion is that once the chess-playing machine can beat the human, the machine will have proved smarter than its maker. Until that point, computing machines remain as non-threatening, and the game continues to be something of little importance in itself. But while the game-playing computer may have been viewed as of limited importance, the game itself continues to resonate.

6. The Games Board

> *I don't particularly like people, never have. Man to my mind is about the nastiest most destructive of all the animals. I don't see any reason, if he can evolve machines that can have more fun than he himself can, why they shouldn't take over, enslave us, quite happily. They might have a lot more fun, invent better games than we ever did* (Warren McCulloch in Kelly, 1994: 452).

The central tropes productive in and of the event of the game, and those that work to establish the shared meaning systems which come to be accepted, can be explored as a series of games, themselves. I explore a series of four games produced within the discourse, each with different effects. The discourse locates them on a continuum from least to most complex. The four games are: trivial pursuits, chess, the imitation game, and economics. The increasing complexity of the games, and the computing machine's differential ability to play them, becomes a further move to contain the potential risk of the smart machine. The location of these "games" on a continuum implies a relationship between them, and reproduces shared underlying assumptions in their understanding, which permits the movement of the notion of the game from actual games of strategy to "other games," such as war and business. The representation of the social as a game locates it in a field of interaction delimited by rules, with winners and losers, grounded in conflict, and where self-interested behaviour is the most appropriate form of agency.

a. Trivial Pursuits

A number of games emerge as trivial pursuits within the public discourse of the game, too trivial to stump the computer, too trivial for the computer's success to worry us. These trivial pursuits include penny-matching, tic-tac-toe, and checkers, all of which are relatively simple zero-sum games. These games are employed within the discourse to simultaneously confirm and contain the smart machine.

As games, tic-tac-toe and penny-matching are very simple and one learns very quickly that perpetual draws can be produced as soon as both players figure out their simple strategy. In public discourse they are quickly established as games that computers can play and play without error, yet given the simultaneous treatment of the game as simple, there is no resulting threat. For example, in an article entitled, "Automatic Gambler," *Scientific American* reports on a computer from Bell Laboratories that can now beat people at the "simple-minded" game of matching pennies. This machinic achievement is not presented as anything to worry about and the complexity of the game is treated dismissively (*SA*, 1954b: 48). In another piece featuring a penny-matching computer, the potential threat is controlled through its treatment as merely a diversion from more important tasks. "In addition to penny-matching to the enjoyment of those who want to watch man against machine, the device has a serious purpose. It is a forerunner of computers that some day might be capable of adjusting to a new environment" (*SNL*, 1956d: 102).

Newsweek, in a 1949 article entitled, "Sublime and Ridiculous," notes that a nineteen year-old technician at the California Institute of Technology had amazed and amused a conference of electrical engineers with his tit-tat-toe (his spelling) machine; it played like a master. The machine played a perfect game and the best human opponents could hope for was a tie. It could even deal with attempts to cheat it (*N*, 1949d: 51). Yet again, this is something fun: an extra-curricular project by a college lad.

Checkers is the next challenge, both within von Neumann's games theory as well as in the public framing of game-playing machines. It is much more complex than tic-tac-toe, and yet, is at the same time, a zero-sum game which can be played perfectly. Again, however, it is not considered a particularly difficult game. McCorduck describes checkers as the preserve of old men and children and notes that inventor Arthur Samuel suggests of his choice of checkers as a goal for his computing machine: "[w]e thought checkers was probably a trivial game" (Samuel in McCorduck, 1979: 149).

It is in the mid- to late-1950s that stories emerge of successful checkers-playing machines. Checkers (or draughts in Britain) becomes the non-threatening, fun game that computers can, and are allowed within the discourse to, play. After noting that no state of "Orwellian horror" has resulted from the computer and that the "general attitude towards computers is one of good-natured awe, curiosity and respect," *The Economist* describes, disarmingly, an unbeatable computer. "Not long ago, a technician with time on his hands succeeded in teaching the game of draughts to a computer: the reward for his pains is that the best he can hope for now is a draw" (*E*, 1958b: 793).

Interestingly, checkers is often offered as a precursor to other, more important games. Checkers is a stepping stone to a much more difficult game, chess. *The New Yorker* quotes an IBM representative: "[a] computer has been designed that plays checkers and has beaten all comers so far. Chess is still beyond it, but it won't be for long" (*NY*, 1957: 19). But there are more important games on the horizon.

> Machines have already been built that can learn by experience. Taught to play checkers, some modern computers have learned, after only 20 hours of play, to beat the man who programmed them. When the machines get a little brighter, they may learn economic games, such as figuring out the production schedule of an industry or manipulating the stock market (*T.* 1960: 32).

Therefore, a checkers-playing machine is ultimately treated as a non-threatening development. The game is still fairly simple, and while the machine needs to be "smart" to win, other games continue to require more significant skills-sets, games like economics and chess. In a sense, this creates a discursive pressure on chess as a figure in the discourse. It is framed as already invested with a certain cachet, a certain mystique. Chess is the ultimate test.

b. Chess: Good But No Master

> *We now come to another class of machines which possess some very sinister possibilities. Curiously enough, this class contains the automatic chess-playing machine* (Wiener, 1950: 239).

As I note earlier in this chapter, chess is the central figure through which the game is mobilized and articulated in public discourse. Yet, there is a central paradox in chess being framed as an instant IQ test for the machine, thus, winning at chess would be simple proof of intelligence, versus the simultaneous ongoing trivialization of the pursuit and development of games-playing machines. In this section, I detail and analyze the complex discursive means through which this paradox is played out and if not resolved, then at least, the patterns for its containment of the risk of the smart machine, of the sinister possibilities, are produced. I first explore the presentation of chess as the privileged figure and then examine the construction of the machine as a good, but not great, player, as a discursive containment technique.

References to chess and chess-playing computers abound in the public discourse around emergent computing machines. *Newsweek*, in a general article about computers, subtitles a section "Chess Robots" and features an extensive treatment of the issue, informed by Claude Shannon (*N*, 1948d). Wiener poses the notion of the chess playing machine in his 1948 book as a possibility and is among the first to suggest that "this sort of ability represents an essential difference between the potentialities of the machine and the mind" (Wiener, 1948: 190). He feels it is possible to build a chess-playing machine that "... might well be as good a player as the vast majority of the human race" (Wiener, 1948: 193-4).

In his landmark article in *Scientific American*, Shannon tries to explain, technically, why chess is such a favoured project of computer developers. He divides the problem of a computer playing chess into three parts. First, all of the positions and chess pieces have to be coded as numbers; second, a strategy has to be determined for choosing the moves to be made; and third, the strategy must also be coded into a program. He suggests that the problem of the chess-playing machine is an ideal place to begin for several reasons – the problem and the moves are sharply defined and so is the ultimate goal. "It is neither so simple as to be trivial nor too difficult for satisfactory solution. And such a machine could be pitted against a human opponent, giving a clear measure of the machine's ability with this type of reasoning" (*SA*, 1950a: 48). We can see the slide from coded machine choices with a predetermined goal to reasoning in Shannon's claim. He further suggests, "[f]rom a behaviouristic point of view, the machine acts as though it were thinking. It has always been considered that skillful chess play requires the reasoning faculty. If we regard thinking as a property of external actions rather than internal method the machine is surely thinking" (*SA*, 1950a: 51). Again, Shannon equates thinking with reasoning and measures its proof by behaviour.[5]

The press thrives on comparing the relative advantages of the machine and the human for chess playing, of pitting their respective intelligences against each other. "Against the greater inventiveness of the human chess master, the machine with its built-in procedures for choosing the next move, would have the advantage of high-speed operation, freedom from errors, and freedom from laziness" (*SA*, 1950b: 29).

> A machine has several obvious advantages over a human player: 1) it can make individual calculations with much greater speed; 2) its play is free of errors other than those due to deficiencies of the program, whereas human players often make very simple and obvious blunders; 3) it is free from laziness, or the temptation to make an instinctive move without proper analysis of the position; 4) it is free from 'nerves', so it will make no blunders due to overconfidence or defeatism. Against these advantages, however, must be weighed the flexibility, imagination, and learning capacity of the human mind (*SA*, 1950a: 50).

Chess is therefore figured as a contest between man and machine where the stakes are the attribution of intelligence. A resulting discursive opening is created that a machine could be smarter than a human being, where a hierarchy could be established. A hierarchy measured by behaviour which looks like reasoning and is called thinking. The figure of chess is further figured to minimize this potential spectre. A distinction is made between theory and practice: in theory, it is conceivable that a perfect playing chess machine could be built, but in practice, they are fallible players (like the rest of us).

Each of tic-tac-toe, checkers and chess are classified as "saddle point games" in games theory, namely they have a pure, winning strategy that with sufficient knowledge, can be deduced. "Chess is exciting because the number of possible moves and positions is so great that the finding of that strategy is beyond the powers of even the best calculating machines" (*SA*, 1949a: 23). Shannon calculated that the possible moves in chess were 10^{120}, making the completion of a perfect game impossible (*SA*, 1950a).[6] Thus, chess is an interesting and provocative theoretical problem, but perfection is impossible, in practical terms.

So, whether framed as a complement or a slight, the machine is allowed within the discourse to play chess, just not good chess. "Such a machine would not only play legal chess, but a chess not so manifestly bad as to be ridiculous" (Wiener, 1948: 193). *Newsweek* notes in 1949, as a sign of limited intelligence, that the computer in question could not do taxes, but it could play chess (*N*, 1949d). Shannon is quoted as recognizing expressly that a computer could theoretically play a perfect (as in unbeatable) game of chess, but in practical terms no existing or planned computer is fast enough to make the calculations (*T*, 1951b: 65). Again, the threat of the smart machine is diffused.

> It would be easier, says Shannon, to make a machine play a fair game of chess, seeing three moves ahead and avoiding obvious bad strategy. Such a machine would play rapidly and would have no mental lapses. It would never get lazy or nervous. On the other hand it would lack flexibility, imagination, and the valuable human ability to learn by experience. It would never beat a good player (*T*, 1951b: 65).

In an article entitled, "Build Intelligent 'Brain,'" *Science News Letter* is considering a claim by William Ross Ashby that man could build a machine more intelligent than himself. Chess is used as an indication that we are not quite there yet. "Although the electronic computer might not be able to play chess, its ability to amplify intelligence could solve some of the world's social and economic problems" (*SNL*, 1956b: 277). In the 1953 British collection, *Faster Than Thought*, detailing the history of the early computer, there is a chapter on game-playing co-written by Turing and his colleagues (Bowden, 1953). They present a program for chess-playing, but it is described in somewhat lacklustre terms by Turing.

> If I were to sum up the weakness of the above system in a few words, I would describe it as a charicature of my own play. It was in fact based on an introspective analysis of my thought processes when playing with considerable simplifications. It makes oversights which are very similar to those which I make myself, and which may in both cases be ascribed to the considerable moves being inappropriately chosen (Turing in McCorduck, 1979: 60).

Turing is describing the machine's weaknesses as being too human, not rational enough, not enough like a machine. It is in its imperfections that the machine is like the human and not, therefore, a threat.

Yet, this process of containment, of equalization of the imperfect computer and human player, is not forever. There are claims made for machines that will be able to learn, develop their own strategies, and which will achieve a higher level of play in the future. After describing the various uses to which decision-making machines will shortly be put to use, *Scientific American* notes that,

> [e]xplorations in the field of machine-devised game strategy are already being made. It is rumoured that a computing machine in the U.S. will play a machine in England at chess. These machines will not attempt to play by arithmetic evaluations of all possible plays. They will have to learn to play the game and develop their own strategies (*SA*, 1952m: 147).

Darwinian claims are made for machine-learning in chess playing: "[b]y applying its rules of selection it will create new and highly organized entities (i.e. chess strategies) from its chaotic input in the same way as natural selection evolves new forms of life" (*SA*, 1952i: 68). Thus, we can see the beginnings of the artificial intelligence goal to produce a more sophisticated "learning" machine. The thought processes which previously the machine was felt not to possess are targetted for achievement. The machine emerges as the evolutionary successor to the human. This potential for a learning machine is at the heart of the next game that I will discuss, the imitation game of Alan Turing.

c. The Imitation Game: Artifice and Intelligence

In 1950, Alan Turing considers the question of "can a machine think?" in a piece he wrote for the journal, *Mind*, a review of psychology and philosophy. There he turns the question on its head, describing yet another game which comes to form part of the cybernetic imaginary – the imitation game – and thereby sets the test that would become a debate within artificial intelligence circles to this day. Alison Adam suggests that the "imitation game" now holds the status of a "canonical thought experiment" (Adam, 1998: 50) and N. Katherine Hayles argues that it set the agenda for artificial intelligence research for the next thirty years (Hayles, 1999: xi). Interestingly, other than being an intervention into public discourse in its own right, Turing's piece does not really make much of an impression on the American popular press. It does not take on an intertextual life like Wiener's and von Neumann's and Morgenstern's books did. It does form a part of public discourse, however, and is read extensively by practitioners in the field. It takes on a mythical quality within the field of computing science.

Turing outlines what he calls the imitation game, or a means to determine the answer to the question – do machines think. In the game, three people, a man (A), a woman (B), and an interrogator (C) "who may be of either sex" are the players. The interrogator is in a room apart from the other two and the objective is for the interrogator to determine who is the man and who is the woman through a series of questions. A's task is to try to cause C to make an incorrect identification; B tries to help the interrogator guess correctly. Questions and responses are exchanged through typewriting so that voices (i.e. bodies) do not affect the results. "We now ask the question, What will happen when a machine takes the part of A in this game? Will the interrogator decide wrongly as often when the game is played like this as he does when the game is played between a man and a woman?" (Turing, 1950: 433-4).

Interestingly, Turing suggests that the best strategy for the machine would be to give the answers provided by a man. He does not seem to recognise that it is supposed to be a man playing a woman; nor does he address the notion of a computer lying, the spectre of the dissembling machine. As well, I have always found it intriguing that the game turned around the ascertainment of gender, rather than the question of whether the machine could convince the interrogator that it was a human, regardless of gender. Most subsequent popular descriptions of the test frame it as a test of humanity, not gender (for example, Bolter 1984 and Edwards, 1996). Turing therefore, replaces the question, can a machine think with, "are there imaginable digital computers that would do well in the imitation game?" (Turing, 1950: 442).[7]

Hayles correctly notes that the Turing Test has the impact of disembodying intelligence. Intelligence becomes about the manipulation of symbols as opposed to experience anchored in human interaction. She also recognizes that in the subsequent life of the Turing Test, it is often forgotten that the original test was about the distinction between a man and a woman, and poses a series of provocative and insightful questions.

> If your failure to distinguish correctly between human and machine proves that machines can think, what does it prove if you fail to distinguish woman from man? Why does gender appear in this primal scene of humans meeting their evolutionary successors, intelligent machines?

> What do gendered bodies have to do with the erasure of embodiment and the subsequent merging of machine and human intelligence in the figure of the cyborg? (Hayles, 1999: xii).

She suggests that the test facilitates the reading of the body as constructed, mediated by technology, and lays the groundwork for later cyborg discourses. In her extended analysis she connects this to the challenge to, and occasional recuperation of, the liberal subject.

Hayles concludes with an important recognition, which I suggest applies to each of the games here considered.

> Think of the Turing test as a magic trick. Like all good magic tricks, the test relies on getting you to accept at an early stage assumptions that will determine how you interpret what you see later. The important intervention comes not when you try to determine which is the man, the woman, or the machine. Rather, the important intervention comes much earlier, when the test puts you into a cybernetic circuit that splices your will, desire, and perception into a distributed cognitive system in which represented bodies are joined with enacted bodies through mutating and flexible machine interfaces (Hayles, 1999: xiv).

I agree with Hayles, but feel that it is also important to consider the discursive effects of the imitation game as it circulates within public discourse, as a test of humanity. The game remains a magic trick. The assumptions which ground it are that humanity is manifest in writing; that a lack of a body is not fatal to the identification of a human being; that it is possible for a machine to successfully imitate a human. We assume that the test proves anything at all. We assume that it proves that the machine's intelligence is equal or superior to that of the tester. Thus, the test which becomes a canonical thought experiment figures the smart machine as able to replace/be a human, or at least reflect those characteristics which identify us as such. The chalk line between human and machine has been brushed away, and that is the biggest magic trick of all.

Yet the magic show continues with economic games.

d. Economic Games

> *[T]he mathematical study of games offers the possibility of new insights and precision in the study of economics* (*SA*, 1949a: 22).

Theory of Games calls for the movement of games theory to other domains, particularly to economics, as I note previously. As *Scientific American* notes, the theory of games was developed in the 1920s but did not achieve prominence until its publication in 1944 (*SA*, 1955b: 78). "The theory then 'caught on,' and there has been a multitude of studies and papers developing it in a great many directions" (*SA*, 1955b: 78). These great many directions included economics. I have noted previously the lack of debate over the application of games theory to other social phenomena. In the case of economics, the social science test case, there was no debate because games theory was seen to be filling a pre-existing gap in economic theory. Economics is presented as a failed science, and games theory is offering it much needed rigour.

The claims by von Neumann and Morgenstern for their approach are not modest and are reported, rather than interrogated, in the press. Von Neumann and Morgenstern assert the identity of the set of problems which define game-playing and economic behaviour.

> We shall first have to find a way in which way this theory of games can be brought into relationship with economic theory, and what their common elements are. This can be done best by stating briefly the nature of some fundamental economic problems so that the common elements will be seen clearly. It will then become apparent that there is not only nothing artificial in establishing this relationship but that on the contrary this theory of games of strategy is the proper instrument with which to develop a theory of economic behaviour (von Neumann and Morgenstern, 1967: 1-2).

There is a self-evident quality to the presentation, lending it discursive power.

Von Neumann and Morgenstern go on to brush aside social scientists' concerns that the social sciences are much too complex to be rendered sufficiently by scientific methods. They assert that because we have not yet proven that science cannot decide all social questions, "... it would be very unwise to consider anything else than the pursuit of our problems in the manner which has resulted in the establishment of physical science" (von Neumann and Morgenstern, 1967: 3-4). What they do not account for is that if the problem is defined, at the outset as solvable by science, it is very unlikely that science will not work to solve the problem.

Morgenstern, in *Scientific American*, applies game theory to the problem of two manufacturers competing for a given consumer market, considering three different sales strategies (*SA*, 1949a: 24). He argues that games theory is much more successful in addressing this sort of problem than classical economic theory because economic theory assumes only individuals in a free and open market, whereas games theory is able to take account of coalitions. A significant element in the legitimation of the application of games theory to economics, is not merely the unfailing logic of von Neumann and Morgenstern, but rather that it is offered as the logical approach to address complex economic questions, given that traditional economics has failed.

The bolded abstract in *Scientific American* claims, "From it [Game Theory] is being forged a new tool for the analysis of social and economic behaviour. The new approach already has shown its superiority to classical economic theory" (*SA*, 1949a: 22). *Time* magazine describes economists "guesses" as "primitive" and reports that a robot is doing just as well using mathematics (*T*, 1947: 48).

In embracing games theory as a tool with which to explore economic issues, the identity of the game and the economy is assumed. Economics becomes rewritten as a zero-sum equation. "We shall therefore assume that the aim of all participants in the economic system, consumers as well as entrepreneurs is money or equivalently a single monetary commodity" (von Neumann and Morgenstern, 1967: 8). By 1949 when Morgenstern is writing in *Scientific American* the claims he makes for a popular audience are even stronger than those in the original 1944 work, laying the groundwork for much broader applicability for games theory. He appeals to the common sense and shared knowledge of readers.

> The analogy between games of strategy and economic and social behaviour is so obvious that it finds wide expression in the thinking and even the language of business and politics. Phrases such as "a political deal" and "playing the stock market" are familiar reflections of this. The connection between games and these other activities is more than superficial (*SA*, 1949a: 22).

If economics is a game and computers can play games, then it would seem that computers can do economics. Indeed, *Time* magazine claims: "[m]achines have already been built that can learn by experience. ... When the machines get a little brighter, they may learn economic games, such as figuring out the production schedule of an industry or manipulating the stock market" (*T*, 1960: 32). Wiener suggests that "other games" that computers could learn to play include war and the economy (Wiener, 1964: 24). Morgenstern claims, "the problems now being explored [with games theory] include the application of the mathematics for a game involving 7 persons to the best location of plants in a particular industry, the relation between labour unions and management, the nature of monopoly" (*SA*, 1949a: 25).

It is in its economic work which the computer takes on the role of decision-maker. Further, within the discourse, economics takes on a bridging function between the harder sciences and other social sciences. It offers a "test-case" for other social problems. It also facilitates the reading of other social problems as sets of variables which can be known and manipulated. What emerges is a discursive conjuncture of the game whereby machines which can play games can be explained by games theory; games theory can explain economic and other social decision-making processes; and computers can engage, therefore, in economic and other social decision-making processes. The theory is described as "charming," in *Newsweek*, and as being used by the Navy and the Air Force to solve military problems. The move from one kind of "game" to another is facilitated when games theory becomes a generalized methodology. What other social problems share an identity with games, and therefore, can be "solved" by games theory?

7. War (and Other) Games

> *I'm not very happy with most of the applications of games theory because it tends to perpetuate the rules of the game as perceived at a given moment by the players - say, the international game. The problem of the international game is how to change the rules, whereas game theory tends to give us solutions to the question of how not to lose according to the rules as they are now. Nobody knows a thing about changing the rules of the game* (Bateson in Brand, 1974: 28).

Having conquered games of strategy from tic-tac-toe to economics, games theory is treated as a universal methodology in the social domain.[8] Two other social domains emerge, in particular, as discursive threads emanating out of the event of the game. For example, *Scientific American* predicts in September 1952, that "[w]e can expect to see in the future automatic machines which will make decisions in business and military operations by the application of theory of games, developed by John von Neumann and others" (*SA*, 1952m: 147).

The game opens up the conditions of possibility to formulate each of war and business within a language of games, strategy, winners, losers, and decidability. There can be a right and a wrong. The challenges can be quantitatively measured, the variables articulated and weighed, and the most appropriate decision, in relation to the predefined goals, can be taken. James R. Beniger describes this in the following way: "any decision tree of finite length can be duplicated by a finite automaton, thereby equating the question of *decidability* with that of *computability*" (Beniger, 1986: 49). In a circular movement, questions of war and business become decidable because they are computable, and are computable because they are game-like. In this way, the risks of uncertainty can be managed and controlled. *Scientific American* suggests of games theory that "[w]ithin the last few years mathematicians have begun to develop a system theory of 'rational' decision-making in problems involving ... uncertainties" (*SA*, 1955b: 78). War and business pose two such uncertainties.

a. Simulated War

The first and most successful application of ideas from games theory to other social issues was operations research, namely the application of mathematical analysis to the observable data of war. Games theory was also used in flight and other military simulations. Within operations research, humans are read as just one of many variables involved in the zero-sum game of the simulation. The perceived utility of games theory to the military in the Cold War context ensured the continued affiliation of computer and military objectives.

The ever-colourful Norbert Wiener, bitter about his own experiences in the war and very performative of his own refusal to continue military-funded research, seems eager to comment on the implications for game-playing machines for war.[9] He tells *Time* that he

> ... foresees a time when modern pushbutton war will become so swift and complex that only computers can think fast enough to make its strategic decisions. They will train themselves by playing war games, as human general do now, and will figure out more quickly than humans when it seems necessary to push the fatal buttons (*T*, 1960: 32).[10]

A *Saturday Review* editorial speculates on using electronic brains to decide the question of whether there can be world peace (*SR*, 1954a).

It is the very application to strategies of war that facilitates the move to business. Rand, the Research and Development wing of the U.S. Airforce reported to the System Simulation Symposium in 1957:

> [a] real-time simulation approach to man-machine systems fairly heavily depends upon the system being largely an information processing or control system – or perhaps more basically, it depends upon the system's being one that deals with symbols – symbolic representations of things instead of things. Certainly business, management in particular, is in large part manipulation of symbols, and this is becoming increasingly the case in this electronic age. There will of course be limitations in simulating such systems, but in conjunction with the proper analog devices, the general flexibility of the modern digital computer can be expected to solve many of the problems which will arise (Rowan, 1958: 87).[11]

Indeed, operations research moves from the war room to the boardroom, constructing management science as a strategic management of conflict for a favourable economic outcome.

b. <u>The Battlefield of Business</u>

Moving from one "battlezone" to another, the assumptions underlying pushbutton war, are at work in the extension of games theory and computing machines themselves, to the decision-making processes of business. Von Neumann and Morgenstern set up the possibility for this in their claim for the applicability of their approach to all forms of social organization. "We think that the procedure of the mathematical theory of games of strategy gains definitely in plausibility by the correspondence which exists between its concepts and those of social organizations" (von Neumann and Morgenstern, 1967: 43).

In the preface to the third edition of *Theory of Games*, written in 1953, von Neumann and Morgenstern themselves note the spread of their work throughout the social sciences. They cite articles and books published within the field of mathematics, games theory, political economy, economics, and politics, as well as more popular titles such as *Strategy in Poker* and *Business and War*. They note that business management theorist, Herbert Simon is applying mathematical techniques to decision-making – *Administrative Behaviour* (1947) and *The New Science of Management Decisions* (1960).

Paul Edwards argues that games theory was exploited by business because it promised to resolve certain problems previously thought to be insurmountable, such as inventory control and work flow in large factories (Edwards, 1996: 114). "This extension of mathematical formalization into the realm of business and social problems brought with it a newfound sense of power, the hope of a technical control of social processes to equal that achieved in mechanical and electronic systems" (Edwards, 1996: 114). He argues that as this developed in the 1950s and 1960s into notions of systems theory, that it went "… hand in hand with a language and ideology of technical control" (Edwards, 1996: 114).

The game opens up the conditions of possibility for treating business as science, management science. In this process, people, and their labour, become abstract variables to be managed with a view to maximizing economic benefit and minimizing risk. Notwithstanding the immense complexity of the social realm, the game assumes that the "right" decision can be taken. All social organization is assumed then to be goal-driven, to be rational, and to be knowable to science. Computers as smart machines are not only tools in this process – they are models. In order for us to take smart decisions in all contexts, therefore, we need to employ the same decision-making strategies, the same numerical reason as the smart machine.[12]

8. First Round to the Humans

In many ways, the event of the game does not resolve until the 1997 defeat of Garry Kasparov by Deep Blue – finally the machine is "smarter" than the man. However, it is in 1958 that I locate the end of the game for my purposes, because it is then that IBM's 704 publicly plays a "cheerful, soft-spoken young man," programmer Alex Bernstein (*NY*, 1958: 44). The 704 features the first program where the human has to have more than novice chess skills in order to win and the press is invited to the spectacle.

Bernstein describes daily matches between himself and 704 which took place "[i]n a friendly, civilized fashion, like any chess players" (*NY*, 1958: 44). Bernstein reports to *The New Yorker* never having lost to 704, but concedes, "[o]nce or twice, it played so well that it rattled me. I'd actually find myself asking it, 'What the devil are you up to now?'" (*NY*, 1958: 44). Readers finally have the opportunity to "meet" and talk with a person who has played the machine. Scientists are willing to show off their toys.

Even more significant, however, is the feature in *Scientific American* in June, 1958 entitled, "Computer v. Chess Player," featuring, for the first time, a photographic image of Alex Bernstein playing chess with 704. The man gazes thoughtfully at the game board while the machine looms all around him. All the familiar themes are present: chess is an intriguing test of the computer; outwitting one's opponent is equated with thinking; and intelligence manifests in the taking of the best decision based on all known variables. For the first time, it is acknowledged that the computer has won some games. (Incidentally that risk is contained within the narrative.) "We have deliberately chosen [as an example] a game which the machine lost, because we want to emphasize the point that a machine is not infallible and also because it is more instructive to watch the computer lose than to watch it win" (*SA*, 1958: 103). In a foreshadowing of artificial intelligence research, the articles concludes: "some day – not overnight – we may have machines which will improve their game as they gain experience in playing against their human opponents" (*SA*, 1958: 105).

Finally, it is perceived as acceptable to reveal a direct man-machine battle of wits. The 704 is smarter than most chess-playing machines and Bernstein himself is no dummy. The image can be captured photographically and the element of spectacle can creep in. Yet, notwithstanding this risk of the ultimate game, the human prevails, and all is as it should be. The resolution of the game simultaneously confirms the material existence, the undeniability, of the smart machine, but it also confirms, the order of things. Humans still control the smart machine.

9. The game has to be played out

> *The players met, on the great, timeless board of space. The glittering dots that were the pieces swam in their separate patterns. In that configuration at the beginning, even before the first move was made, the outcome of the game was determined.*
>
> *Both players saw, and knew which had won. But they played on.*
>
> *Because the game had to be played out* (Sheckley, 1953: 16).

As is suggested in the short story I quote from above, within the event of the game, "even before the first move was made, the outcome of the game was determined." The outcome, at least, of whether or not the man would beat the machine. But there were other outcomes of these games.

First, the game-playing machine worked to redefine intelligence and in this contest of reasoning ability, it is the human who must adapt to the machine. Notwithstanding the very different "mental" approaches used by the human and the machine to reason, they are both treated as equal, as smart. Intelligence is reduced to reason and reason manifests in behaviour. If the behaviour seems rational, then the being exhibiting it, be it human or machine, is intelligent. Intelligence is measured by result, not process, rendering it an external, rather than internal function. As with the imitation game, reasoning as the only marker of intelligence focuses our gaze on exteriority, leaving interiority invisible. The body is irrelevant to intelligence; it must be because the computer is intelligent and it has no body. This is very apparent in the images of the computer playing chess. Further, intelligence, the ability to manifest reasoned and reasonable behaviour, becomes a necessary and sufficient test of humanity, working with the thinking machine to offer the future computer as the evolutionary successor to the slow-witted and emotional human.

The game defines the social as a field of play, as a game board, rendering all social interaction as moves in the Monopoly game of life. The model is economic at its heart and values self-interested, individual behaviour above all else. The overriding goal is the acquisition of value; the defeat of the other players. Any collective action is contingent and must reward self-interest. Because games are defined as the manifestation of reasoned behaviour, reason becomes privileged as the way of knowing our world. Rationalism becomes the epistemology of the cybernetic imaginary. That which falls outside of reason, ways of knowing which are not rational, are marginalized. Science becomes the privileged method of this rational(ist) world. It applies to all problems which can be submitted to reason, be they a labour conflict, nuclear war, or a marital dispute. Thus, the game, which begins as fun, as a trivial pursuit, as of no importance in itself, can have deadly consequences.

And again, I marvel as I watch a television advertisement for a Nissan Pathfinder whose theme is finding civilization in unlikely places. As the Pathfinder crashes through the woods, ultimately towards a brown bear vigorously singing an aria, it passes a wooded glen, where at a tree stump an owl and a racoon play chess. The game plays on.

VI. The Future

> The future as it is previsioned is one in which cybernetic machines provide the dynamic of progressive change. More importantly, although certain groups – industrialists, technocrats and scientists – are portrayed as the appointed guardians of the new technology, they are not ordinarily viewed as an elite usurping the power to make history and define reality. They are viewed as self-abregnating servants of power merely accommodating themselves to the truths and the future determined as the inexorable advance of science and technology. In modern futurism, it is the machines that possess teleological insight (Carey and Quirk, 1989: 191).

Prologue: Reading the (cyber) future

Hyper-fluorescent orange and yellow, screaming out from the shelf, Wired magazine's first special issue is entitled, Scenarios: The Future of the Future. Wired, tactily and visually stimulating, bible to the cyber-entrepreneur set, was making a mark.

Why the future of the future, and not merely the future? Why Wired? What gave it the authority to map the future? What does this future look like? Whose future is it? Whose isn't it? Finally, how does this attempt to read and write the future relate to other past attempts to do so?

The future is now.

Stewart Brand, co-founder of The Well and the Global Business Network, suggests that as for the future, "things are getting better" not worse. We can think about time in two ways, as wide or long. "Wide time is now, and last week and next week, whereas long time is deep, flowing, and processual. ... The wide view sees events as most influenced by what is happening at the moment. The long view perceives events as most influenced by history. ... Wide time is on the increase these days and for good reason. Technology *seems to be accelerating, and you have to keep up. Networks and markets, instead of staid old hierarchies, rule, and you have to keep up."*

The future is manageable.

Lawrence Wilkinson explores "how to build scenarios," drawing upon the planning strategies of business managers to offer advice on how to manage our futures. "A growing number of corporate executives are using scenario planning to make big, hard decisions more effectively. And it's not just for bigwigs: scenario planning can help us at a more personal level as well." Scenario planning is not about predicting the future, but rather about "helping us make better decisions today." Yet it is a powerful way to understand the future. "It can prepare us in the same way that it prepares corporate executives. It helps us to understand the uncertainties that lie before us, and what they might mean."

The future is knowable.

Wired rates the predictions of other futurists, such as John Naisbitt (American business consultant), Alvin and Heidi Toffler (pop non-fiction writers), Arthur C. Clarke (SF author), Herman Kahn (military futurist), Charlton Heston (star of "Planet of the Apes," "The Omega Man," and "Soylent Green"), and Faith Popcorn (a marketing expert).

The future is unpredictable?

Contributor, Ed Regis, suggests, "People like to make predictions. People love to read predictions. Above all, people love to believe predictions; it gives us the feeling we know *the future. After having written two books about 'the future,' however, one thing I've learned is that the future cannot be known in advance. To know the future, you'll have to wait until it actually arrives." "A prediction is an assertion that the future will turn out in a certain way. But with the exception of matters covered by the hard sciences (including mathematics), the future cannot be known."*

1. Introduction

Writing the future is not new. From science fiction such as H.G. Wells' *The Time Machine* (1895) and *The Shape of Things to Come* (1935), to popular social futurism such as Lewis Mumford's *Technics and Civilization* (1954), to the military futurism of Herman Kahn's *The Next 200 Years* (1976), to the pop-left politics moved right of Alvin Toffler's famous trilogy: *Future Shock* (1970), *The Third Wave* (1980), and *Powershift* (1990), writers and thinkers have been engaged in attempting to capture and predict the face of tomorrow in stories of today. Can the earth sustain its population? Will we be able to control the weather? Will the nation-state continue as the structure of political organization? Can medical science halt the aging process? Will artificial intelligence research produce computers indistinguishable from human minds? Will global warfare destroy humanity?

Research suggests that visions and forecasts of the future are present in the writing of classical antiquity and early Christianity. However, many scholars recognize an historical break in the Enlightenment where modernist writing about the future came to be distinguished by the significant, if not determinative, role played by scientific knowledge in the techniques of prediction. This writing is marked by a conjuncture of discourses of the inevitability of technological progress and the central role played by scientific knowledge and technology in the emancipation of the human condition. Barry Smart suggests that the current notion of the "information revolution" flows out of this tradition of social progress through technological means.

> The idea of an information technology revolution and much of the discussion over the possible emergence of postindustrial forms of life belong in this context, in so far as they represent contemporary manifestations of a view which constitutes one prominent element of the Enlightenment legacy, namely that the development of technical rationality promotes an increasing understanding and control of natural and social phenomena, and in consequence makes possible the cultivation of improved conditions of existence (Smart, 1992: 62).

James Carey and John Quirk agree, suggesting that "... the language of contemporary futurology contains an orientation of secular religiosity that surfaces whenever the name of technology is invoked" (Carey and Quirk, 1992: 114). Technology and technical rationality have played central roles in the various genres of writing and thinking which explore the future. Cast as either hero or villain, technology is inevitably the motivating force of change, the motor of history, across the various institutional sites of futurist writing.

In addition to its imbrication with technology and technological progress, another central aspect of writing the future has been its utopian or dystopian nature – from fears of nuclear annihilation to the various invocations of the term "global village" to represent a utopian communal (and communicative) state of existence. Andrew Ross, in his book *Strange Weather: Culture, Science and Technology in the Age of Limits* (1991), suggests that prior to World War II, writing the future was largely the terrain of the progressive left, which linked an optimism around the social progress attainable through technology with a Marxist-inspired social utopian vision. He argues that there has been a decline or break in Marxist approaches to the future because of the rejection of "... the traditional Marxist historical teleology with its roots in the Enlightenment faith in scientific progress through technical mastery of the natural world's resources" (Ross, 1991: 170). While I agree with Ross that there was, at the very least, a shift in the privileging of left utopian views of the future after WWII, I am unconvinced that this is due to a rejection of an Enlightenment faith in scientific progress, but suggest rather that it is more due to a rejection of the shared goal of human emancipation. Further, where a Marxist historical telos may well be rejected, my research suggests that the telos as a model of historical change was not. A Marxist teleology was replaced by a techno-evolutionary teleology.

It is in the postwar period however, that a new science is identified: futurology.[1] Ross describes futurology in somewhat jaded terms as "... a social science of systems analysis created to facilitate military and industrial planning and fully institutionalized today as an instrument for acquiring strategic military or corporate advantage" (Ross, 1991: 170). Futurology's goal has been the use of systems analysis, computer databases, and modelling to manage and control the future (Ross, 1991: 176). Ross labels this writing as " 'bourgeois' futurism" and includes in the category, both strictly scientific futurologists and liberal popular writers like Toffler.[2] He begins his analysis in the 1960s, however, whereas I suggest that a number of the trends that he is identifying have their roots at least a decade earlier.

It is in the late 1940s and early1950s, I suggest, that the future becomes a know-able object of scientific knowledge and that this process is inextricably linked to the development of computing technology. It is in the 1950s that techno-evolutionism emerges as the model of historical change in the cybernetic imaginary. Carey and Quirk suggest that the future "as an idea" has a definite history and major social implications, one of which is connected to new technologies.

> [T]he future has acquired a new expression in the development of modern technologies of information processing and decision making by computer and cybernated devices. Here the future is a particular ritual of technological exorcism whereby the act of collecting data and allowing the public to participate in extrapolating trends and marketing choices is considered a method of cleansing confusion and relieving us from human fallibilities (Carey and Quirk, 1992: 174).

Carey and Quirk correctly identify the historical relationship between the future as notion and the production of various forms of futurist knowledge. The foregrounding of technology, technical rationality, and ideas of progress remains central to current writing about the future. But how did this unquestioned, yet ubiquitous, terrain of the future come to be established?

2. The Future as Event

It is in establishing a set of relations between past, present and future, with a privileging of the future and the means whereby we can know it, that a teleological move towards a techno-evolutionary understanding of historical change is constituted within the cybernetic imaginary. The future as an express notion appears less frequently in the public discourse than do either the thinking machine or the game. The first two events which I discussed in Chapters 4 and 5, have a metaphorical identity in public discourse which the future does not. Instead, the future is the way that I have named an overall move in the ordering of relations of past, present, and future, drawn out through other metaphors, other figures, but which I suggest forms a central site of contestation nonetheless. It is in the future as event that the relationship between the future and information technology, so taken-for-granted in the recent writing to which I refer above, is established, how certain understandings of temporality become *de rigeur*, how certain authorities become constructed as prophets, and how history is erased as a credible means of knowing the present.

The future as event privileges the future over the past and the present as a way of knowing. In doing so, both the present and the past are rendered less significant and the future defined as the most pertinent domain. The future is named as knowable and central within cybernetics itself. Computers are presented as oracles in the press. The past is erased, in part, as memory is named and redefined within public discourse as a machinic notion, not based in experience. Finally, the computer is situated in the present at an historical rupture point, the "Second Industrial Revolution." The debate which emerges is not whether or not we are within a revolution -- that is assumed – rather, the question becomes, will its effects be positive or negative. The establishing of past, present, and future into this hierarchy speeds up the pace of history, normalizes change, vests historical agency in the machine, and produces what I call technological immanence, being always-on-the-brink of the next great technological leap. This purposive, teleological understanding of historical change comes to stand in for history within the cybernetic imaginary.

In terms of the central cast of this particular event, rather than a specific person, the actors who emerge as the spokespeople, the representatives, and also the creators of this event, are "the prophets." Mathematicians, physicists, other scientists, and emergent computer experts are named within public discourse as prophets. Asked to speak about both technological and social issues, in this role, they become authorized to speak about, and thus write, the future.

In this event, there is no strong moment which emerges to single-handedly distill the whole event. However, there is a moment, produced in public discourse, which is one of the few acknowledged errors made in relation to the circulation of the computing machine and the future. It is the absence of reporting of the 1952 American presidential election results, predicted early in the returns by Univac, but not trusted by her operators or the media commentators covering the election. Although not treated substantially in 1952, this becomes a favourite anecdote of "the silly lack of trust that we had in computers' abilities to predict the future" and thus takes on a discursive power after its occurrence. It reinforces the computer as truthful and serves as a continual reminder of a lack of faith that should not be repeated, the moral of our technological story.

Fourth, the future is mobilized and reproduced through two primary figures – the roulette wheel and the weather – which combine to define the incomplete determinism of the future, as I will discuss. These two tropes produce a public educational process in statistical probability, complexity, and risk. The roulette wheel, representing games of chance, is the simple way that complex notions of statistical probability are articulated in the press. Probability is a strategy to address social complexity, yet complexity is also evoked to describe computing machines, themselves. It is statistical probability that ultimately allows these machines to accurately predict the future and unpack the complexity. Weather forecasting, on the other hand, shifts from art to science and the early success of computer-assisted weather forecasting serves to "prove" the role of the computer in futurology. The weather defines the shifting value attributed to judgment-based expertise as it becomes colonized by science; knowledge production becomes further disembodied. It also confirms the rationalism begun in the event of the game – the computer can use mathematics to replace the "hunches" of human knowledge workers.

Fifth, the circulation of this event, the connections which the future establishes with other discourses, are significant. First, working at potential cross-purposes with a language of historical rupture found in the framing of the second Industrial Revolution, notions of evolution frame technological development as an inevitability, and as inherently progressive. A form of emergent social darwinism begins in the popular and academic press, bolstered by ideas of technological progress. Second, computers become the oracles of industry, offering tools to management to predict outcomes and manage the risks of an increasingly complexified environment. This foretells a dramatic impact upon the work of middle management. What emerges is a techno-evolutionary mindset which bundles computer technology, progress and the future into a model of progressive inevitability. Statistical probability becomes the tool through which to manage the risks of techno-evolutionism.

Sixth and finally, I mark the resolution of the future as an event in the press treatment of the 1956 American presidential election. Reprise a landslide victory for Ike, but this time computers are front and centre, accurately predicting the outcome; even more importantly, they are presented as able and likely to do so. The place of the computer on network television, predicting the future, hours before it unfolds, is normalized by this time. The computer as crystal ball is no longer new, no longer surprising, no longer contentious. It is mainstream media fare. The computer is on a continuum of technological progress and will only become better and better at telling us our future.

3. Knowing the Future, the Past, and the Present

The marking of the future as subject to knowledge, bringing it within epistemology, occurs through three discursive manoeuvres. First, the future is privileged both within cybernetics and its circulation, but also in the naming of computers as oracles. Second, the notion of memory, as commonly understood, is defined within the discourse as a technical element in a computer which permits the computer to be a learning device. Memory becomes a notion of numerical self-correction, rather than of experience, embodiment, or history. Third, the computing machine is situated in a present which is at the heart of what is being called a Second Industrial Revolution, asserting an historical rupture, and suggesting inevitability, progress, and speed.

a. Prediction and Oracles: Naming the Future

Cybernetics, as told by Wiener, Ashby, and others, involved the application of "prediction theory" and of a "statistical approach to communication engineering" to the problem of communication and control in animal and machine systems (Wiener, 1950: 18; see also Ashby, 1956: 1-5). Thus, cybernetics is concerned not only with the future, but with ascertaining methods to accurately predict the future. Wiener acknowledges that the earliest application of cybernetic models, to anti-aircraft artillery during WWII, were concerned with usurping two human functions: computation and "forecasting the future" (Wiener, 1948: 13). With the elimination of improbabilities through the application of statistics, optimum prediction could be produced (Wiener, 1948: 16-17). Wiener draws upon Willard Gibbs' application of statistics to physics which "... had the effect that physics now no longer claims to deal with what will always happen, but rather with what will happen with an overwhelming probability," what Wiener calls an "incomplete determinism" (Wiener, 1950: 18). One reviewer characterized this as "... the change from theories of definite causality to those of statistical probability" (Albu, 1955: 86).

This shift in causality permits the knowing of the future through statistics and ensures, because of its incompleteness, a greater accuracy on the part of the methodology. Causality becomes a circular model of statistical selection, facilitating the later move to an evolutionary model and permitting the liberal notion of choice to enter into the discourse again.[3] Finally, because computers are the best devices through which to conduct statistical analysis, the computer becomes an agent in the future, an agent in history; the machine possesses teleological insight.

Computers are empowered to predict in their naming within the discourse as oracles. The 1950 *Time* magazine cover story on thinking machines opens: "[o]n Oxford in Cambridge, Mass. lives a sibyl, a priestess of science. Her devotees take their problems to her as devout ancient Greeks took their insolubles to Delphi. She is no mumbling anonymous priestess, frothing her mouth with riddles" (*T*, 1950a: 54). She was in fact Bessie, an early computer at MIT. Oracle is the actual name of a computer described in *Science News Letter* (*SNL*, 1953d: 309); Univac is also labelled an "electronic oracle" (*R*, 1954: 4). Finally, in a review of a futurist book, *The Next Million Years*, a reviewer in *Scientific American* writes, "... I am delighted to report on his speculations on the use of high-speed computers as soothsayers. He sees the possibility of calculators which could improve on the performance of the Delphic oracle, not to say poll-takers and military intelligence experts" (*SA*, 1952o: 168).

My critical reading of the writing in the period before the mid-1950s suggests, however, that the use of a language of "oracle" is not always directly in relation to the machine's ability to predict the future. It is sometimes more in response to the fact that the high-speed computing abilities of computers allow scientists to answer mathematical questions, in particular, which were previously theoretically possible, but practically impossible. Prediction becomes the knowing of the difficult, rather than the unknown. Complexity is equated with the unknowable, which can be made knowable. The naming as oracles is significant however, as it implies a relationship with the future; as well, it certainly facilitates the move to read the ability of foretelling not just as seeing into that which is unknown to man, but into the unknown in general, as represented by the future. The language of oracle facilitates a language of prediction, of crystal balls, and of soothsayers, all of which have a purchase on knowing the future.

Interestingly, virtually all periodical articles of more than one page, across all types, and many popular non-fiction books include sections considering the future. Thus, in their very structuring, these texts are creating a relationship, and an expectation between cybernetics, the calculating machine, and the future. For example, *Business Week* suggests, "[t]he future will probably witness ..." (*BW*, 1954a: 82), and like most other pieces, concludes with a section where scientists offer their predictions about future developments. The focus of expert discussion is on the future: "... hardly a week has gone by without a major conference somewhere around the country, discussing the new technology and its implication for the future" (*BW*, 1955l: 78). And of course, many easy claims can be glibly made for the machines of the future. "Computers of the future will leap lightly over such barriers" (*T*, 1950a; 58). The future is named as an important domain, a knowable and fast-approaching domain.[4]

b. Memory: Forgetting the Past

The second movement through which the future is privileged in the event of the future, is through the erasure of the relevance of the past to current knowledge production through the reconceptualization of the notion of memory. Memory, central to the discourse in terms of the machines themselves, no longer functions as a temporal or social notion: time is digitalized. I borrow the notion of digitalized time from Kathleen Biddick (1993). In reference to the digital time read-out of a character's visual display in a science fiction novel, she suggests that "[t]his close attention to digitalized time, which endlessly subdivides the increments of time to their shortest distance, also helps us to forget. Digitalized time collapses time into space" (Biddick, 1993: 52). I suggest that the notion of memory in the future digitalizes time, reducing more complex notions of history into micro-measurements of the present, bringing the future closer, helping us to forget.[5]

The problem of memory is cast as one of the most significant aspects in the development of applied cybernetics. After drawing an analogy to biological beings, A. Ya. Lerner suggests that "[o]rganization of a memory in artificial systems is one of the most important and most difficult problems of communication and control engineering" (Lerner, 1972: 66). In comparing computing machines and the human nervous system, Wiener notes that the concept of memory is relevant to each. "A very important function of the nervous system, and ... a function equally in demand for computing machines, is that of *memory*, the ability to preserve the results of past operations for use in the future" (Wiener, 1948: 142-3). Memory becomes a tool for improved future performance.

Memory is another easily digestible, and instantly comprehensible, metaphor through which to understand the operation of computing machines. Yet it is also another metaphor which produces a reduction in its movement from human to machine and back again. *American Mercury* suggests that the computer has a memory just like a human (*AM*, 1953: 56-7). "They [flip-flop mechanisms] act as part of the machine's memory, retaining information, wiping it out after it becomes useless by 'forgetting it,' and then acquiring new information as the problem progresses" (*AM*, 1953: 57). *Time* suggests that computers "... can observe facts and reach conclusions from their observations. They can store facts in their memories. They can make decisions based on observed facts plus remembered facts" (*T*, 1950b: 68). Computers offer memory "without error or sentiment" (*NY*, 1950b: 139). It is solely on the basis of their inefficient memories that computers are compared unfavourably with humans (for example, *T*, 1950a: 58; *SA*, 1955e: 58-9); better computers are measured by better memories in numerical terms (*SA*, 1952m: 136; *T*, 1949c: 66).

In the reconstruction of memory evidenced in the foregoing, past experience is equated with information in the cybernetic sense. Remembering is reduced to an information retrieval process that is goal-oriented and short term. The sole measure of the value of remembering and memory becomes speed, accuracy, and efficiency, in keeping with the thinking machine as well. This has, however, discursive implications for the construction of the past, present and future. Human sensory perception is assumed to be quantifiable, as are decision-making processes. These characteristics combine to shift memory from a function of meaning-making, or history recording, to a function of performance evaluation, from a function of time, to a function of behaviour in space. Time becomes foreshortened and the past is both quantifiable and, except in its very recent performative nature, not relevant to producing valuable knowledge. We are one step closer to Stewart Brand's wide time, mentioned at the outset of this chapter.

c. A Second Industrial Revolution: Redefining the Present

The future has been privileged, the past erased; what of the present? "The era of automation," as the period from the late 1940s until the mid-1960s is labelled by commentators, is written within this period as a very particular historical conjuncture, a revolutionary moment. Wiener, himself, contributes to this language when he suggests that the notion of feedback and the invention of the vacuum tube have enabled a "new automatic age" on the order of a "Second Industrial Revolution" (Wiener, 1950: 207-8). Wiener's books are reviewed with such titles as "The new automatic age" (Rolo, 1950: 186) and "Come the Revolution" (*T*, 1950b: 66). The *Time* review of *Cybernetics* devotes a majority of its analysis to the framing of the book as predicting and mapping a second industrial revolution (*T*, 1948: 45). Wiener was widely quoted for his description of "the modern industrial revolution" (*T*, 1948: 45; *T*, 1950a: 55; *NY*, 1950b: 140; *F*, 1949: 116). By association, cybernetics becomes a "revolutionary" knowledge (*T*, 1950b: 66).

The computing machine is at the heart of this revolution as both cause and symbol. *Fortune* claims, "[t]he automatic digital computer is currently the highest expression of man's mechanization of mental function. As such, it is the most profoundly significant symbol of the second, industrial revolution, which is on the way" (*F*, 1949: 118). Harry M. Davis in his appraisal of computer technology for *Scientific American* in May 1950, opens his article with the following:

> [a] new revolution is taking place in technology today. It both parallels and completes the Industrial Revolution that started a century ago. The first phase of the Industrial Revolution meant the mechanization, then the electrification of brawn. The new revolution means the mechanization and electrification of brains (*SA*, 1950b: 29).

Fortune agrees noting that the first industrial revolution impacted upon musculature, while the second is reworking senses, nervous systems, and brains, evidenced by the development of thinking machines (*F*, 1949: 117). Science and business are figured as authorities for this new era. The President of IBM, Thomas Watson, Sr., is quoted as naming the advent of the computer the second industrial revolution (*T*, 1955: 81). *Business Week* asks of computers, "[a]re they the next big step in the industrial revolution?" (*BW*, 1949a: 38). Although the question is occasionally asked, it is not really debated within the discourse.

The fact of living a second industrial revolution in the present very quickly becomes a background assumption and introductory context for many articles exploring cybernetics and computer development (for example, Starr, 1950: 15). *Newsweek* notes that "[a]t least three technical journals have sprung up within the last year to cater to a growing interest in what one expert has called 'the second industrial revolution'" (*N*, 1954: 59). The *American Mercury* recognizes "... the promise of another industrial revolution, a revolution that may affect our civilization more profoundly than the steam engine or the atomic bomb" (*AM*, 1953: 53).

Business Week, in its special issue on automation, considers the "rather nebulous concept of a Second Industrial Revolution" (*BW*, 1955l: 88). The nebulous-ness referred to is one of semantics only, however. The authors accept that a period of rapid historical change is underway, and that the computer is at the heart of it; they are merely uncertain how to name it. The positions of a variety of specialists, from scientists, to technicians, to social scientists, to businessmen are reviewed. However, the question is not whether or not there *is* an industrial revolution taking place but rather, what will be its effects.

The most immediate effects of the second industrial revolution are upon the workplace and the workforce. Wiener, in his chapter entitled, "The First and Second Industrial Revolution," in *Human Use*, highlights the impact of automation on the workforce (Wiener, 1950: 136-162). In other sites there is also a flurry of writing exploring the impact of computers in terms reminiscent of issues posed by the historical interpretation of the first industrial revolution. According to *Business Week*, scientists and technicians are optimistic, social scientists go both ways, and business is on the fence. The language of a present revolution is continually reinforced, notwithstanding that the article is attempting to present "both sides" of the issue. David Rubinfien of Armour Research Foundation is quoted: "[a]utomation is the promise of a second or third or even final industrial revolution" (*BW*, 1955l: 80). Rubinfien's view is shared by the other businessmen quoted as experts. Wiener's voice is the sole negative opinion and appears on the first page, to be drowned out by the positive counter opinion by the end of the lengthy article. Again, not one position questions the fact of an industrial revolution, however. The lack of debate presents the second industrial revolution as a *fait accompli* within public discourse.

> People who keep a thoughtful eye on the trends of U.S. technology can see the signs of this second industrial revolution: The rate of technical change is increasing. The changes themselves are becoming more fundamental; they introduce [novelty] ... rather than simply improve old processes (*BW*, 1949a: 38).

This view of the present as a moment of revolution, and in particular, technological revolution combines with the framing of the future and the present to produce several implications for the construction of the future in the cybernetic imaginary. First, it embraces and normalizes change. There is a sense of rapid speed and of impending massive social change, not all of it good. Embodied in these claims is a surrender of human agency in terms of the ability to control, or even critique technology -- the best we can hope to do is predict it. Second, the past, history, and memory are rendered instantaneously irrelevant to an understanding of the present and the future because of the qualitatively distinct nature of the present. The larger historical moment of post-World War II America is not irrelevant to the conceptualization of an historical rupture, the dawn of a new era. Finally, the "second industrial revolution" entrenches technology as the effective motor of the future. Thus, both technology and technological change become a ubiquitous and unquestionable terrain of present and future, outside of history.[6]

Jennifer Daryl Slack in an article entitled, "The information revolution as ideology," suggests that the information revolution posits information technology as responsible for bringing about a new social order. This process is often linked, as I have demonstrated, with the first industrial revolution; it is offered as the next logical development (Slack, 1984: 251). Revolution is linked with progress, as my research demonstrates, rendering it outside of our control, outside of our engagement. Slack agrees stating that the information revolution "... arises autonomously to bring about a society that is fundamentally different in that it has progressed fundamentally. The information revolution is simply the next marker in the steady march of progress" (Slack, 1984: 252).

This linking with progress and the sense of both speed and inevitability work together to produce, as a key characteristic of the cybernetic imaginary, the effect of *technological immanence*, namely the sense that through technology, the future is closer than we think. The future is now. Technological immanence captures the sense that the technology is here, it is having effects, and it cannot be stopped. For example, a *Business Week* articles notes: "[t]he future will probably bring automation with moderation. As the *Monthly Labour Review* recently put it, automation will not sweep over industry like a tidal wave. Rather, it will come as a series of ground swells hitting different industries at different levels at different times. But it's coming" (*BW*, 1955l: 102). There is a sense of immediate technological obsolescence (see *NR*, 1947) which has echoes to this day. The *New Republic*, as early as 1947, suggests: "[b]ut with so many scientists feverishly dreaming up new machines, ENIAC, with its paint still fresh, and eager to work at the proper bidding, is almost ready for the junk heap – obsolete and outmoded" (*NR*, 1947: 14). Or *Scientific American* in 1950 suggests: "[i]t became clear that every calculator now in operation will soon be as outdated as an earphone-and-crystal radio compared with the frequency modulation-television models of 1949" (*SA*, 1950b: 39). Technological immanence shifts the terrain of the debate. It is not whether or not we are living in a second industrial revolution, nor what are the implications of its framing this way; the issue becomes how to manage its effects, primarily upon the labour force. The future is almost upon us, the pre-revolutionary past cannot help us, and the present is always future-looking, never paused, always in motion.

4. The Post-Industrial Prophets

> *The scientist did not just look to the future, however, but was also a prophet, a fantastic Tiresias whose eyes were said 'to see much more than you or I' and who could thereby identify discoveries not yet made* (LaFollette, 1990: 75).

The second characteristic of any event, the individual or individuals who take on the status of its promoters within public discourse, is central to the construction of the future. The spotlight turns, in this instance, however, not to a particular individual or individuals who are named, but rather to a category of individuals -- scientists as prophets, and in particular, rational prophets. No toothless hags in circus tents, these visionaries. Within public discourse science is validated as a knowledge form which is privileged to speak to us about our future, not only our future as influenced by science. This is reflected in a language of prediction and of prophesying in the presentation of scientific expertise. Scientists emerge as a group privileged to see our shared future. Their "guesses" are given credibility through reinforcement and framing in public discourse.

"Imaginative scientists can only guess at what other mental marvels its more efficient descendants will be able to produce," suggests *Time* magazine (*T*, 1949c: 66). At the end of an extended *Newsweek* cover story on computer automation in government, "the scientists" are asked to speak about the future and to make predictions about labour (*N*, 1956a: 23). Scientists are fearless; "[e]ngineers and designers are generally optimistic, unafraid of the future" (*BW*, 1955l: 78). They are almost magical -- a scientist is quoted in *Newsweek*, who, in addition to weather prediction, has "made some other fantasies come true" (*N*, 1947a: 56).

Wiener is said to have predicted the cybernetic revolution (*T*, 1950c: 66-7 and *NY*, 1950b: 140). He is a prophet vis à vis the technology as well. *Business Week* suggests, "... what will interest the businessman most in Wiener's book is the light it throws on the likely direction of technological change" (*BW*, 1949a: 42). William Kuhns, in his chapter about Wiener, interestingly titled, "Engineering the Future," confirms my research findings that the publication of *Human Use* made Wiener, "... an important figure in interpreting the coming implications of the computer" (Kuhns, 1971: 214-15). Reviewers seized upon Wiener's futurist claims in particular (for example, *T*, 1948: 45; *C*, 1950: 512). *Time* in 1950 refers to him as a "prophet" (*T*, 1950c: 66) and finally, both Wiener and Howard Aiken are set up as authorities on the future by Fliegers in *The American Mercury*. They are asked, and thus authorized, to comment on the future in general (*AM*, 1953: 61).

But it is not only Wiener nor even Wiener and Aiken; the discursive movement is broader than one or two individual scientists. Wiener and Aiken are only examples of the larger phenomenon. The future is clearly an uncertain time – who can lead us into it? "Where then, is the leadership to be found? Not among the backward-looking man of 'culture,' not among the uncaring technicians," but rather in the scientist, claims the *New Yorker* (*NY*, 1950b: 141). The scientists are the only ones with sufficient expertise to be able to figure it out. The attempts by other knowledge producers to predict the future and guide society are mocked; hard sciences are privileged over social sciences and humanities, ironically, within the same language of prediction.

> The crystal ball set – economists, sociologists, and free-lance writers – are split right down the middle. The more publicity-conscious prophets have let their imaginations run wild to produce ghastly science fiction, underscoring the horror of lost jobs and predicting machine control of people. Other forecasters blithely skip over any short-term snags to concentrate on a vision of an age of plenty far in the future. Either way, they tend to scare people (*BW*, 1955l: 78-80).

It is this framing of what is valuable expertise and knowledge that I find most pertinent. As Carey and Quirk note, drawing upon Innis, certain monopolies of knowledge develop, in this case, one which I suggest locates science as the privileged knowledge to write our future. And of course, the future scientists write is very particular.

> Armed with the techniques of modern science ... a secular priesthood seized hold of the idea of a perfect future, a zone of experience beyond ordinary history and geography, a new region of time blessed with a perfect landscape and a perfection of man and society (Carey and Quirk, 1992: 173).

The future scientists write reflects the triumph of rationality, of moderation, and of automation. Humans will be freed of the tedious tasks which shackle them and humanity will benefit from the resulting leisure and released creativity. The future will be one where science heralds one grand development after another.

LaFollette argues that a sense of expectation develops around science in the immediate postwar period, a sense that big things are to come. She suggests that this sensibility is reproduced in six ways that are also confirmed by my research. First, the repeated discussion of successful research and an absence of questioning of methodology reinforces science's cultural authority; I found this to be true as well, even within science journalism. "Second, each time they failed to question a scientists' claim to universal expertise, journalists inadvertently strengthened the social prestige of all scientists" (La

Follette, 1990: 172). Even further, my research suggests that scientists were invited by journalists to take on this role. Third, science becomes presented as useful knowledge, powerful knowledge. This is evidenced to a significant extent in the figure of the weather, which I discuss subsequently. Fourth, describing scientists themselves, as different, serves to legitimate their authority. My analysis and LaFollette's suggest that the role of prophet is a common one.

Fifth, she notes that there is the suggestion in the discourse that scientists are motivated only by altruism or intellectual curiosity, not power, money, nor glory, and that as a result, they appear trustworthy. In my research, it is always intellectual curiosity driven by a desire to produce something useful for society which is the stated or implied motivation for research. Sixth and finally, LaFollette suggests that the omnipresence of science in all aspects of popular culture serves to legitimate its importance to society (LaFollette, 1990: 172). This would seem to be confirmed by the rise of pulp science fiction and popular science magazines at this time (Corn and Horrigan, 1996).

The effects of the tendencies LaFollette identifies in relation to scientists also accrue to science, itself. Scientists, and hence science, are privileged not only to speak about the scientific or technological aspects of our society, but about all social phenomena. Science becomes a more generalized social expertise, a cultural disposition which continues to this day. As Carey and Quirk suggest, "... modern scientists use their capacity to predict the behaviour of narrow, closed systems to claim the right to predict and order all human futures" (Carey and Quirk, 1992: 174). Yet this is not a mystified process relying upon the internal or inherent validity of certain scientific methods, nor of cybernetics, as is suggested by certain cybertheorists; it is a discursive process which can be mapped.

5. The Moral of the Story

The failures of science or of scientists are and were rarely made public knowledge. Notwithstanding that within scientific knowledge production failures are more common than successes, it is the successes which are news. Perhaps that journalistic tendency explains the "non-story" of Univac in the 1952 American presidential election, a story which subsequently took on mythical status in public discourse.

In the 1952 presidential election, the farsighted CBS television network decided to augment its coverage of the election returns by renting time on the newly released Univac in order to better predict the election outcome. Univac was in fact retained and was prepared to take on this task of predicting the future.

> No human mathematician who valued his good name would have dared to predict the outcome on the strength of such fragmentary data. But the Univac, an electronic 'brain' put together by engineers of what is now the Sperry-Rand Corporation had been hired by CBS-TV for the express purpose of sticking out its mechanical neck (*SR*, 1956a: 45).

And stick out its mechanical neck, Univac did. In fact, very early on in the race, the machine predicted 100 to 1 for Eisenhower, contrary to the polls and the opinions of the political commentators at CBS. So unsure were the experts of Univac's abilities that its claims were not broadcast to the public at the time; they were made public only much later in the evening when it was apparent that Eisenhower's victory was assured. Interestingly, as I note in Chapter 4, this did not emerge as much of a media event at the time, perhaps because of the embarrassment of the participants, perhaps because it was still relatively early in the use of computers for social behaviour predictions.

Yet what makes the 1952 presidential predictions by Univac a key moment within the event of the future, is the story's subsequent retelling as a cautionary tale of human lack of trust of machine intelligence. "No one in the TV Studios had enough faith in the machine to give its answer to the public. Not until midnight, when the magnitude of 'Ike's' victory was clear from the fuller returns, did the human announcers concede with chagrin what a marvellous guess the robot had made" (*SR*, 1956a: 39). Within humanist journals such as *Saturday Review* and *The New Yorker*, in particular, the 1952 election "fiasco" becomes an amusing anecdote which has the discursive effect of reinforcing the power of the computer, and the fallibility of humans. Univac is confirmed as able to predict the future, and to do so better than its human operators. We should have trusted the machine.

Lending confirmation to the mythical status of this anecdote, it is retold forty-four years later by Theodore Roszak in bemused tones in his book on the folklore of the computer.

> At CBS election headquarters, the esoteric machine, which the anxious electrical engineers were coddling like a spoiled child, was regarded as a mere sideshow attraction. So when UNIVAC, drawing upon a mere 5-7 percent of the popular vote, began projecting a landslide for Dwight Eisenhower, the CBS experts refused to report its prediction. The worried technicians then agreed to adjust the machine to keep it in line with the network pundits. Still UNIVAC insisted on an Eisenhower sweep, even in the solid Democratic South. Finally, when its predictions proved accurate, the experts conceded publicly, confessing that UNIVAC had indeed outguessed them and that the machine's apparent inconsistencies that night were due to human interference. UNIVAC had predicted an electoral vote for Eisenhower of 438; he finished with 442, within one percent of UNIVAC's startling prediction (Roszak, 1986: 7).

Clearly the legend lives on.

I suggest that a significant effect of the "non-story" of Univac's 1952 success is that the computer emerges not only as soothsayer, but also as truthsayer. The experts were faced with competing knowledge that fateful night; it was the computer, and not the human experts, that spoke the truth. This lends a certain character of infallibility to the machine, limiting the potential to challenge it, but also suggesting that numbers, the medium of the machine's predictions, do not lie.

6. Managing Complexity

> *Those who are able to harness science itself, and direct it to their own ends, have gained considerable advantage. For them, the competitive task of anticipating the future has become easier since they now have the means for determining the future themselves. So it was with the alchemists of the late nineteenth century, and their successors of the twentieth, who undertook to transform science into gold and, in the process, gave rise to modern science-based industry* (Noble, 1977).

The two discursive figures that do the work of the event of the future to refine its meanings and implications are the roulette wheel and the weather. It is through these two tropes that a public education process takes place. Computing technologies and the world around us are cast as very complex, and increasingly so; probability becomes the way to understand and manage this complexity. Through techniques of probability analysis, that which was previously too complex to know, can be subjected to the methodologies of science. It is in this way that the risks of complexity can be managed and controlled by science. As Ed Regis suggests in *Wired* at the beginning of the chapter, "[b]ut with the exception of matters covered by the hard sciences (including mathematics), the future cannot be known." What is produced in the tropes of the roulette wheel and the weather is the outline through which we can define the "matters" which can be predicted.

a. Roulette – Counting the Uncountable

> *Chance can help us to count things that can not actually be counted* (Scheid, 1993: 131).

While the event of the game dealt with games of strategy, the roulette wheel in the event of the future, figures games of chance, where one is playing not against an opponent, but against the odds. The historical relation between games of chance, probability, and the future is commonly recognized.

> The art of taming chance with the 'quantification of the possible' with *probability* theory or *stochastics* (the art of predictions) have earned their current, important position in society by serving as tools to produce prognoses about possibly future events. But they have developed from questions that were raised in games of chance ... (Scheid, 1993: 130).

The roulette wheel and games of chance become the means by which probability, a relatively complex mathematical concept at the heart of computer "prediction," is explained to the public. Cybernetics as a theory of statistical probability and computers as probabilistic devices then work together to figure the causality at the heart of the cybernetic imaginary, incomplete determinism.

Scientific American emerges, in particular, as almost single-handedly conducting a public education process on probability. Warren Weaver writes a landmark piece for the journal in which he recognizes the gambling history of theories of probability and uses the roulette wheel as a visual image to explain its basic concepts (*SA*, 1950d). "Three centuries ago some sensible questions asked by gamblers founded a branch of mathematics. Today it powerfully assists our understanding of nature" (*SA*, 1950d: 44).

Weaver claims that probability is the very guide of life and employs metaphors of dice-throwing and gambling, suggesting it has since surpassed its disreputable origins. He argues that a large body of theory has been developed on the basis of a mathematical definition of probability, and notes its applicability to voting and sales (*SA*, 1950d: 44).

"The Monte Carlo Method" is presented through the imagery of the roulette wheel. It "... is used to predict the outcome of a series of events, each of which has its own probability. Here it is outlined in terms of neutrons, needles, roulette wheels, and furniture" (SA, May 1955: 90). The name of the method arises from work during the war by von Neumann and a Russian scientist who used a roulette wheel to come up with a particular mathematical solution; von Neumann code named it Monte Carlo during his secret work at Los Alamos. "The Monte Carlo method was so successful on neutron diffusion problems that its popularity later spread. It is now being used in various fields, notably operations research" (*SA*, 1955f: 90). The article predicts: "[i]t is safe to say that we shall hear more from the Monte Carlo method in the next few years" (*SA*, 1955f: 96).

While the Monte Carlo method per se does not circulate widely in the discourse, the roulette wheel does. Scientists suggest that the roulette wheel can be simulated by a computing machine, rendering computers an important tool for answering other questions of the future.

> With the Monte Carlo method high speed computers can answer such questions as these: How should the schedule be changed to accommodate a market change demanding twice as many chairs as tables? How much could the shop produce, and at what cost, if one man should be absent for two days? How much would the total output be increased if one man should increase his work rate 20 per cent? Under a given schedule of work flow, what percentage of the time are the men idle because the work is piled up behind a bottleneck machine? If money values can be assigned to idle time, loss of orders due to low production and so on, dollars-and-

cents answers can be given to problems of this kind in business operations (*SA*, 1955f: 94).

The Monte Carlo Method or the roulette wheel is used when a problem depends in some way upon probability and a physical experiment or exact calculation is impossible (*SA*, 1955f: 94). Thus, when something is very complex, as are the situations above, it can be submitted to probability analysis.

The implications of probability are significant. *Saturday Review* tells readers that we must look to the "intelligent correlation of chances and probabilities which together total human well-being" (*SR*, 1956a: 46). Weaver notes: "[p]robability theory has also been most fruitfully applied to series of dependent trials – that is, to cases, such as arise in medicine, genetics, and so on, where past events do influence present probabilities" (*SA*, 1950d: 45). A number of things are subject to probability analysis because they are so complex – inheritances, inner processes of communication, time, etc. (*SA*, 1950d: 46-7). Thus chance events, random occurrences, can be predicted, with incomplete determinism, in order to be managed. Probability theory, and the computing machines which use and embody it, are tools with which the risks of randomness can be identified and then controlled.

b. Weather: The Science of Prediction

The *proof* that probability theory works, that situations previously too complex to understand can be unpacked, predicted, and thus controlled, is found in meteorology, namely in the forecasting of the weather. Virtually every claim made about the prediction of the future in public discourse is connected to the weather, particularly in popular science newsmagazines. It is interesting to see that the only other claims to prediction pertain to industry and business. Examples are plentiful: "Weather on Order" (*Newsweek*, 1947a), "Machines Predict What Happens in Your Plant" (*Business Week*, 1948b); "Will Forecast Weather Routinely by Brain" (*Science News Letter*, 1954b); "Computers Predict Rain" (*Science News Letter*, 1954e); "Predict Hurricane Paths?" (*Science News Letter*, 1954); "Weather by Giant 'Brain'" (*Science News Letter*, 1953d); "Electronic Computers to Forecast Weather" (*Aviation Week*, 1954e); "Business Predicter" (*Business Week*, 1948a); "Oil Field Fortune Teller" (*Popular Mechanics*, 1946); "Predictions by electronics" (*Scientific American*, 1947); "Machines do tomorrow's thinking" (*Coronet*, 1950); "Brains forecast weather" (*Science News Letter*, 1952); "Mechanical brains to relieve tomorrow's executive planning" (*Financial Post*, 1957); and "Machine predicts weather" (*Science News Letter*, 1952).

The weather is represented as a domain of chance, regularly outside the scope of human control. Humans can collect data about it, but cannot yet predict it. Enter the computer. Computers are able to manipulate the scores of available data in order to offer a more complete analysis. This analysis is then figured as a prediction. *Newsweek* notes that, computers are assisting in forecasting the weather through their superior computing abilities (*N*, 1947a: 56). Again, the size of the numbers is meant to impress.

> Von Neumann's calculator is now being applied to problems in meteorology. It is making 24-hour forecasts of the general weather patterns .... In doing this the machine considers weather data from 361 grid points over North America and Performs some 1,660,500 operations on the figures to obtain an hour by hour prediction (*SA*, 1952c: 36-7).

In public discourse, weather prediction becomes one of a long-line of skills that computers can do (*N*, 1946: 76; *SA*, 1950b: 30). "Already, computers are checking some U.S. income tax returns; testing designs for nuclear weapons; forecasting the weather;

determining low bidders on Army contracts; compiling census results; and telling the Air Force how to put in effect its ultra secret war plans" (*N*, 1956a: 21).

This ability to manipulate data for forecasts is treated as prediction, staking a claim on the future. "Then he [the meteorologist] would set the machine running into the future to see how each of these changes would affect the weather for the next few days . . ." (*N*, 1947a: 56). Weather emerges as instant proof of the computer's abilities to predict the future (*SR*, 1956a: 45; *SNL*, 1954e: 358). A computer named ORACLE is at the heart of "[p]lans now [being] made for daily use of electronic computer as an aid in predicting weather" (*SNL*, 1953d: 309). This ability to predict is also revolutionary. "Using electronic computers is a revolutionary method in numerical weather prediction. . . . The system is so new there are comparatively few experts on it in the world. Yet it is so promising that government weather officials have completed plans for its trial . . ." (*SNL*, 1953d: 304).

The weather, as something we all experience, has potent discursive power. Again, as with the computer oracles, the computer is analyzing data otherwise too complex to use effectively. Thus, quantitative analysis is lent the mystique of prediction. The future is rendered knowable through statistical analysis and mathematics. It is interesting within the discourse, that the success rate of the computer's predictions are not evaluated, only its projected ability. This absence permits the comparison of the human and machine forecaster, to the detriment of the human, without the proof of the results. Again, the computer is assumed to speak the truth.

Figuring the weather as a science moves it from uncertainty to certainty, from an art to a "true" science. The knowledge and experience-based expertise of the weatherman is devalued. The weather is too complex for mere humans to know. The machine's superior computing ability allows it to clarify this complexity. This notion of complexity is then mobilized within the discourse to permit the use of probability-wielding computers to address other social issues.

First, existing weather forecasting is demonstrated as an outdated, almost quaint knowledge. In a section entitled, "The Promise of the Future" in a 1947 piece in *New Republic*, the author notes "[w]eather forecasting is a prime illustration of a science yielding vague, unsatisfactory results" despite the fact that the laws which govern it are certain (*NR*, 1947: 18; see also *T*, 1955). *Newsweek* concedes,

> [t]he best the weatherman can do today, and not always that, is to predict what's ahead in the way of heat, cold, rain, or snow. Storm warnings are issued, for example, whenever a hurricane approaches Florida. Then it's a matter of cancelling flights, detouring ships, nailing up shutters, and hoping for the best (*N*, 1947a: 56).

Weather forecasting is described as an art, subject to subjective experience and judgment and with computers that subjectivity can now be eliminated. "In making forecasts at the present time, weathermen rely heavily on the skill and knowledge they have acquired, during years of practice, to make their predictions as accurate as possible" (*SNL*, 1953d: 309). Others are even less generous: "[p]reviously, weathermen's predictions of amounts of rain or snow have been pretty much educated guesses" (*SNL*, 1954e: 358). Computers, however, can make this knowledge objective. "One numerical forecasting expert now foresees that high speed 'brains' will eventually eliminate most of the forecaster's personal opinion from his prediction" (*SNL*, 1953d: 304).

Does this incredulous quantification sound familiar? "If, for example an expert meteorologist were to start on February 20 to analyze fully all the observations and facts bearing on the weather for Washington's birthday, he might be able to make a perfect forecast for Feb. 22 – by the Fourth of July" (*N*, 1947a: 56). The *New Republic* offers a similar example. "If the weatherman had to make calls based on all the available data, instead of predicting 'warm and rainy tomorrow,' he would have to say, 'It rained 4 years ago on the 12th of May – just as I would have predicted had I finished my calculations in time'" (*NR*, 1947: 18). Through these sorts of claims, both the computer and probability analysis are legitimated at the expense of the knowledge worker. Objective calculation replaces subjective knowledge in the quest to know the future – the triumph of technical rationalism.

Weather prediction is more than a guide to the likelihood of rain at a picnic, however. The claims for the computer become progressively more dramatic. The chance associated with the weather, renamed as risk, can be managed and perhaps controlled in the future through these techniques.

> The weatherman of the future may keep the storm away. When he gets word of an incipient disturbance off West Africa, where the tropical hurricanes that hit Florida are born, he may send out tankers to spread an oil slick over some square miles of the ocean. Then the oil will be set on fire so that the heat, rising up through the air, will break up the hurricane before it can start its whirling pilgrimage of destruction (*N*, 1947a: 56).

Computers can be used to help meteorologists forecast the paths of hurricanes, and perhaps even their formation (*SNL*, 1954d: 211).[7] Knowing the future very quickly becomes controlling the risks of the future. It is not enough to eliminate chance through objective calculations alone; chance is a risk, a risk which must be contained. Knowledge of the risk gives us the ability, and the right, to control it.

7. Techno-evolutionism as Social Temporality

The roulette wheel and the weather designate the future as a know-able domain. It is clear that the only way to understand the complex present and control the risks we currently face is through the application of probability and the use of computing machines; only in this way can we know the future. These interrelated connections between complexity, probability, and the future make possible two other discursive moves, which I will allude to briefly in this section: evolution and industry oracles. In turn, these discursive filaments have a recursive effect on the event itself, continuing to privilege the future, at the expense of the past and present.

a. Evolution

> *To maintain its evolutionary logic, techno-futurism has to separate itself from the echoes of its own history. Evolution thus remains a powerful and magical instrument* (Berland, 1997: 3).

There are implications of evolutionism in the treatment of the machine as man's evolutionary successor in the events of the game and the thinking machine. There is also strongly overt evolutionary language which emerges in the event of the future, serving to forge a notion of progress to its incomplete determinism. What results is an evolutionism integrally connected with computers – a techno-evolutionism.

The early reliance upon physiological metaphors for understanding machine systems and their conjuncture with predictive statistical analysis leads Wiener to draw parallels between systems and the process of "natural selection" or "survival of the fittest" (Wiener, 1948: 53-5). In the public discourse of cybernetics, evolution is evoked as a metaphor or a model of a self-correcting system of statistical selection. In some science writing and most popular journalism, the notion of evolution is employed in another way. Evolution refers to changes in machines themselves; it legitimates the notion of survival of the fittest; and characterizes the human-technology relationship as a progressive continuum, driven by technological advance.

A 1955 article which opens with the question, "[i]s man no more than a machine?" concludes with a section entitled, "The Genetic Tail" and queries "could such machines go through an evolutionary process?" (*SA*, 1955e: 58, 67). Some commentators take the perspective that men and machines are evolving together. *Time* magazine speculates that "[p]erhaps the computing machines, by lifting more of the thinking burden, will prove a last step in the long, slow process of mental collectivization" (*T*, 1950a: 64).

Evolutionism also manifests in the use of a terminology of heredity and family in the anthropomophization of the computer which I discuss to some extent in Chapter 4. One correspondent feels that the easiest way to explain the workings of the thinking machine is through the metaphor of a father telling his children about the facts of life. Computers are repeatedly referred to as scientists' "babies" (*AM*, 1953: 56). One of the first computers at MIT is characterized as a "mother," "not the brightest of her breed," a "sort of mechanical Eve," and her "descendants" are referred to as "children and grandchildren" (*T*, 1950a: 54). Another machine is described as a "mutation in this evolutionary line" (*SA*, 1950e: 40).

Techno-evolutionism shapes the future in a very particular way. First, the notion of historical manifest destiny is present, the inevitable and inexorable progress towards something better, a long-standing trope in futurist writing. Second, this manifest destiny is also technological; machines are evolving alongside humans. A notion of agency, of vitality, is thus attributed to computer technology. This vitality differs from that previously attributed to mechanical machines, precisely because it is marked within evolutionary language. Computers are figured on the same evolutionary path as humans. Thus the futures, ours and the machines,' are inextricably bound on a progressive continuum.

Jody Berland writes eloquently about the effects of techno-evolutionary discourse.

> The conflation of human evolution and technology is particularly successful, for it not only helps to envision electrifying futures but also effectively displaces alternate strategies for imagining our futures. Techno-evolutionist speculation is ideal for this displacement because it posits the technological imperative as coming from somewhere outside ourselves, outside of human culture, through a self-generating evolutionary progression rather than from the culpable logics of our own social system. The logic of autonomous technological change ... now possesses a largely unchallenged authority in political discourse, commerce, and the farthest reaches of cultural myth (Berland, 1997: 4).

She argues that this vision of the future as evolutionary reproduces a form of social Darwinism (Berland, 1997: 11). In my research, strands of social Darwinism are present, particularly in the mid-1950s in the social science literature embracing cybernetics. For example, one sociologist argues, "[a]n open system, whether social or biological, in a changing environment either changes or perishes. In such a case, the only avenue to survival is change" (Cadwallader, 1959: 155). Berland recognizes that a vision of the future necessarily implicates a vision of the past and of the present. "Just as images of the future have imperialised the present as we live it, so the discourse of technological evolutionism has imperialised the future as we imagine it. This discourse, like the technologies it promotes, forfeits collective memory for a fantasmagoric future" (Berland, 1997: 6). The history of that fantasmagoric future is found in the 1950s.

b. Oracles of Industry

In management circles, the consensus of opinion holds that the future will take care of itself as the past has done (*BW*, 1955l: 99).

A second domain into which the future seeps is industry and management. Through parallels drawn between the complexity of the weather and business, the conditions of possibility are created for the embrace by business of not only the second industrial revolution, but of probability techniques and management science as means of managing complexity and controlling risk. These processes are always, of course, led by the technology. "Electronic computers are rapidly becoming the oracles of industry. As machines and processes become more complex, problems can become too involved for quick solution by old methods and too vital for trial-and-error testing" (*T*, 1954b: 44).

In an article entitled, "Brains and Calculating Machines," the *American Scholar* notes: "[b]ut new computers, already built or under development, will be able to prepare the same [weather] forecasts within a day. They will also solve similarly complex problems in atomic energy, aircraft design, census analysis, insurance, economics, and many other fields" (*AS*, 1950: 22). The weather becomes the quintessential complex problem which can be solved with probability theory.[8] This notion of complexity, as figured by the weather and its submission to prediction science, comes to define the field of what can be predicted and managed through probability theory.

Complexity underlies many different problems. Market research is one of the early terrains of the unknown to be conquered in the ongoing quest to predict the fickle behaviour of customers (*T*, 1954b: 45). Yet other problems can also be solved.

> The [computer] may be concerned with predicting the market for a new soapflake, determining the most efficient loading schedule for a factory machine, studying the response of living organisms to the physical laws that govern combustion engines, ... applying mathematical theories of combination to the inheritance patterns of the genes, or using the laws of chance to help solve psychological problems of individuals and the community problems of slums, traffic jams, and juvenile delinquency (*SR*, 1956a: 46).

In *Business Week*, 1948, in an article entitled "Business Predictor," the Univac is claimed to compute the chances of success in a new business in a given community. "Univac, a high-speed electronic computer to be installed at the Bureau of Census, will be able to do a crystal-gazing job for almost any business venture you contemplate" (*BW*, 1948a: 75). Thus, any situation which is deemed complex, or which has unknown quantities, can be subjected to statistical probability analysis, can be given to the computer for the ascertainment of the true future.

This embrace of complexity and probability creates an interesting dilemma within certain popular business writing, however. Just as the weatherman is being put out of business by the computing machine, or at least having the nature of his work radically altered given the transfer of knowledge functions to the computer, so is a similar possibility opened up with respect to the work of middle-management. Middle-managers work with the information and data of business in order to manage the day-to-day operations of work. The problems are complex and subjective, at least until the computer arrives. "A few years ago it was a scientists' plaything. More recently, it has become an engineer's most versatile tool. Now it has moved into the field of corporate management. It's the electronic computer" (*BW*, 1954a: 82). *Fortune* cites the sheer amount of information in work as necessitating aids for management (*F*, 1949: 116). Aids like the computing machine.

The work of management is being quantified:

> … the greatest potential benefit to the division management lies in the future use of this equipment to provide forecasts and projections of production, marketing, and other activities. Through the use of such data, all levels of management will be better informed as to future courses of action (*BW*, 1954a: 82).

Knowledge work which had previously been subjective can thus be made objective. "Sales analysis, market research, forecasts that take into account variables and unknown that management can understand now only by instinct all these fields lie wide open to attack by Univac" (*BW*, 1954a: 82).

Just as computers are replacing weather forecasters, or radically altering the nature of their work, so too, middle managers are predicted to be under attack. *Newsweek* notes, in 1949: "[i]n theory, at least, the fabulous electronic brain machines have been credited with power to predict weather, compute salary payments, replace minor executives, and produce synthetic 'emotions'" (*N*, 1949b: 52). *Time* in 1948 also contemplates the replacement of executives with computers. Business journals speak to both sides of the issue.

> Of course, there are some in management circles who shudder at the thought of electronic brains. They see them usurping management's decision-making powers. This fear doesn't seem well founded. The new machines will give management the data basis for more intelligent decisions in an increasingly complex economy. To the decision-makers in management, the electronic age will now have the same meaning as it has had to engineers (*BW*, 1954a: 82).

Fortune reassures its readers, "[r]ight now, it seems somewhat premature for front-office executives to worry about technological unemployment – at least about its impact on themselves" (*F*, 1953a: 129). There is clearly a recognition in the public discourse that this industrial revolution is impacting upon a different type of work, knowledge work.

The ultimate effects remain uncertain, but they clearly implicate not only the "blue-collar" industrial worker. Management functions are implicated in what is becoming, but what is not yet named, the information revolution.

There are a number of interesting effects of this stream of discourse. The new understanding of the future sees corporate organizations as complex, yet manageable structures. We could not subject them to quantitative probability analysis in the past because we did not have the computing power to do so. Now we do, and so we should. The question of whether or not complex social organizations should be made subject to such analysis, merely because they can, or what is lost in that process, is not present in the public discourse. The issues of the workplace are framed as about the identification, management, and ultimate containment of risk. Management, as a knowledge practice, is well on its way to becoming a science.

In an eerie echo of current discourses of management science, Peter Drucker is quoted in a *Business Week* article in 1955 suggesting that the new mathematics and new computers will "help to define the objectives, assumptions, and risks" of business (*BW*, 1955c: 90).

> Basically the new tools will help a manager by: showing him the whole business in fairly simple terms, and helping him set the right objectives for it; letting him make a decision in one area that is right for the business as a whole, showing a manager all the alternatives and risks in any situation – some of which escape even the best managers without such aid; making clear to a manager what measurements are appropriate to a certain decision and to certain areas of business; showing who should know about decisions and actions; alerting a manager to what can or should happen in the future as a result of proposed actions – showing him all possible impacts on other parts of the business and the economy (*BW*, 1955c: 90-2).

The unknown has been conquered and the oracles of industry are replacing the knowledge of management, taking business into a well-charted future.

8. Univac by a landslide

> *Hitherto considered the undisputed home of the left-wing utopian or 'scientific' socialist though, corporations and the military establishment have come to devote enormous energies to the future, setting large numbers of futurologists to work in academia and in foundations, institutes, and think-tanks established to provide legitimation for the policies of the modern corporate state through the use of the new intellectual tools of systems analysis, operations research, information technology, and simulation modelling* (Ross, 1991: 172-3).

The *Saturday Review* claims, just four short years after the 1952 election fiasco, "[i]n the 1956 Presidential election, next week, robot forecasters will be everywhere ... The inhibitions which stood in the way of UNIVAC's recognition in 1952 were broken down to a large degree in the next two years" (*SR*, 1956a: 45). The inhibitions were indeed gone. Univac, and a number of its electronic cousins, were front and centre. Univac was working with CBS; NBC had IBM's 705; and an IBM tranceiver was being used to speed up the vote. The *Detroit News* had a UDEC machine and ABC was using Underwood's Elecom 125. "Only the Mutual network [stood] aloof from this rash of electronic prophesying" (*SR*, 1956a: 45).

Having learned their lesson in 1952, this time when computers predicted Ike as the winner by 100 to 1, computer experts, political pundits, and the public alike, believed. That unquestioning trust, and its public display in an unprecedented use by all network television stations of computers in their election coverage, marks the end of the future as an event. The 1956 election coverage is a high-profile media moment which marks the public acceptance of the computer as a device with which to predict the future.

One of Univac's operators is quoted on election night, posing a striking contrast to four years before. " 'Univac, predicts on the basis of one million votes counted, three hundred and ninety-eight electoral votes for Ike, sixty-eight for Stevenson, with the balance in doubt. Perfectly splendid. Right on the beam! Univac is willing to go a hundred to one for Eisenhower'" (*NY*, 1956: 45). And sure enough, even though Univac technically made more errors in this election than in the previous, the reporter concludes his report with an affirmation of Univac's abilities, "Eisenhower by landslide" (*NY*, 1956: 45).

Like 1952, the role of the computer in the 1956 election is not really even big news, but unlike 1952, the reasons for that are very different. In 1958, *The Economist* notes that the Univac "... made no enemies by predicting, with uncanny precision, the two Eisenhower election victories" (*E*, 1958a: 793). Thus, the legend of Univac is unchallenged. Again, the computer spoke the truth, but this time it was expected to do so. The future is successfully refigured as a domain about which we can have objective knowledge. We cannot do this on our own, however, we need the electronic oracle, the computing machine. With the computer, we can know the future and thus avoid the potential pitfalls to which chance and our complex world would otherwise subject us.

The computer is confirmed within the discourse as an essential device for managing information, controlling risk, and making decisions in complex situations. "[W]hat all this together means is that the electronic computer is a new blackboard for the schoolhouse of the immediate future" (*SR*, 1956a: 46). The future has been marked as a knowable domain and science is the way to know it. The legitimation now exists for a science of the future, for futurology.

9. From Transcendental to Methodological: The Future as Knowable

> *Attempts today to provide a progressive imagery for the future will find the terrain tough going. Over the last 40 years, the 'future' has been heavily populated by traditionally anti-progressive interests. It has become the natural habitat of technocratic elites; a lucrative haven for financial speculators, an indispensable tool in the politics of crisis management; a professional training ground for militarists; the next frontier for free marketeers; and the locus for thinking about the 'unthinkable,' to use Herman Kahn's notorious phrase for describing the logistics of post-nuclear survivalism* (Ross, 1991: 172).

While I have sympathy for Ross's politics, I do not think that it is quite so easy to divide the world up into progressive and anti-progressive interests. However, the notion of the future as a terrain which enables various forms of power, creates their conditions of possibility, is cogent and remains pertinent. This chapter details some of the *how* of that process, as well as some of its implications at the historical moment where the future becomes knowable through techniques of technical rationalism.

Yet what is it that we know? As I finalize this chapter, Hurricane Floyd sits poised off the coast of Florida, ready to wreak a path of destruction. Forecasters are adamant, the hurricane will strike soon. The President of the United States takes the rare political step of declaring a state of emergency in advance of the disaster. Millions of people flee Florida in a mass evacuation before the spectre of the "storm of the century." Yet Floyd does not strike Florida; he dances up the coast, being regularly downgraded until mere Tropical Storm Floyd hits the Carolinas. So what of the predictions? What of our future vision?

Three conclusions strike me as I see the media report Floyd's daily decreasing status with what verges on disappointment. First, we can predict the path of a storm no better than we could fifty years ago; chance still makes fools of oracles. Second, the media and science, as institutions, are much more interested (and invested) in predicting the future than in subsequently evaluating those predictions. Third, risk management strategies continue to be deployed on the faith, rather than the results, that science can predict the future. Floyd tells us that the future is still important and that we still believe we can know it. These beliefs first became discursively possible and spoken in the late 1940s and early 1950s. It is in this period that mathematical and scientific techniques and their superlative manipulator, the computer, first permit the treatment of the future as knowledge, not merely speculation.

Unhumbled by our past, which is now irrelevant, we look eagerly to the future rushing towards us. The present is a complex and uncertain moment. We have the tools to turn embodied, experience-based, subjective knowledge into statistical, numerical, objective knowledge. Knowing the future has moved from art to science, from guesses to truth. And a very particular future is being prophesied. It is a techno-evolutionary vision, viewed through the rose-coloured lenses of technological progress. As *Business Week* notes:

> ... you get an entirely different response to questions when you substitute the term 'technological progress' for the word 'automation'. Progress is a friend; automation is a foe. Progress means a future of plenty; automation conjures up visions of jobless hordes scrounging for food. Progress is evolution; automation is revolution (*BW*, 1955l: 78).

Evolution, the future, progress, technological immanence. The machine is the author and catalyst of our future. It shares our future – an historical telos of shared technological progress. The " [t]echnological narrative blooms then in the fertile ground of amnesia, in our chronic inability to remember either the past or the present" (Berland, 1996: 5). In the cybernetic imaginary, there is only the future, or perhaps, as *Wired* suggests, the future of the future.

Epilogue: A look into the crystal ball

> *Some day we may even have small computers in our home, drawing their energy from electric-power lines like refrigerators or radios. These little robots may be slow, but they will think and act tirelessly. They may recall facts for us that we would have trouble remembering. They may calculate accounts and income taxes. Schoolboys with homework may seek their help. They may even run through and list combinations of possibilities that we need to consider in making important decisions. We may find the future full of small mechanical brains working about us (SA, 1950e: 43).*

VII. Information

> Money is increasingly experienced as informational patterns stored in computer banks rather than as the presence of cash; surrogacy and in vitro fertilization court cases offer examples of information genetic patterns competing with physical presence for the right to determine the 'legitimate' parent; automated factories are controlled by programs that constitute the physical realities of work assignments and production schedules as flows of information through the system; criminals are tied to crime scenes through DNA patterns rather than through eyewitness accounts verifying their presence; access to computer networks rather than physical possession of data determines nine-tenths of computer law ... (Hayles, 1999: 27-8).

The Goods

IBM: *Buried in the final pages of Wired magazine, a small quarter square of white page is blocked off with a thin black line. No image; a circle is demarcated within the square of white, two inches in diameter. Inside the circle: " If you'd just managed to store a record-breaking billion bits of data per square inch (allowing you to save the text from over 90 volumes of the Encylcopaedia Britannica on a disk this small), you'd probably want to run an ad announcing it, too."*

Net Runner: *Green text directs: "Jack into the Information War" as a beefy, tattooed cyborg touches a floating orange sphere on a graphic display. " In the shadowy corners of cyberspace two entities wage a covert war. One is known as a Runner. High-tech data thief. The other is the Corporation. Powerful and deliberate, advancing hidden agendas. They vie for the one commodity that guarantees fortune to those who control it: information."*

***IBM**: "When I meet with living breathing customers, why don't I recognize them from the profiles in my database?" asks the page of text beside a full page image of a figure holding a large Baroque portrait, obscuring her or his visage. "You know that your customers aren't numbers. Certainly no graphs, charts, or even fancy multimedia presentations can fully describe them. 'So how do I paint a fuller picture of my clients?' IBM consultants are being asked the same question by thousands of companies. And we've found that they all have one thing in common. Almost all of the information they need already exists. But where? ... So IBM has developed new ways to connect your company to all of this vital information – ways to make sure the latest, most relevant facts are instantly available every time you come in contact with your clients."*

***geekware**: A red-checked tablecloth, a short-sleeved, collared short is laid over it, patterned with black and white etchings of early automated workplaces. Across the top of the page: "In highschool, they called you a computer geek. Now, they work at burger joints and wear polyester uniforms. And you don't."*

1. Introduction

As the above advertisements suggest, information has come to be one of the primary ways in which we know our selves and our world. We label our time, the information age, the information economy, or as prefigured in the preceding chapter, the information revolution. We are implicated within DNA databanks, privacy legislation, data-matching, consumer profiling, data security, polling, and other means of data collection and information management. Computers, cell phones, pagers, networks, have all become information technology. As Theodore Roszak suggests, information is the primary concept to which computer technology has been linked in the public mind (Roszak, 1986).

While occasionally an alarmist voice is heard decrying the potential for electronic surveillance, genetic abuses, or invasion of personal data privacy, these concerns often take place within the same terms of reference as their counter-position. Information is assumed to be a discrete, manipulable commodity; its value is unquestioned; its universality impermeable. Yet its definition, ambiguous. "The word has received ambitious, global definitions that make it all good things to all people. Words that come to mean everything may finally mean nothing; yet their very emptiness may allow them to be filled with mesmerizing glamour" (Roszak, 1986: ix-x). It is in this ambiguity and its resultant mesmerizing glamour that other scholars, as well, have recognized, the power of information (for example, Slack, 1984; Slack and Fejes, 1987; Marvin, 1987). How is it that this innocuous term came to hold such power?

I share Carolyn Marvin's concern, which she expresses in her historical analysis of the notion of information, that the "commoditization of information has come to be regarded as an empirically and theoretically correct representation of imaginative life and activity instead of a highly culturally specific and even suprising abstraction from a world in which many views of meaning are possible" (Marvin, 1987: 57-8). It is this very logic of information that requires unpacking. N. Katherine Hayles suggests that if one goes back in history before information became a "black box," its limited definition seems less like a foregone conclusion and more like a process of negotiation specific to the immediate postwar period (Hayles, 1999: 50). Central to the interrogation of information as a formative event in the cybernetic imaginary is, of course, information as it was most publicly articulated by Claude E. Shannon in the late 1940s.

Hayles suggests that Shannon's theory defines information as "... a probability function with no dimensions, no materiality, and no necessary connection with meaning ... a pattern, not a presence" (Hayles, 1999: 18). She cogently argues that there are two primary reasons why Shannon and his followers came to define information in this way. First, it permitted reliable quantification, and second, it facilitated theoretical generality (Hayles, 1999: 18-19). Information was divorced from its context, becoming a free-floating entity. This freed information to become a mathematical function, permitting Shannon to offer powerfully general theories which were true regardless of the medium through which the information moved (Hayles, 1999: 19).

While recognizing the significance of Shannon's notion, Roszak, in his interesting study of the folklore of the computer, makes a paradoxical statement. "To be sure, Shannon's work is highly technical and therefore largely inaccessible to the general public; nevertheless, its influence has been enormous" (Roszak, 1986: 14). My work intervenes directly into this paradox. I demonstrate that both the processes and effects of quantification and universality, named by Hayles as a scientific legitimation for Shannon's concept of information, are also produced in the public negotiation of information, the site where its enormous influence was in fact produced. Contrary to Roszak's assertion, Shannon's notion of information did circulate widely in public discourse, even if his original paper did not. There can be no influence of the nature Roszak is implying without the acceptance and participation of a broader public. It is in the production of this influence that the event of information takes place. It is through the commodification of information and its separation from meaning and context that information becomes a universal medium, unlocking secrets of organisms and organizations, enabling the informating of humans and machines.

2. Information As Event

> *Seeing the world as an interplay between informational patterns and material objects is a historically specific construction that emerged in the wake of World War II ... The time was ripe for theories that reified information into a free-floating, decontextualized, quantifiable entity that could serve as the master key unlocking secrets of life and death* (Hayles, 1999: 14-17).

Perhaps even more difficult than the introduction of a new term into public consciousness is the redefinition of an already established notion in a radically different way. The advertisements noted above suggest that for information, this redefinition process has been successful, but how was it achieved? Hayles correctly recognizes that the struggle over the meaning of information and the separation of text from context took place in the 1950s (Hayles, 1987: 25). Roszak agrees, describing the shifts in its definition as a "remarkable rags-to-riches career in the public vocabulary over the past forty years" (Roszak, 1986: x). Without articulating the *how* of that process, and perhaps reproducing some of the very phenomenon he is attempting to critique, he argues that information

> ... was surely among the least likely candidates to achieve the exalted status of a godword, but so it has become, and not by accident. Beginning with its esoteric redefinition by the information theorists during World War II, it has come to be connected with a historic transition in our economic life, one which united major corporate interests, the government, the scientific establishment, and at last draws in the persuasive rhetoric of advertisers and merchandisers (Roszak, 1986: x).

Addressing the "how" to some extent, Hayles suggests that the Macy conferences were central to the struggle over the definition of information. She argues that there was opposition to the abstraction of information as a quantifiable entity, and that alternate models were offered during the course of discussions. The "reification" of information according to Shannon's model succeeded because the debates of the day made it seem the best choice (Hayles, 1999: 50). My research also confirms that the struggle over the meaning of information took place in this period. However, building on Hayles' work, my research suggests that the struggle to define information scientifically in the relatively closed environment of the Macy meetings parallels a process taking place in public discourse where information was not being so much defined as redefined.

Some scholars argue that this redefinition began with the publication by Claude E. Shannon of his article, "A Mathematical Theory of Information," in the *Bell System Technical Journal*, in July and October, 1948. I suggest, instead, that it was with the publication, in a more public forum, in a small book with Warren Weaver, *The Mathematical Theory of Communication* (1949), that the event of information can be said to begin. The book also contained Warren Weaver's *Scientific American* article promoting Shannon's theory to a wider public. While the publication in the Bell journal was chronologically the first publication of Shannon's notions on information, the circulation of the journal was very restricted and it is the publication in book format which permitted a public discourse on information to begin.

As alluded to by Roszak above, Shannon's work is highly technical. Nonetheless, contrary to what Roszak suggests, my research indicates it had a significant profile in public discourse. It is this tension which frames the first characteristic of the event, the naming and framing of information. Information had to be redefined from its colloquial usage, to a narrower understanding. More particularly, the semantic aspect of the colloquial understanding of information had to be obviated. This is accomplished through direct recognition of the new definition's counter-intuitiveness, activated through the repeated valuation of gibberish or nonsense as having greater informational content than many meaningful phrases. Within the second part of this event characteristic, information theory is framed in three ways through the use of specific textual strategies. First, it is framed as necessary as a result of burgeoning amounts of data which must be managed. Second, information theory is framed within a context of emergent greatness and grandeur, lending an immediate credibility to its postulates; third, the theory is presented within a language of "naturalness" and "obviousness" which ensures its logic, its continuity, and its normalization.

The cast of characters is dominated by the profile of Claude E. Shannon. Although Norbert Wiener is also credited at some times with having contributed to the reconceptualization of information, Shannon is the modest, quiet engineer whose theory of circuit switching becomes a philosophy of communication. Interestingly, Warren Weaver, the mathematician who helped Shannon publish his article in the book, and serves as the promoter of the theory through a significant piece in *Scientific American* just before the book was published, does not emerge as a public personality (despite his best efforts, it would seem). The fourth characteristic, the key moment, is the "bit." The abbreviated form of binary digit – the bit -- as a measure for information, comes to symbolize information as measure and obviously continues to have a key impact in information and computer sciences.

Having been redefined and framed as both great and natural, information is then mobilized in public discourse through three central and interrelated figures – coding, translation, and "the computermen." These work together to value information (and the computing technologies associated with it) as a quantitative, rather than qualitative, measure and medium. Coding is the process by which data becomes numericized and the language of computing machines becomes numbers; translation foregrounds language, both in terms of machine translation, and in the need to translate to speak with the technology; and finally, "computermen" emerge as a new group of experts by virtue of their fluency in the language of this technology.

As information continues to circulate in its "new" sense, it facilitates other discursive moves, in the fifth characteristic of an event, its tendrils. The central move facilitated by the event of information is the application of information theory to business management resulting in the quantification of business as a set of variables to be managed – organization as information. Finally, in its resolution in the late-1950s, information, clearly established as a bounded, manageable unit, can become a universal medium. It is marked as a domain of study and knowledge in its own right. Within this context, information becomes a general life process. This opens up the possibility of information theory becoming a universal theory, a veritable philosophy. Communication as a broader process becomes defined as the successful transfer of information. Humans, machines, organisms, and organizations (as communication systems) can then be represented (sufficiently) by information.

3. Erasing Semantics

> *In retrospect it all seems so obvious. Of course Claude Shannon had to leave meaning out of the question; otherwise, how could he quantify the new concept that he called 'information'?* (Hayles, 1987: 24).

To successfully quantify and measure information for his technical ends at the Bell Laboratory, Claude E. Shannon had to remove the ambiguous, complex, and inexact element of semantics from his treatment of information. Yet information as a word pre-existed Shannon's reformulation. Clearly scientists and the public alike had to be convinced to accept an understanding of information which had nothing to do with meaning, which erased semantics. Hayles suggests that he was not only writing scientific theory, but also enabling a new technology, and reliable quantification was essential to both purposes. At the same time Shannon was faced with the semantic difficulties of natural language. Information already meant. He resolved the dilemma by boldly stating that his information had nothing to do with meaning.

> Shannon solved the problem of how to quantify information by defining it *internally* through relational differences between elements of a message ensemble, rather than *externally* through its relation to the context that invests it with a particular meaning. It is this inward-turning definition that allows the information content of a message to be always the same, regardless of the context into which it is inserted. Thus, the first, and perhaps the most crucial, move in the information revolution was to separate text from context (Hayles, 1987: 24-5).

Shannon defined information as a function of probability; the information content of a message cannot be calculated absolutely, only in relation to other possible messages that could have been sent. Yet, it is one thing to say this, but how to convince others to accept this "new" understanding of information?

a. Redefinition

> *You have to realize ... that this is a little like Alice in Wonderland. The word 'information' means exactly what we say it means* (*F*. 1953b: 137).

An active discursive process of redefinition takes place in the public debate over information. Information was already circulating as a central element in the communicative processes which Wiener had suggested underlay humans, machines, organisms, and society. But Wiener's focus was much more on the notion of communication. Further, even though they were and are often linked together in the public press as co-authors of information and communication theory, Wiener and Shannon had different understandings of information.

This difference becomes apparent when their respective understandings of information in relation to entropy are examined. For both thinkers, entropy is a measure of randomness. However, for Wiener, entropy and information are in a reverse relationship -- the more information, the less entropy; the more entropy, the less information. Thus, information is measured as negative entropy. For Shannon, on the other hand, entropy is a measure of information. The more random a message is, the more information it contains. While Hayles suggests that Shannon's formulation triumphs in science, serving to legitimate chaos and delegitimate order, I suggest that what results in the broader public discourse is a curious hybrid. The hybrid recognizes that information is a measure of randomness but at the same time, information becomes defined as negative entropy, or as about the production of order. I suggest that this is in part because American society, following the war and in the Cold War is not prepared to embrace entropy as a wider social value. Lack of order and randomness are still the enemy. Information becomes about putting order onto that chaos.[1]

So, suddenly (as far as the public was concerned), in 1949, Claude E. Shannon and Warren Weaver published, *A Mathematical Theory of Communication* which, *inter alia*, sought to redefine information for scientific and technical purposes. As a form of promotion for the upcoming book, however, in July 1949, Weaver wrote a "teaser" article in *Scientific American*. Writing for a wider public audience, he had to address the specific usage to which information was being put. Information had to be redefined from its dictionary sense to something more specific.

Weaver defines communication very broadly to include any process by which one mind can affect another and language is defined as any method of conveying information (*SA*, 1949b: 11). As in the book to come, the central elements of communication are defined in technical terms: "[t]he questions to be studied in a communication system have to do with the amount of information, the capacity of the communication channel, the coding process that may be used to change a message into a signal, and the effects of noise" (*SA*, 1949b: 12). In fairness, this technical focus is because Shannon was trying to solve technical problems of circuit switching for Bell.

Weaver directly addresses the issue of information for readers:

> ... we have to be clear about the rather strange way in which, in this theory, the word 'information' is used; for it has a special sense which, among other things, must not be confused at all with meaning. It is surprising but true that, from the present viewpoint, two messages, one heavily loaded with meaning and the other pure nonsense, can be equivalent as regards information (*SA*, 1949b: 12).

He recognizes in a language of "strange" that this is different, unexpected. Information is defined, not by what one does say, but rather, by what one might say. This probablistic model then slides into a model of liberal agency when Weaver suggests that information becomes a measure of freedom of choice. Information applies not to the individual message, but to the situation as a whole. "The unit information indicates that in this situation one has an amount of freedom of choice, in selecting a message, which is convenient to regard as a standard measure or unit amount" (*SA*, 1949b: 12). Thus, the semantic dimension of communication and the elements of meaning which belong to information are erased. The goal becomes convenience and the communicators are given agency through choice. Probability and randomness are outside of our control; choice is not.

At several other points in the article Weaver reminds the reader, "[w]e must keep in mind that in the mathematical theory of communication we are concerned not with the meaning of individual messages but with the whole statistical nature of the information source" (*SA*, 1949b: 12). He again addresses its counter-intuitive nature.

> The concept of information developed in this theory at first seems disappointing and bizarre – disappointing because it has nothing to do with meaning, and bizarre because it deals not with a single message but rather with the statistical character of a whole ensemble of messages, bizarre also because in these statistical terms the words information and uncertainty find themselves partners (*SA*, 1949b: 14).

This redefinition of information to exclude meaning is again reiterated and confirmed in the eventual publication of the full-length book containing Shannon's essay from the Bell Laboratories journal and an extended version of Weaver's *Scientific American* piece. Weaver reiterates that the definition is special, not ordinary, and must not be confused with meaning (Shannon and Weaver, 1949: 8). Three problems of communication are set: how accurately can the symbols of communication be transmitted? (the technical problem); how precisely do the transmitted symbols convey the desired meaning? (the semantic problem); and how effectively does the received meaning affect conduct in the desired way? (the effectiveness problem) (Shannon and Weaver, 1949: 4). It is significant to note that even semantics is reduced to a problem of precision. Further, Shannon confirms that the "...semantic aspects of communication are irrelevant to the engineering problem" (Shannon and Weaver, 1949: 33). What is offered is a highly functionalist, highly instrumental view of communicative processes, and as extended by cybernetics, of social organisms and society, itself. Communication as a larger process is defined in utilitarian terms – a problem to be solved. Information becomes the measure through which to achieve this technical objective. As one early critic notes: "[n]othing is said on what the information is about, and why is should be relevant to have it. The scheme allows no room for such a question even to be raised" (Jonas, 1953: 191).

It is interesting to watch the broader circulation of information and its theory. Journalism takes on an educational tone with journalists admitting that it is difficult to get a handle on this new notion, but ultimately worth the effort. *Fortune* magazine offers an extensive article on information theory in 1953, claiming grand things.

> Information as used in the theory, is very carefully defined and information theorists have trouble forcing people to stick to the definition. To Wiener and Shannon, information is contained, to great or less degree, in any message a communication engineer is asked to transmit. He is not interested in semantics or meaning; he must assume that even gibberish may have meaning if someone is willing to pay to have it transmitted (*F*, 1953b: 137).

The author goes on to note that gibberish may well have more informational content than a line from Shakespeare (*F*, 1953b: 137). Informational content is defined as that which has a commodity value. This textual strategy of the recognition of the counter-intuitive nature of this "new" understanding of information is reproduced in other sites as well.

Scientific American, in its special issue on automatic control in September 1952, establishes the importance of information by stating its integral relationship with control. Receiving and acting upon information is the primary work of a control system. But it is necessary first to understand information. "This is not as simple as it may seem. Information, and the communication of it, is a rather subtle affair, and we are only beginning to approach an exact understanding of its elusive attributes" (*SA*, 1952m: 132). Information can take on many forms and is at the heart of the economy, railroads, automobile traffic, and so on (*SA*, 1952m: 133).

The semantic exercise of redefining information without its semantic sense leads to a definition and ordering of a number of terms, including information, communication, data, message, and noise. Information is both statistical and a matter of choice, but the choice is ultimately binary.

> Communication consists essentially in the progressive elimination and narrowing of the totality of all possible messages down to the one message it is desired to convey. ... In the binary notation each symbol represents a simple choice between just two possible ones, and this has many advantages for expressing information (*SA*, 1952m: 135).

Information is buried in the message, which includes both information and noise.

> So far we have used 'message' and 'information' interchangeably, but there is a distinction between them. The information content of the signals is reduced by the noise that comes with the message. The central problem of information theory, now undergoing investigation, is to determine the best methods of extracting the sender's message from the received signal, which includes noise (*SA*, 1952m: 137).

Communication then becomes a reference to a broader notion than information, and is rendered as the successful transfer of information in a feedback loop as defined by cybernetics. As will be discussed in greater detail in the next section, data is a mass of information and noise; inherently not yet useful. Through the application of information theory, valuable information can be extracted from this data. Data is the raw material for the production of information. The message is the material trace of the communicative act which contains both information and noise. Again, a message has very little value until its informational content is extracted. Finally, noise is the enemy; it is the resistance or complications which distort and trouble the purity of information, usually as a result of the material channels over which it is necessary to transmit information.

It can be seen from the foregoing that communication is reduced to a technical process of choice; choice between the binary options presented by information. Information is more efficient in binary terms. Therefore, the human choice must be adapted to the machine's options. The overall redefinition of communication and information is taking place in accordance with a machine model of these processes; communication becomes the yes/no choice of the machine.

Information is not about meaning; it can be language, but need not be; and it is unpredictable, statistical, and can be represented in binary code. Information becomes a measure, a unit of analysis. This then allows for its quantification, as an author considering the relationship between information and memory suggests. He notes that the translation of data into certain kinds of symbols greatly enhances the ability to remember as the amount of information per item can be greatly increased (*SA*, 1956b: 45).

> A person who can repeat 9 binary digits can usually repeat 5 words. The informational value of the 9 binary digits is 9 bits; of the 5 words, about 50 bits. Thus, the Wiener-Shannon measure gives us a quantitative

> indication of how much we can improve the efficiency of memory by using informationally rich units (*SA*, 1956b: 44).

A relation begins to be established between greater information and greater value Information is well on its way to becoming a commodity form.

b. From Data Overload to Information: The Need For a Theory

More is being sold to the American public in the redefinition of communication and information than merely the commodity of information, however. This redefinition is embedded in a broader theoretical approach, information theory. Interestingly, what begins as a technical theory for a telephone company moves through the discourse to become a social theory, even a philosophy, always grounded in an acceptance of the assumptions of information as a discrete, quantity divorced from meaning (drawing upon Shannon) and communication as a process engaged in by all communicative systems (from Wiener). This theory is sold in a series of three discursive manoeuvres: the construction of need, promotion, and normalization.

In the first of these moves, from data overload to information, the theory is justified through the creation of a need and through this process, information is confirmed as a measure of value for ordered data. The need for a new understanding of information arises in light of the huge amount of data, loose numbers, and statistics which surround us. These will only be useful if we can turn them into something measurable and manipulable, namely information. This also inextricably (and imperatively) links computing technology to information production and management.

For example, the *American Scholar* notes that we have developed a variety of tools to help us in our work.

> But these are not enough. Facts, usually in the form of numbers, are piling up far too rapidly for the computers we have now. Numbers are accumulating in thousands of consumer surveys and public-opinion polls, in the 20,000,000 cubit feet of space required to hold government records and statistics, and in more than 1,000,000 scientific papers published annually throughout the world (*AS*, 1950: 21).

Time magazine notes that scientists are limited in what they can do by their need to be able to manipulate data beyond their own abilities.

> To many a scientist the discouraging moment in life comes when his figures begin to run amok. Figures can bristle like barbed-wire barriers between his data and his conclusions. He finds that before he can get on with his work, he must multiply numbers as long as his middle finger, divide them, add them, square them, extract their roots. ... Often a scientist gives up in despair. Many important lines of research have bogged down in a morass of figures (*T*, 1949c: 65).

Inventory control is another common example of a large amount of data which needs to be controlled.

Information theory is necessary because valuable information is embedded within these masses of data. The *New Republic* claims, "[i]mmense accumulations of data and statistics can be mined for invaluable information" (*NR*, 1947: 18). *Scientific American* acknowledges that information needs to be extracted from census data (*SA*, 1950b: 29). "Answers are buried in this mass of information, if we could only perform the necessary calculations" (*AS*, 1950: 22).

Computing machines are clearly the solution; "... the computing machine extracts more information from the record than we could otherwise obtain" (*SA*, 1952m: 137). They can easily be used in these types of environments, turning that data into valuable information (*BW*, 1953a: 118-120). *Business Week* notes, as early as 1947, that the abilities of computing machines to manipulate data will facilitate their move from military applications to actuarial science. "They may have magnetic tape capable of storing information – a thousand units of information on a square inch of tape" (*BW*, 1947: 20). In the *Newsweek* feature exploring the move towards automation in the American civil service, the information management role of the government is made clear and the application of computing machines is described as making a whole host of these activities more efficient, from monitoring military stores, to tax collection, to weather forecasting, to payroll for postal employees, to census data management (*N*, 1956a: 21-2).

The need is articulated for such a theory of information:

> [s]o much information is being produced that no researcher, worker, or engineer can be aware of all that is pertinent to his problem. In other words, the feedback loop is terribly congested. It is hoped that the new ideas of information theory will help to clear up the congestion and make the needed information more accessible (*SA*, 1952m: 147-8).

This need is given further validation in its recognition by scientists.

> It is precisely here that the value and power of a good theory become difficult to describe. A theory builds no machinery. But inevitably, when good theories are enunciated, they make machinery easier to build. 'Before we had the theory a lot of us were deeply troubled,' says Jerome Wiesner, director of M.I.T.'s Research Laboratory of Electronics. 'We had been dealing with a commodity that we could never see or really define. We were in a situation petroleum engineers would be in if they didn't have a measuring unit like the gallon. We had intuitive feelings about these matters, but we didn't have a clear understanding (*F*, 1953b: 140).

Therefore, information theory, bracketing meaning and serving as a unit of measurement, is an overdue development which will permit us to mine the wealth of data we have collected for useful information. Information then becomes useful knowledge and its theory of equal utility. These are the first steps in the move towards a social theory of information.

c. The Grandeur of Information Theory: It Must Be Important

> *FORTUNE's editors invite the reader to a venture into an exciting area of scientific thought. The accompanying article explores a new concept of information, pointing to communication systems of the future that will make present telephone and television circuits look primitive. While it is of immediate interest to engineers, the theory has profound implications for all those who handle information – i.e. everyone* (*F*, 1953b: 136).

The second justificatory framing of information theory is as a revolutionary and fabulous development. Textually produced in a hyperbolic language of importance, revolution, and power, this strategy serves, I suggest, as a bridge between the preceding and succeeding framings. It further reinforces that there must have been a need for the theory and as well, it works to build the foundation for the logic of the theory's legitimation and naturalization. As well, its extraordinary nature suggests that information theory has an importance greater than mere technical communications use. This grandeur facilitates its application as a broader theory of the social, a philosophy of communication.

First, as with all scientific theories, a language of scientific discovery is employed, suggesting that information (understood this way) pre-existed our redefinition of it. Its exactness, its quantifiability, become inherent characteristics of information, rather than a result of its redefinition by science. It is a result of discovery, not construction.

> During the past decade, mathematicians have discovered with surprise and pleasure that information can be subjected to scientific treatment. Indeed, it meets one of the strictest requirements: it can be measured precisely. Information has been found to have as definite a meaning as a thermodynamic function, the nonpareil of all scientific quantities (*SA*, 1952m: 133).

The parallel to thermodynamics implies a high level of scientific significance. Warren Weaver in July of 1949 calls information theory "an important new theory" (*SA*, 1949b: 11). He notes that even though Shannon's theory applies in the first instance only to the technical problems of communication "the theory has broader significance" (*SA*, 1949b: 11).

In his article, Weaver becomes a veritable cheerleader. In relation to the use of a language of coding, enciphering, and decoding, he suggests that the approach is natural, and frames its significance in an almost reverential hush.

> Viewed superficially, say in rough analogy to the use of transformers to match impedances in electrical circuits, it seems very natural, although certainly pretty neat, to have this theorem which says that efficient coding is that which matches the statistical characteristics of information source and channel. But when it is examined in detail for any one of the vast array of situations to which this result applies, one realizes how deep and powerful this theory is (*SA*, 1949b: 13).

He labels its central theorem "great" and employs superlative language: "[t]his powerful theorem gives a precise and almost startlingly simple description of the utmost dependability one can ever obtain from a communication channel which operates in the presence of noise" (*SA*, 1949b: 13). He does not stop there; this theory is not just amazing unto itself, it is also better, more accurate, and more generalizable than other theories. "One must think a long time, and consider many applications, before he fully realizes how powerful and general this amazingly compact theorem really is" (*SA*, 1949b: 13).

But it is not only Weaver (self-interestedly) claiming great things for information theory. An extensive article in *Fortune* in December 1953 opens:

> [g]reat scientific theories, like great symphonies and great novels, are among man's proudest – and rarest – creations. What sets the scientific

> theory apart from and, in a sense, above the other creations is that it may profoundly and rapidly alter man's view of his world. In this century man's views, not to say his life, have already been deeply altered by such scientific insights as relativity theory and quantum theory. Within the last 5 years a new theory has appeared that seems to bear some of the same hallmarks of greatness. The new theory, still almost unknown to the general public, goes under either of two names: communication theory or information theory. Whether or not it will ultimately rank with the enduring great is a question now being resolved in a score of major laboratories here and abroad (*F*, 1953b: 136).

Throughout the article, it is clear where the author lies on the question of the ultimate ranking of information theory. "It may be no exaggeration to say that man's progress in peace, and security in war, depend more on fruitful applications of information theory than on physical demonstrations, either in bombs or power plants, that Einstein's famous equation works" (*F*, 1953b: 136).

Interestingly, it is the hyperbole and the eagerness to extend the theory to other realms which causes Weaver to re-insert semantics. He notes that "this analysis has so penetratingly cleared the air ..." that perhaps a more sound theory of semantics can be developed (*SA*, 1949b: 14). Even though he does all of the work to redefine information to remove semantics, he reinserts it in some ways while trying to extend the pertinence of the theory (*SA*, 1949b: 11). Later in the article, he reiterates, "[t]he theory goes further. Though ostensibly applicable only to problems at the technical level, it is helpful and suggestive at the levels of semantics and effectiveness as well" (*SA*, 1949b: 14).

Perhaps most importantly, however, embedded in these claims of grandeur are the seeds for the universality of information theory. It has a multidisciplinary focus: "[t]he new theory of communication has focused the attention of scientists on the statistical nature of the process and has brought together workers from physics, engineering, physiology, mathematics, psychology, linguistics and phonetics" (*SA*, 1955c: 98).

> The development in the twentieth century of a mathematical theory of communication enables us to see more clearly how this process serves the convenience of communication and, coupled with the fact that it is the length, not the variety of the material that limits our memories, give us an important insight into the economics of cognitive organization (*SA*, 1956b: 46).

And Weaver again reinforces that,

> [t]he mathematical theory of communication is so general that one does not need to say what kinds of symbols are being considered – whether written letters or words, or symphonic music, or pictures. The relationships it reveals apply to all these and to other forms of communication. The theory is so imaginatively motivated that it deals with the real inner core of the communication problem (*SA*, 1949b: 14).

Information theory, with its powerful and useful tools operates at the heart of *all* problems of communication. Cybernetics has established the centrality of communicative behaviour to all systems, individuals, communities, societies. And with such a great theory, why wouldn't we apply it to all communicative systems?

d. Information, naturally: Normalizing and Legitimating

> *... the result of this intellectual sleight-of-hand was a lamentable bamboozling of the public, who came to see arguments made in this esoteric terminology (all decked out with many numbers) as intimidatingly authoritative* (Roszak, 1986: 15).

A third textual strategy is employed to frame information theory. Through appeals to common sense, through its portrayal as natural, the veil of bizarreness and counter-intuition established in the naming (redefinition) of information is lifted in the circulation of the theory. I suggest that this framing legitimates the understanding of information, justifies the general applicability of the theory, and silences any potential critics through marking them as illogical and their critique as unnatural and unscientific.

First, information theory is presented as common-sensical. The *Saturday Review* suggests in 1956, "[w]hen you stop to think about it, you realize that a [great] deal of what you say in any language is predictable ... Often you can listen with one ear and still catch a speaker's intent ... You know that's how it is when you stop to think about it" (*SR*, 1956b: 69). *Fortune* urges:

> [l]est the reader, at this point, balk and say that Shannon and Weaver have no right to call 'gibberish' information, he must let them continue. Most people will agree that any message communicates information only to the extent that it contains 'news' ...Wiener and Shannon show with their statistical approach, that all ordinary message – speech, music, pictures – are highly predictable (*F*, 1953b: 137).

Second, information is linked with the authority of science. Weaver claims that the theory is "based on the statistical character of language," namely, language is assumed to be *a priori*, statistical. The theory then follows logically from that. He locates the theory historically, reviewing other mathematical treatments of information in relation to communication. As well, he links it to other current scientific practices, and the contributions of other notable (and visible) scientists such as Wiener (*SA*, 1949b: 11). After explaining the new definition of information, Weaver notes "*[o]bviously*, probability plays a major role ..." (emphasis added; *SA*, 1949b: 12). He explains the notion of entropy in relation to communication, noting its significance within thermodynamics. Its use is natural: "[t]hus when one meets the concept of entropy in communication, he has a right to be rather excited. That information should be measured by entropy is, after all, natural when we remember that information is associated with the amount of freedom of choice we have in constructing messages" (*SA*, 1949b: 12).

The naturalness of the theory leads to its naturalization in other domains. *Fortune* sets up a discursive movement where if one accepts the ideas of Wiener about the centrality of communication then the spread of information theory naturally follows.

> In particular it is Wiener's belief, shared by many others, that one of the lessons of cybernetics is 'that any organism is held together by the possession of means for the acquisition, use, retention, and transmission of information.' Naturally, therefore, attempts are being made to use information theory in a dozen fields from psychiatry to sociology. In a few fields, notably psychology, neurophysiology, and linguistics, the theory has already been applied with considerable success (*F*, 1953b: 137).

This movement is both natural and obvious. "It is doubtful if many communication engineers, before Wiener and Shannon, grasped the essence of their job in quite this light, obvious as it may seem now" (*F*, 1953b: 137). *Business Week* suggests, the central problem of both war and science is

> ... the handling of information – its transmission and its use. You need some very fancy mathematics, like group theory and statistical mechanics, to demonstrate the essential similarity of such problems as the design of servomechanisms, radio-engineering, computing-machine development, and the improvement of artificial limbs. *But it's not hard to see* that they usually involve two key features: (1) the feedback principle found in the thermostat; and (2) a preoccupation with accuracy rather than efficiency (emphasis added; *BW*, 1949a: 42).

Therefore, the "new" understanding of information is first identified, explained and then marked as simultaneously amazing and obvious. While apparently contradictory, these framings serve to both educate about and legitimize the new understanding, but also to mark its theory as anchored in a moment of knowledge progress and scientific triumph. The widespread applicability of information theory and the definition of all beings as informational lays the conceptual groundwork to informate all types of organisms and organizations. Because the models of communication and information now applied to us are those developed to explain and produce the computer. our kinship to this information technology and the redefinition of ourselves in machine terms is naturalized. legitimated, and given mesmerizing glamour.

4. The Information Scientist

> *Automation would be as empty as a sideshow barker's promise without Shannon's philosophy* (*SR*, 1956c: 73).

As scholars like Hayles. Keller. Kay. Edwards. Roszak. and McCorduck all note. there were a number of scientists during and after WWII exploring communication systems. and more particularly. how information functioned within those – Norbert Wiener. Claude E. Shannon. Alan Turing. Warren McCulloch. and Walter Pitts to name a few. Hayles cogently demonstrates the struggle in the site of the Macy meetings over the cybernetic notion of information (Hayles. 1999). She also recognizes that at the scientific level both Wiener and Shannon contributed to the redefinition of information.

Fortune magazine attributes information theory to both Wiener and Shannon.

> The theory has an unusual joint origin. To MIT's eminent mathematician. Norbert Wiener, goes the major credit for discovering the new continent and grasping its dimensions: to Claude Shannon of the Bell Laboratories goes the credit for mapping the new territory in detail and charting some of its breathtaking peaks (*F*. 1953b: 137).

Wiener's text. *Cybernetics* is described as his "now famous book," and Shannon's contribution in the same year is described as "his great work ... aimed specifically at the electrical engineer" (*F*. 1953b: 137). In fact, in this article, the theory is later referred to as "the Wiener-Shannon Theory of Communication" (*F*. 1953b: 138). Miller in *Scientific American* makes this connection as well. "The mathematical theory of communication developed by Norbert Wiener and Claude Shannon provides a precise measure of the amount of information carried" (*SA*, 1956b: 44).

In the majority of public discourse, however, it is Shannon who emerges as the central information scientist. *Saturday Review* notes, "[m]ost people don't stop to think [about the statistical nature of communication]. What makes Dr. Claude E. Shannon different is that he stopped, thought, and put the thought to work. The work is now known, wherever scientists gather, as information theory" (*SR*, 1956c: 73). Their profile of Shannon, entitled "Information on a Theorist," portrays him as the inventor of the theory.

This language of invention is widespread. The system of using binary arithmetic is described as "a revolutionary algebra Shannon first invented" (*SR*, 1956b: 69). *Scientific American* suggests, "[n]ow Shannon, in his famous theorem on communication theory ..." (*SA*, 1952m: 137). Shannon is even recognized for his 1938 article within popular science journalism (*SA*, 1952a: 70). The theory from 1938 is recognized to have been applied by him more broadly in his universal information theory (see also *SA*, 1956a: 29).

Shannon is the thoughtful genius with a practical bent:

> [i]nformation theory has been adapted to psychiatry, biology, economics and social relations. Shannon thinks a lot about the impact of his ideas on people, which seems normal for a man whose face and wry figure are reminiscent of Abe Lincoln. Having so much information to transmit himself, he fidgets even when he talks, and is happiest when trying his theories in practice. His mechanical mouse, which finds its own way through a maze, is famous. His automatic chess-player is fairly well known. Only his intimates are aware that he studied his own personal communication system by learning to balance atop a unicycle (*SR*, 1956c: 73).

He is portrayed as underappreciated and somewhat beleaguered by his own theory. "Everyone is familiar with the formula Einstein used to calculate the atom's locked-in power. Shannon's formulas are still too new to be popularly appreciated as the means of manipulating atomic force and still more remote mechanisms of nature" (*SR*, 1956c: 73). He is, in some ways, the voice of reason around his own theory. Hayles recognizes that he often had to caution other scientists that his theory was meant to apply only to certain technical situations, rather than communications in general (Hayles, 1999: 17). "Shannon himself was meticulously careful about how he applied information theory.... Although others were quick to impute larger linguistic and social implications to the theory, he resisted these attempts" (Hayles, 1999: 54). Weaver tells the favourite anecdote.

> Once, when explaining his work to a group of prominent scientists who challenged his eccentric definition he replied, 'I think perhaps the word 'information' is causing more trouble ... than it is worth, except that it is difficult to find another word that is anywhere near right. It should be kept solidly in mind that [information] is only a measure of the difficulty in transmitting the sequences produced by some information source' (*SA*, 1949b: 12).

This anecdote appears in *Fortune* as well, in identical language (*F*, 1953b). Any great theory must have its author, its lone genius. Shannon is constructed at this time, and is recognized by history, as that genius, the inventor of information theory.

Hayles refers to his theory as a "watershed." Roszak waxes enthusiastically for the significance of Shannon's work calling it "ground-breaking" (Roszak, 1986: 11). He argues, "Shannon's work is universally honoured as one of the major intellectual achievements of the century. It is also the work most responsible for revolutionizing the way scientists and technicians have come to wield the word *information* in our time"

(Roszak, 1986: 11). I suggest that it is Shannon's dual role, however, as the technician in relation to the chess-playing machine in combination with his role as the inventor of information theory, which is integral to the public legitimation of information as an idea and information theory as a broader social theory. Information theory was clearly important, because it worked. The chess-playing machine, the thinking machine, was proof. This was not incomprehensible high theory; information theory was useful theory. This mutually reinforced the power of the theory and the technology wielding it. If it worked in machines and we communication like machines, it should work for us. The practicality of Shannon and his work made it all simple.

5. Bits of Information

> *The presence of one or the other [1 or 0] constitutes a binary digit. The phrase binary digit has been abbreviated in a new term – 'bit' a rather neat usage because it is essentially a bit of information* (*SA*, 1950b: 36).

A central moment in an event marks a significant occurrence which takes on representative status within the unfolding of that particular event. It marks a dramatic development or turning point in the event. A moment encapsulates many of the effects of an event. What emerges as a central moment in information is not so much an occurrence, but a notion: the binary digit, or bit. Information is cast as quantitative, as a measure, but the unit of measurement needs to be established. How do we talk about quantities of information? We use the bit. Once the terminology of the bit is established, there is no turning back. Computers are information processors, binary code is the universal standard, and information can be measured numerically in numbers of bits ... and still is.

Because it had no previous colloquial usage, the definition of "bit" is much simpler to establish within the discourse than was the redefinition of information.

> Information is the most human of all the problems that the exact sciences have yet tackled. We shall need instruments like those of the human body – memory devices like the human brain and control devices like the reflex networks of the nervous system – to handle information for automatic control. Progress is being made, and one of the most useful concepts developed so far is the 'bit,' by which information can be measured, stored, processed and transmitted most efficiently (*SA*, 1952m: 148).

A bit is that which makes a decision between two equally probable events – it is "baptized" a bit because 1 and 0 within binary code had already been called bits (*F*, 1953b: 140). Bits become a measure of informational content. "[T]he theory provides an equation that gives, in bits, the amount of information per symbol in any message – be it speech, music, or pictures" (*F*, 1953b: 140).[2]

Bits become a measure of more than merely information, however. "The number of bits in a message is a measure of the amount of information sent. This tells us exactly how much we are learning, and how much equipment is needed to handle the messages expected" (*SA*, 1952m: 135). It is becoming a measure of value. But the significance of the notion is not, and cannot be, underestimated. As one early commentator correctly predicts:

> [i]n a message consisting of binary digits, each digit conveys a unit of information. From 'binary digit' the mathematicians John Tukey and Claude Shannon have coined the portmanteau word 'bit' as the name of such a unit of information. It is almost certain that 'bit' will become common parlance in the field of information, as 'horsepower' has in the motor field (*SA*, 1952m: 135).

So, in terms of commodity value, more rather than less bits of information are preferable. Further, computers are by definition valuable machines by virtue of their superior abilities to manipulate bits of information. In an echo of the IBM advertisement at the outset of this chapter, *Saturday Review* recognizes that "[e]lectronic 'brains' can hold millions of bits of information in their memories and can search back and forth through those memories with lightning speed" (*SR*, 1956b: 71). Yet to be rendered in bits, data must be formulated as in on/off binary choices. The meaning of all this information is its quantity rather than its quality, given that what the information is about has not been part of the equation since the 1950s. So embodied within this small notion is the very potential of the event of information. It is the common measure for all types of information, regardless of source or medium, regardless of context or meaning. Information can now become a manipulable commodity form, one of the conditions of possibility of the information economy is therefore established.

6. Lingua Machina

> *One evidence of its generality is that the theory contributes importantly to, and in fact is really the basic theory of, cryptography, which is of course a form of coding. In a similar way, the theory contributes to the problem of translation from one language to another, although the complete story here requires consideration of meaning as well as information. Similarly, the ideas developed in this work connect so closely with the problem of the logical design of computing machines that it is no surprise that Shannon has written a paper on the design of a computer that would be capable of playing a skillful game of chess* (*SA*, 1949b: 14).

In public discourse, information is, in fact, articulated in the discursive field through three central figures: the code, translation, and the computermen. Interestingly, these figures map well onto Weaver's claims above for the mathematical theory of communication. At the root of each of the figures is a communicative model of structure and function shared by the human and the machine. Both humans and computers communicate. Yet in order to reach a shared understanding, in order to communicate with each other, it is the humans who must adapt to the machines; humans must learn the language of the machines.

a. Binary Coding: Quantifying Information

The code is the notion which works in public discourse to shift the rendering of information from a qualitative to a quantitative measure. The code is numerical. All manner of information, from human language to music, can be represented by discrete numbers. Having been established as codable, it is then a short move to their representation in binary code, in particular. In June 1955, in an article exploring computer memories, Louis N. Ridenour explains the imperative process of translation between human language and binary coding. "Human language is composed of 10 digits ... and 28 letters of the alphabet (in English) and various punctuation marks and other symbols. But in an electronic computer it is essential to translate all information into a simpler code, and the most convenient is the binary system, using just two symbols: 0 and 1" (*SA*, 1955f: 93). In articulating the benefits to the American civil service of computing machines in terms of their superior ability to manipulate data, *Newsweek* notes that "[n]ew computer assignments must be broken down into long series of mathematical formulas and 'programmed' onto tapes, step by step" (*N*, 1956a: 22).

Time, in 1947, suggests that "[l]ike the brain, the machine accepts information, generally in the form of figures represented by small holes punched in paper tape" (*T*, 1947). *Newsweek* advises "[i]nstead of the decimal number system, the machine uses the binary system, in which all numbers are represented by combinations of 0 and 1" (*N*, 1950: 56; see also *SA*, 1950b: 36). *The Economist* notes that machines can be built to deal with facts and words, but first they must be "converted into computer fodder in the form of numerical symbols ..." (*E*, 1958b: 824). Thus, clearly any problem which can be rendered numerically can be dealt with, be it a thing, an idea or a process (*NR*, 1947: 18).

Numbers are framed as a machine language spoken by the computer. *Saturday Review* notes that books can be conveyed through mechanical models. This is phrased in linguistic terms: "... a kind of number language is employable to instruct robots to act as librarians" (*SR*, 1956b: 70). Another reference is made in the same issue to the language of numbers (*SR*, 1956b: 71). This process of numericization is continually portrayed in a language of coding and decoding (*SA*, 1955h: 75; *SA*, 1952m: 141). Any information can be translated into code. "If translated to binary code and recorded as black and white spots on this emulsion, all the words in all the books of the Library of Congress could be stored in a cubic yard" (*SA*, 1952m: 145). *The Economist* notes, "[t]he digital machines are programmed – that is, supplied with whatever knowledge they need, such as mathematical tables or rosters of employees – by means of a code applying the binary system of numbering" (*E*, 1958a: 793). Thus, as long as the problem can be rendered into numbers, or coded, it can be resolved.

A striking example of the coding of "data" and its rapid extension is the report in *Scientific American* of the manipulation of a 15 million name mailing list for a mail-order house. The selection of names in the past was made on the basis of experience, but now the names are selected using a vast quantity of information on the clients' previous sales histories and so on. "With such information available to mechanical manipulation, it is possible to bring a high order of sophistication to bear on the task of selection" (*SA*, 1952m: 147). Clients, therefore, can be coded according to their data profiles ... as IBM suggests in its 1998 advertisement.

Finally, the encryption implications of a language of coding are not incidental. The language of encryption is used by Shannon and Weaver; Shannon's secret work on encryption devices in WWII is publicly known; and the notion of coding itself implies a need to decode. Those who can decode, are those with the key. Thus computer programs were (and are) referred to as computer code. This language distances the public from an intimate knowledge of the computer, renders the communicative processes of the computer secretive, and lends a mystique to the work of the "computermen." The *American Scholar* notes, "[t]o communicate with the machines, mathematicians prepare lists of numbers and detailed instructions which specify how the numbers are to be used and in what order. This information is then translated into special codes ..." (*AS*, 1950: 22). Because the numbers involved in coding are described as language, the process of binary coding to suit the computer becomes one of translation rather than reduction and allegedly, little to nothing is lost in the resignification.

b. Translation

As suggested above, "language" is employed as a terminology to describe the ways in which both humans and machines communicate. This implies a parallelism in the behaviours of humans and machines, with a difference more of type than of fundamental nature. The focus on "translation" reinforces that the process whereby we interact and exchange information with computing machines is linguistic, in other words, communicative. Furthermore, because the only barrier to effective communication, in this instance, is the speaking of different languages, an effective means of translation should ensure that no serious reductions in meaning (or miscommunication) can take place. This manifests in the public discourse both in a language of translation to describe human-machine communication, but also in the presentation of computing machines as possible translators, the latter offering the practical, technical proof of the former.

Information is defined from the outset as a problem of language, to be treated statistically (*SA*, 1949b: 15). As noted previously, the parallelism of language use is reflected widely in the discourse. "A big difficulty lies, of course, in the fact that the language of men must be translated into this language of the machines. At the output end the machine itself can perform the translation, but on the input side men usually have to do the translating to the machine" (*SA*, 1955f: 93). Before the machine can speak its numbers language, however, a process of translation must take place. "Of course, human beings must put the information into the robot memory to start with, and even before that must translate the data into numbers a computer can use" (*SR*, 1956b: 71). It is the humans who must adapt to the machines.

Translation also extends to the capabilities of computing machines themselves. "Language Translation by Electronic 'Brain'" cries a title in *Science News Letter* in January, 1954, noting an 85% success rate with electronic translators. There was a public demonstration of a Russian to English translation at IBM headquarters in 1954, and two years before, one from German to English (*SNL*, 1954a:59). Others also recognize this potential in the machines (*E*, 1958c: 824; *SA*, 1956a: 31). *Scientific American* offers an extended piece in January 1956 entitled, "Translation by Machine." It recognizes a need for translation of scientific articles in other languages in order to have access to the best scientific information available; the costs of this language barrier in terms of human resources constitute proof that we need electronic translators.

> We are practically driven to the answer that always suggests itself when we are faced with a need for mass production: machines. To translate languages by machine is a little less easy than falling off a log, but the need is so great that in less than a decade since it was first seriously suggested many groups of people have gone to work on the problem (*SA*, 1956a: 29).

Drawing the parallel between human language and machine language even further, reports circulate of machines which can recognize human speech. "Translation of the sounds of spoken language into a machine code (which is closely comparable to a secretary translating dictation into shorthand) is another active field at present" (*SA*, 1956a: 31). One interesting experiment, detailed by *Scientific American* in February, 1955 is an attempt to develop a computer (Audrey – the Automatic Digit Recognizer) which can recognize elements of speech, can distinguish spoken numbers and can translate a code number into a command to perform a set task. "Audrey has recently been modified so that she can speak a language which contains 16 phonetic elements. Although these elements do not necessarily correspond to phonemes, Audrey's efforts to reproduce human speech are surprisingly understandable" (*SA*, 1955c: 95).

Language is just one more way that we are similar to the machines. Computers and humans both speak and use language, just different languages. But who shall be our translators? As *Saturday Review* asks: "[h]ow do we talk to robots? In the same general way that we talk to people who speak foreign languages ... by translating. Those who translate accurate meanings from human words into the robot's arithmetical symbols are now known as 'programmers'" (*SR*, 1956b: 46).

c. Speaking in Numbers: Computermen as Literate

> *Today's worker is more skilled, better educated, better paid than his ancestor. With automation, there will be more 'dress up' jobs, more shift work, more leisure if the trend toward shorter work weeks continues, higher pay if productivity continues to climb. There'll be a continued demand for tremendous numbers of highly skilled men, to program computers, as well as to build and maintain them* (*BW*, 1955l: 78).

The translators, those who will help us to talk to computers are the programmers, a new name to recognize a new expertise. In the event of information, a new class of professionals emerges – the computermen – those trained to speak the language of the machine, those who can speak in numbers. They have the keys to the code. Perhaps not surprisingly, they are immediately elevated to significant professional status.

As computers spread to the commercial domain computermen are in high demand. *Newsweek* notes a common concern after the advent of the computing machine for commercial sale: "[p]roperly trained automation engineers are scarce" (*N*, 1954b 59). Trouble shooting with these complex machines usually requires two experts, according to *Scientific American* in November, 1950, a mathematician who knows what the instructions to the machine say, and an electrician to work with the electronic parts (*SA*, 1950e: 40).

Time, in July 1954, carefully explains how one must mobilize expertise in order to effectively use computing machines to answer business problems. "If a client has mathematicians of his own ... he translates his problem into language that the computer can understand" (*T*, 1954b: 44). If he does not have his own mathematicians, then the businessman can bring his problem to the center and there he can hire a consultant to translate his problem into computer language (*T*, 1954b: 45). *Saturday Review* suggests that a new kind of illiteracy is emerging and is grateful that the use of computers in the

1956 American Presidential election highlights this problem. "[I]t focuses national attention sharply for the first time on the problem of a new illiteracy. The language we as a people need to learn is mathematics: the robot's number-tongue" (*SR*, 1956a: 45). What are needed are people who speak the language of the machines, the robot's numbers tongue.

In considering the translation of library data into computer-digestible numbers, the *Saturday Report* suggests the advent of a new profession, the language engineer or the information retrieval specialist.[3] *The Economist* suggests:

> … more often than not … the robots find time to stand around idle and eat up the profits. And the corps of stenographers and key-punch operators replaced by a computer have, in fact, only given way to an army of workers – some in high wage brackets – who are necessary to instruct it, translate for it, and dispose of its efforts (*E*, 1958a: 794).

Thus, not only is it a new profession, it is a "high wage bracket" profession.

There are also implications for education, both for individuals new to the job market as well as retraining for those who will be working with the machines. The *Saturday Review* notes that West Coast colleges are beginning to make their business students study calculus (*SR*, 1956a: 46). *The Economist* refers to these skills as "the art of computer programming" and notes that courses in it are being offered by IBM (*E*, 1958a: 794). Out of this educational process

> … is emerging a new and increasingly numerous breed of organization men, not only conversant with electronic computing but also excited about its potentialities. Most of them are now young. But as time goes by, these 'space men,' as one company calls them, will command a voice in management at least as loud as that of the well-entrenched executives now to resistant to change. Then the wonderful robots will be ready to manage themselves right into a seat on the board (*E*, 1958a: 794).

And the computermen and organization men are just that, men. Women become a signifier within advertising of the ease of use of computing technology, as operators, whereas all complex technical functions with respect to the technology are attributed to male technicians and programmers. The gender differentiation of expertise is quite marked in this time period. Automation will bring some "labour displacement" commentators concede, but it is very interesting how the process is framed.[4] The loss of work to be felt by young women is trivialized as but a small concern in the overall rampaging progress of the implementation of the machine in the office.

Information as an event creates a new and powerful expertise around and for those who can speak the language of the computer, those who can encrypt and decrypt the numbers code of the machine. This new profession has implications for those who will practice it as well as the new skills now needed by other professionals. Yet it is interesting to note that it remains the human communicative process and the human communicators who are adapting to the machine. And in this process of adaptation, communicating like a machine is normalized.

7. **Organization as Information**

Information becomes, in a sense, a medium through which the event extends its domain and impacts upon an ever-wider set of knowledge sites. The central site of circulation within my research is the application of information theory to business management practices. In a further development of the automation process facilitated by the thinking machine, and further to the scientific decision-making processes of the future, information theory permits what Shoshana Zuboff defines as *informating*. For her, information is a process which works with automation whereby "[a]ctivities, events, and objects are translated into and made visible by information" (Zuboff, 1988: 10). As computers enter the commercial market, information theory becomes one of management's tools. The organization and its employees become informated.

It is significant that *Fortune* seized upon information theory as significant as early as 1953, offering an extended analysis of it for its business readers (*F*, 1953b). *Business Week* in November 1954 also considers the role of computers and information theory as tools for managers: "[e]lectronic computers are giving management a tool for tackling operating problems scientifically; They're helping to boost a new management job that's rapidly developing use of scientific logic and mathematics to plan operation of a business as a whole ..." (*BW*, 1954h: 104). At the heart of this development is the quantification of business decisions. The article recognizes that some businessmen will deny the possibility of quantifying business, but this is taken to be a problem of technique, rather than philosophy. "Even now methods are available for giving number values to things considered intangible" (*BW*, 1954h: 104).

Four reasons are presented for why this transfer of theory and method is now possible. First, scientists are realizing that there are stimulating and profitable questions to tackle in the domain of business. Second, management knows that speed and size of current operations means that they need new approaches to organization; third, "[t]oday management is able to gather bundles of statistics; but it senses that they haven't yet been put to full use;" and fourth, we have computers (*BW*, 1954h: 108). "Put these elements together and you have the foundation of this new business function of gathering, relating, and applying logical interpretations to masses of data, to aid management in making decisions" (*BW*, 1954h: 108). Again, management knows it needs to adapt, there is data that needs informationalizing, and we have the technical tools to achieve it, so we should do it.

Information techniques are being used successfully in marketing, production, and communications, and the possibilities seem endless. "Beyond this, many in the field hope that eventually there will emerge from all the experimentation and testing a body of laws for an industrial organization that holds true in any given set of circumstances" (*BW*, 1954h: 108). The organization can be rendered as information. In an article in 1953, *Fortune* also considers the question, "can computing machines be used by businessmen to formulate major decisions of policy?" It recognizes that "[f]or such an apparatus to work, there would have to be some way of translating the elements of business policy into numerical terms – or, to be more precise, into dollar terms" (*F*, 1953b: 129). Thus information, as newly defined, becomes a medium with multiple applications. Its shared assumptions submit an increasing number of knowledge domains to techniques of scientific management. Yet information's commodity value and the profit motive are always recognized.

The model of information is also applied to individual employees, informating the worker. Social engineering enters the workplace through information management and computing machines. *Nation's Business* gleefully reports on a calculating machine which collects information on the speed of people's interactions, determines their personality type, and then matches them with job skills which suit them. The claims are not modest. "As a result of this work, it is now possible to support some impressively sweeping statements about personalities in general, and about personalities in business in particular" (*NB*, 1947: 54). Here we see the beginning of the spread of a notion of information to personality characteristics. Related to this, General Electric also turned to computer manipulations of data in order to find matches between its employees and its available jobs (*BW*, 1956e: 105). The model of the business organization as a set of variables to be managed results in a coding of employees, their location and control as bundles of information. They, like the organization of which they are a part, are being informated and this process continues to this day.[5]

8. The Universal Commodity

> *Notions like 'post-industrial society' and the 'information age' are forecasts – social science fictions – of a social order based on knowledge* (Feenberg, 1995: 132).

> *Rarely in writing about the new communication technology is the relationship between information and knowledge ever adequately worked out, because it is not recognized as a problem* (Carey and Quirk, 1989: 194-5).

Redefined, information becomes the medium underlying virtually all human and machine activities and hence a universal quantity or measure. Information theory is presented as a general theory, a universal theory, a philosophy of communication. "The theory, of course, does more than express a philosophy of communication, it provides universal measures" (*F*, 1953b: 137).

The event of information marks a process, perhaps ironic given the ultimate definition of information, of semantic negotiation. At the beginning of information as an event, information had its colloquial meaning, which includes its semantic content. As Roszak observes, "[w]hen I was growing up in the years just before World War II, information was nothing to get excited about. As an intellectual category, it held a humble and marginal status. Few people would have conceived of it as the subject of a 'theory' or a 'science'" (Roszak, 1986: 3). By the end of the event of information, the negotiation is complete and the new definition of information is widely accepted.

I mark this acceptance through a shift in the periodical indexes. In interesting ways, the categories which appear in the indexes are ways of recognizing shifts in public knowledge. The generation of a new category in a source polling popular journals reflects a critical mass of public material on a particular subject in a particular time period. While information appears in periodical indexes prior to 1957-8, in relation to such things as freedom of expression, it is in that period that the new category of "information storage and retrieval systems" is added. This new category reflects information as a commodity form, as a manipulable quantity, as the medium manipulated by the computer. It is accepted as a domain of intellectual production and of commercial activity. Clearly by 1957-8 Shannon's model of information was no longer contested. We were on our way to the information age. Information had begun to take on unprecedented power to define language, communication, work, individuals, and society.

9. Information Technology ... Information Society

> *A defining technology defines or redefines man's role in relation to nature. By promising (or threatening) to replace man, the computer is giving us a new definition of man, as an 'information processor,' and of nature as 'information to be processed'* (Bolter, 1984: 13).

As one undertakes a large research project, one becomes concerned, perhaps obsessed, with the central terms and ideas of that project. This is why I did a "double take" recently while walking up boulevard St. Laurent in Montréal. A band named "Coded Feedback" was playing at a local alternative club. What this moment, in the event of my project, suggests to me is the ubiquity of the language of cybernetics, information, and information theory in our culture. Perhaps information theory had even become cool! The redefinitions necessary to these shared understandings were being sold to, presented to, and debated by, a North American public in the 1950s.

Grand claims are made for information theory. Marike Finlay describes it as the ideology of the information age (Finlay, 1987: 162). Roszak argues that in its generality it levelled the meaning and value of that to which it was applied, becoming irrevocably tied to the technology which made it work (Roszak, 1986: 14). Hayles suggests "... a simplification necessitated by engineering considerations becomes an ideology in which a reified concept of information is treated as if it were fully commensurate with the complexities of human thought" (Hayles, 1999: 54). Information theory is clearly about more than telephone circuits.

Yet this process, as I have demonstrated, is one which can be traced and its effects mapped in more detail. Information was redefined as no longer about meaning. Technical imperatives resulted in its quantification and rendering in discrete, measurable, commodity form. The bracketing of semantics erased meaning from the understanding of information, and as a result, from the process of communication. This stability permitted the circulation of information as a universal medium, a universal model of efficient communicative action.

In many ways, the event of information works in partnership with the other events of the thinking machine, the game, and the future to facilitate their production in, and their movement throughout, public discourse. Bits of information become the shared medium which permits the informating of data, individuals, organizations, and eventually, societies. This shared medium, this shared capacity to represent, empowers information theory to ground broader social claims. No longer limited to circuit switching, information theory can explain the communications processes of all systems. It begins as a technical theory and becomes social philosophy.

It is a short distance to connect the second industrial revolution of the event of the future to information. Indeed, *Scientific American* proclaims in 1950, "[t]he 20th-century revolution is based on the transformation and transmission of information" (*SA*, 1950b: 29). From information technology to information revolution to information society -- the conditions of possibility are established in the event of information for the new understanding of information to become the godword Roszak claims it to be.

VIII. The Cybernetic Imaginary

> "If the 17th and early 18th centuries are the age of clocks, and the later 18th and 19th centuries constitute the age of steam-machines, the present time is the age of communication and control" (Wiener, 1948: 50).

> "We will, of course, have to invent a new form of society if man is to be the master of the machine brain" (*SR*, 1949a: 22).

> We are in a "... passage in contemporary society toward a new configuration of social relations and new conditions of life" (Hardt, 1995: 34).

Separated by a period of almost 50 years, the above thinkers and commentators are suggesting that new forms of sociality are afoot in the late twentieth century. They are not alone, and they are right. What I have done in the preceding analysis is sketch out some of the elements in the production of that new social order, a qualitatively different notion of society. Others have called this moment the computer age, the information society, and more recently, cyberculture. These terms have become "automatic" within our discourse; we no longer wonder what we mean when we use the term information society or cyberculture. We are probably trying to capture the power of the computer in our daily lives, the decline of material structures and their replacement with digital modes of being, the triumph of techno-science as epistemology, and other intangible notions of an overall social aesthetic. We all know what we mean when we use those terms ... but, how did we get here?

These notions of information society, computer age and cyberculture are potent. They mark domains of knowledge, delimit scopes of action, and inform broader social choices and patterns. Much is done and not done in their names. So, how to critically engage with our current way of life? How to analyze a state of culture with ontological status? I chose to return to a key historical moment in the construction of this ontology; I chose to analyze the production of conceptual edges of cyberculture, its coming into being.

What I found is that a very particular cultural sensibility informs claims for cyberculture, the information society and the computer age, a particular and peculiar way of looking at ourselves, our technology, and our world. I have called that cultural sensibility the cybernetic imaginary. It is in the contestation of the four events of the thinking machine, the game, the future, and information that I suggest we can detail, describe, and understand the formation of the cybernetic imaginary. We can make visible the invisible pre-conditions of our daily lives. I further suggest that it is at the moment of coming into being, coming into shared social signification, that we can see how power is at work within this cybernetic imaginary. We can see how the cybernetic imaginary diagnoses our condition as a society of control.

In this chapter, I consider the notion of the cybernetic imaginary in more detail as a necessarily public, necessarily negotiated, moment of meaning-making. I then review each of the four events, specifically in relation to other thinkers who have considered similar notions in their work. I explore the production of the cybernetic imaginary in and through these four events, individually and in combination. Finally, I analyze the social power implications of the cybernetic imaginary, or control and communication in the human and the machine.

1. Producing Conceptual Edges

In offering my vignettes at the beginning of each event, I was not attempting to suggest a process of immutable cultural continuity between the period of my analysis and the present, from when the examples were drawn. I am not asserting that the cybernetic imaginary is the same today as it was in the 1950s. There have no doubt been mutations, additions, developments, and deaths in the ongoing negotiation of our identities, our technology, our work, and our play. It is another study, for another scholar, perhaps inspired by this work, to examine the cybernetic imaginary in the 1960s, 70s, 80s and 90s. Certainly developments in artificial intelligence research, in systems theory, in business restructuring, and in the technology itself – the microchip, the video game, the home computer, the Internet – would all generate other events, other moments of contestation, of definition, and of redefinition. I offer my cybercultural vignettes as resonances; as markers of the discursive power of certain metaphors, certain patterns, certain thematics. What was striking to me was both their startling resemblance to moments in my research, but also the ease with which I found them. I did not search long and hard for examples which "matched" my historical analysis; the examples were all around me. And this is why my analysis is a history of the present, to borrow Stephen Pfohl's phrase.

It is this process of cultural resonance, of shared understandings, of social assumptions, which I am trying to capture in the cybernetic imaginary. Yet, it remains a nebulous notion. This is in part deliberate, and in part, an aspect of the beast itself. It is deliberate, not to be obfuscatory, but rather not to kill the spirit of the sensibility with the weight of the analysis. The cybernetic imaginary is more than a list, more than a four-point definition. Further, my story of the cybernetic imaginary is only one way of narrating it. I am not suggesting that the whole of the cybernetic imaginary can be described conclusively through the thinking machine, the game, the future and information; it cannot. What I am suggesting is that it can be rendered visible, and its implications analyzed through the four events I offer.

There are some points that can be made about the cybernetic imaginary. It is necessarily a public phenomenon, implicating the public imagination. It is a denotation of shared meanings among members of a society. Given various assumptions, a variety of scholars have considered different ways of knowing a process of shared meaning making within a society. I selected the mass media – in part because it is a generally understudied domain of wider cultural production in cybertheory and in technology studies more broadly. As well, however, because of the media's role as both an informer and storyteller, as information source and location of narrative production, it is a key site in the public negotiation and production of the cybernetic imaginary. Given the significance of the mass media to life in North America since World War II, it is here that the cybernetic imaginary is most visible.

I use the notion of production because the cybernetic imaginary is not static – it is a cultural process always under way. One can freeze certain moments for analysis, as I have done, but it is always in motion. I developed event analysis in part to mark that motion. Further, as with any meaning-making process, the cybernetic imaginary has at its heart, negotiation. This negotiation is social, not individual, and so does not involve conscious debate in individual self-interest, but rather a wider process of focusing meanings. As something occurs, there is a range of ways in which it can be represented, a variety of imagery available. Choices are made, debated, refined, until an agreed upon understanding is reached. At this point, one has arrived at the "normal" way that this particular thing will be discussed. This normalization process can never be known in advance and this is what I attempted to capture in the events. The normalization is affected by the structures and practices of journalism itself, of science and industry, of the socio-historical context, by certain individuals, by what has gone before, and by chance. It cannot be predicted, only examined after the fact. It is also very difficult, if not impossible to say *why* some ideas grab a purchase on the imagination of the public and why others do not. What is more significant, and what I have done in the four events and will explore in more detail in this chapter, is to consider the effects of that purchase, the implications of the normalization of *those* particular meanings. How did *those* truths become established?

Further, the cybernetic imaginary is of course about cybernetics and the computer. A brief word on these, however. I would like to address why I have used the term "cybernetic imaginary" and not "computer imaginary" or some other designation. I have always been inspired by Arturo Escobar's suggestion that "... any technology represents a cultural invention, in the sense that it brings forth a world; it emerges out of particular cultural conditions and in turn helps to create new ones" (Escobar, 1994: 211). Yet this perspective which treats technology as a bounded object that influences, and is influenced by, cultural conditions has come to dominate attempts to engage with cyberculture. The computer emerges as the object through which to analyze, as well as the reason for analyzing, cyberculture. An overwhelming amount of critical work in the broader field of cybertheory is attempting to understand the impact of the computer on our world.

In my study, the computer is somewhat decentred, it is more effect than cause. The computer has not yet emerged as an abbreviation for information society, as a magic word. The "computer" is not as semiotically loaded in the conjuncture as it later becomes. The term itself is being struggled over; the machine was variously called the calculating machine or the computing machine, perhaps humbler nomenclatures.

My research suggests that the computer was understood within public discourse at the time as a manifestation, as the material result, of larger ideas in public circulation, namely cybernetics.[1] Kathleen Woodward (1983) correctly recognizes, as I note previously, that most people in the late 1940s and 1950s did not have first-hand knowledge of the computing machine. Their knowledge came from the media reports of the machines and from a knowledge of cybernetics as it filtered through the media and through traces in everyday vocabulary. Further, cybernetics, which many scholars have productively analyzed as a science, has not been explored as effectively as a wider public knowledge, indebted but not limited to, its formulation as a science. Cybernetics and the computer both emerge as notions in the public consciousness. And they are given meaning in conversation with each other.

As I note previously, there is often slippage between the computer and cybernetics in public discourse. In some moments, the computer produced cybernetics; in others it is the reverse. Sometimes computers are proof of cybernetics, embodying cybernetic principles; other times cybernetics is proof of computers to come. It is this terminological and conceptual slippage which I name the conjuncture of computers and cybernetics, and it is at the core of the cybernetic imaginary.

It is this conjuncture which exists and is produced in public discourse that causes me to decenter both the computer as technological object and cybernetics as a science, and to treat the two together as ideas in public circulation. Yet, I have privileged cybernetics in my appellation, cybernetic imaginary. I have done this for a number of reasons, one of which is as a process of recovery. The computer did not die as an object or an idea in the public domain, quite the contrary. As is suggested at the beginning of this thesis, however, cybernetics did. Cybernetics fell out of vogue and ceased to be a specific notion within public discourse, although traces of its passing like feedback, information, control, and entropy lived on. The computer is not invisible within our society, nor are its effects on our lives. Cybernetics is. What I am trying to capture is the sense that cybernetics and its central ideas have continued in the public imagination, although not necessarily named as such, and have influenced how we understand the computer. It is not that one pre-exists or causes the other, nor that the effects do not go both ways, but rather a matter of choice to focus my analytic gaze on the less visible, on the less studied.

This is why I would distinguish the cybernetic imaginary from the broader notion of technoculture, as employed by some scholars. Technoculture implicates the coming together of technology and culture. The cybernetic imaginary is attempting to name a moment which brings together cybernetic ideas and cybernetic technology (as the computer was at that time), in the public imaginary. The cybernetic imaginary arises primarily in and after World War II, notwithstanding that "computers" in one form or another have existed since classical antiquity, as David Bolter (1984) so effectively demonstrates. What makes the cybernetic imaginary particular to the postwar era are a number of factors. It is the time in which cybernetic ideas coalesced and were named; it is the time in which the modern digital computer came into social circulation; but perhaps most importantly, it was the time, arguably for the first time in history, when these developments circulated in the mass media. It was a time when the wider public participated in the naming, framing, and circulation, not of the material technologies themselves, but of how they would be understood, how they would be talked about by society. These factors combine to locate the production of the cybernetic imaginary in the postwar era.

Finally, necessarily, the cybernetic imaginary is also about power and how it is configured within society. The cybernetic imaginary offers an understanding of how power should and does function which I suggest continues to influence us. It is the emergence of the cybernetic imaginary in the immediate postwar period that makes this most visible. The ideas of cybernetics were new; the modern digital computer was new. What effects were these going to have on society? How were we to understand them? As with all new ideas and objects, there is a certain risk that they will disturb the status quo, that they will threaten existing power configurations. This is why within the events we can see both processes of the presentation of new ideas as well as their containment within certain frames, certain boundaries, so that they can be made sense of without threat. We see this very clearly for example, in the almost paradoxical treatment of the smart machine in the event of the game. The cybernetic imaginary as a whole then works to become the normal, namely the unquestioned, terrain upon which new products are developed, new cultural content is produced, and political debate is framed. In this way, the conceptual edges of what will become cyberculture begin to emerge.

2. The events, reprise

Each of the events of the thinking machine, the game, the future, and information emerges as a moment of cultural negotiation, as processes of meaning-making within public discourse in the late 1940s and early 1950s. My treatment of them to this point has been largely empirical – to demonstrate their coming into being within the discourse. In each we can see a process of normalization, whereby meanings which begin as potentially unlimited become organized and focused around certain axes, certain notions are replaced with others, certain ideas become fused, articulated together.

Yet while my analysis may be unique in this regard, others have also mapped out certain central metaphors and figures of cyberculture. While they do not speak of events, they offer an interesting conversation with my four events. In many ways they are mutually confirming. I am referring specifically to the work of J. David Bolter, Stephen Pfohl, N. Katherine Hayles and Paul Edwards. In very different ways, my events speak to and with the patterns, figures, and metaphors that they identify in their work. I review each event briefly through this lens before moving on to consider them in interaction as they work individually and together to reproduce the cybernetic imaginary.

a. The Thinking Machine, reprise

> *The debate over the possibility of computer thought will never be won or lost; it will simply cease to be of interest* (Bolter, 1984: 190).

The thinking machine is perhaps the first and most significant hurdle to overcome in public discourse in the production of the cybernetic imaginary. How to name this machine which does some of what we can do with our minds? How to make sense of cybernetics' claims that machine, humans, and animals are basically all the same? How to create or demonstrate the equivalence of human brains and rooms full of vacuum tubes and blinking lights? How to render as non-threatening a new machine that replaces human mental labour?

Behaviour becomes the basis for the comparison between humans and computing machines and the machines are framed in a familiar set of notions – the physical and mental attributes of ourselves. These machines are like us because in some ways they act like us, more particularly because they can compute like us. Through tropes such as electronic brains, memories, and thinking machines, the technology is anthropomorphized. However, as with any metaphor, both domains are changed in the metaphoric meeting. Humans become framed in machine terms, particularly in relation to their work. Numbers take on a significance as humans and machines can be compared on the basis of their computing abilities (behaviours), in numerical terms. Automation is made a logical and indeed, necessary, step by the clear superior efficiency of the machine. The machines are faster and they "learn" from their mistakes. It would be ridiculous to choose the human worker over the machine worker. The human must adapt and work with the machine in a feedback system which incorporates them both as equivalent information. Both are valued for their use-value in the system of work.

The stage is set for the rewriting of the nature of labour alienation. As Jean Baudrillard suggests of computer work:

> [a]m I a man, am I a machine? In the relationship between workers and traditional machines, there is no ambiguity whatsoever. The worker is always estranged from the machine, and is therefore alienated by it. He keeps his precious quality of alienated man to himself. Whilst new technology, new machines, new images, interactive screens, do not alienate me at all. With me they form an integrated circuit (Baudrillard in Springer, 1991: 314-15).

Yet what of the promises of the leisure society held out by the gurus of automation in the 1950s? Has the happy narrative of Erma and Emmy come to pass – namely that human labourers are liberated by technology to devote more of their time to creative and stimulating endeavours? We are working more hours than we ever have and arguably the nature of that work has changed, as Baudrillard correctly notes. Because of the equivalence of the thinking machine, we form an integrated circuit with the machine. As Shoshana Zuboff (1988) suggests, through the shared medium of information, both workers and their work have become informated. Human labour can be valued in machine terms. There is no happily ever after in the story of automation.

"Can machines think?" becomes a question which haunts artificial intelligence development for the next forty years, but which is answered resoundingly in the affirmative within the public discourse at this time. On the basis of the equivalence in behaviour, computing machines become thinking machines. A language of minds, brains, thinking, intelligence can then be unproblematically applied to the machine. At the same time, the foundation is laid for the further redefinition of the human as (flawed) machine in the event of information, as less intelligent than the smart machine in the game. The event of the thinking machine establishes the functional equivalence between humans and machines.

Having established this equivalence, what is meant by thinking, machines, and humans, has already changed. This change is recognized by Paul Edwards in his consideration of the limitations upon the understanding of human thought that resulted from the acceptance of the Turing Test as a measure of thought process. "The manipulation of written symbols by computer and human being become processes exactly analogous to, if not identical with, thought" (Edwards, 1996: 159). He continues his argument, suggesting, as does Hayles, that thought becomes informationalized and disembodied. "The Turing test thus uses the computer as a metaphor not only to delineate the nature of intelligence abstracted from any embodiment, but also to describe ourselves" (Edwards, 1996: 159-160).

In the notion of electronic brains, David Bolter suggests that programmers apply their models to experience. "Through mathematics, simulations, industrial robots, and databases, more and more human experience comes under communication's 'command and control'" (Bolter, 1984: 189). He does not find it surprising that programmers would want to bring the human into the machine world by turning the computer into an electronic brain, yet he recognizes the power of the metaphor.

> The electronic brain remains for many an uneasy metaphor. No one can say with certainty how far that analogy between the computer and the human brain may be taken – whether some human capacities perhaps the most important, can ever be given to a machine. The popular press often carries reports of the computer's capacity for rational thought (from economic planning to playing chess), of its huge, infallible memory, its unimaginable speed of operation (Bolter, 1984: 190).

Turing claimed that a computer would be able to "think" by the year 2000, yet Bolter feels this claim did more than motivate artificial intelligence researchers. "He [Turing] was instead explaining the meaning of the computer for our age" (Bolter, 1984: 13). And indeed he has. The problematic of the thinking machine has been a central element in the social discourse of the cybernetic imaginary ever since. Within the discipline of computing this debate transfers to the institutional domain of artificial intelligence, but the root metaphor of the thinking machine is felt within the wider culture. We accept that computers might evolve, that scientists are working on giving them emotions, and that they are smarter than we are. This functional equivalence as normalized by the thinking machine may well be contributing to the ease with which we are accepting cyborgian practices of nanotechnology and genetic engineering in North

American society. The computer was, after all, *Time* magazine's "Man of the Year" in 1982. The metaphysical line between human and certain kinds of machines is erased in the production of the thinking machine. The differences, if any are cosmetic, bodily, irrelevant. We become defined by that part of us which is parallel to the machine – our brains. As Bolter suggests, "... by making a machine think as man, man recreates himself, defines himself as machine" (Bolter, 1984: 13). My modification of Bolter's claim would be to suggest that by accepting the idea that what the machine does is think as a man, man defines himself as machine. The results are the disembodied cyborgs of the thinking machine and the technicized human. We are the machine; the machine is us.

b. The Game, reprise

> *The [Turing] test is cast as a form of a game, a duel of wits between man and machine. Games are in fact the form of intellectual activity that computers imitate most effectively. The Turing machine itself is a logical game, whose moves are governed by precise rules, and the computer plays a sort of game with every program it runs* (Bolter, 1984: 192).

To play a game, we agree on a set of rules, thereby marking an inside and an outside, a legitimate and a non-legitimate, a legal and an illegal, space of interaction. We accept that there will be a winner and a loser. We are pitting our skill and talent directly against each other. We want to win, or why else would we play? The game functions as an event to establish the legitimacy of rule-bound interaction, of goal-oriented behaviour, of teleological logic, namely the play of smart machines within an epistemology of rationalism. Intelligence is defined as reasoning, as reasoned behaviour. Reasoning in the thinking machine is produced through computation. Thus, the ability to compute becomes the new definition of being smart, reducing both intelligence and reason in one move. Thinking machines are now smart machines and reason (computation) becomes the privileged way of knowing.

Games are the activities of children and therefore, not very serious, but at the same time, the ability to play games (successfully) is taken as proof of intelligence in both human and machine. Once the game is accepted as an appropriate model for both measuring intelligence and resolving challenges, the model can be applied to a variety of different orders of games – from tic-tac-toe to economics. The game, as model (not only as metaphor), facilitates the movement of these ideas from information sciences to social sciences, and to broader practices of social governance. Again, the method applies to behaviour only, rational behaviour becomes the homologic medium.

Games come to be the underlying framework for understanding the behaviour of computers. "The computer encourages a kind of playful trial and error, a manipulation of electronic possibilities, so that it becomes almost irresistible to view programming as the ultimate sort of game. It is after all Turing's game ..." (Bolter, 1984: 186). Edwards agrees with Bolter, suggesting that game-playing goes to the very heart of computer programming and language as it has developed within computing science.

> [Y]et despite these vivid differences [in computer languages], all computer programs work in essentially the same way. They manipulate symbols according to well-defined, sequentially executed rules to achieve some desired transformation of input symbols into output symbols. Rule-oriented abstract games such as checkers or chess also have this structure. As a result, *all computer programming, in any language, is gamelike* (emphasis in original; Edwards, 1996: 170).

The deep-seated nature of the game in computing technology and in the public discourse with which those machines were embedded has power implications. The game has rules.

Bolter recognizes the implications of the rules of the game.

> To play any game, we agree to something like that suspension of disbelief that makes possible theater and the movies. We enter another world, a world whose logic consists entirely of the rules of the game. Insofar as we take the game 'seriously,' we concentrate upon the logical corners and alleys that the rules define, and we do not bother about experiences that fall outside of the game (Bolter, 1984: 43-4).

He sees the role that the quest to build first a checkers- and then a chess-playing machine played in both the computing of the 1950s, but in artificial intelligence developments until the time of the writing of his book in 1984. Game-playing is a fundamental part of Turing's Man as Bolter defines him.

> The computer man [Turing's Man] ... remembers that computer programming is a game, the spinning out of solutions to well-defined problems according to strict rules. It is not a search for something remote, hidden, deep. A game is played with materials ready at hand; it may indeed be tricky or taxing but always within a familiar field of play (Bolter, 1984: 223).

James Beniger also recognizes the broader implications of games theory and its application to theories of control. "Games ... provided the inspiration for a separate application of decision to control theory, namely statistical decision theory, a formalization of rational choices among alternatives with different probabilities and utilities" (Beniger, 1984: 52). Thus, games form another root metaphor framing the technology from the outset, but more significantly, facilitating the movement of its techniques to other encounters.

Viewed as an essential tool of strategic decision-making, the game causes other effects when one views the domain of government or business as susceptible to this method. What is marked as outside the rules, or as outside the logic of the game when games theory is applied to governance? Politics, social organization, the family, become zero-sum games where rational, self-interested behaviour is valued to the exclusion of all other ways of being. The smart machine, as the purposeful machine, becomes a necessary element in social-decision-making, rendering the social subject to, and completely representable within, an epistemology of reason, within rationalism. It is not accidental that business embraces this mode of decision-making, laying the groundwork for moves towards entrepreneurial discourse and restructuring practices in a later era and their movement from business management to other social forms. The basic equivalence between all forms of social systems and their renderability and management by rational means is established in the game. As Beniger suggests, decidability becomes a question of computability. The exercise of human judgement is no longer needed; the human being as decision-maker, as governor, is obsolete.

c. The Future, reprise

> *We have entered the realm of science fiction, and, as with all science fiction, the predictions are not really about the future but about an extrapolated present* (Bolter, 1984: 210).

As a *Scientific American* author suggests, "[c]rystal gazing is a natural and valuable pastime, even if the visions beheld are only infrequently accurate. Some things, at any rate, are seen more clearly and certainly than others" (*SA*, 1952f: 46). The event of the future illustrates the discursive processes whereby the future becomes privileged as a domain which can be known, particularly through and with computing technology and methods of statistical analysis. The past is discredited and erased through the treatment of memory as a numerical question, a question of past performance, rather than embodied experience. The present is framed as a moment of revolution, normalizing rupture, change, and speed. The future is moved closer. The future is now.

A model of history which grounds understandings of change and stasis is produced in the cybernetic imaginary. History is fast, inevitable, purposeful, and progressive – a telos of technological progress emerges which has strong echoes in the past (Carey and Quirk, 1989; Marx, 1997) and which resonates into the future. The seeds of the information revolution are being sown in the event of the future.

I suggest that a form of perpetual presentism emerges, where the future is defined in relation to the present, as an exercise in risk management. Either utopia must be found in the present or cease to exist because the future is no longer unknown. It has been rendered representable, knowable, controllable. Combined with the event of the game, social engineering becomes science, and therefore, legitimate; the ethos becomes, if we can, we should. Certain forms of expertise are marked as privileged to "know the future," to tell us our future. Science, in particular, is legitimated to speak, not only of scientific matters, but social futures. Therefore, the social can be rendered scientifically, and science becomes a general knowledge. Cybernetic prediction, which becomes among other things, systems theory, allows us to know the future from the present.

Our world is cast as hopelessly complex and risky. If we are to navigate it safely then we must be prepared to accept probability analysis. We must be prepared to accept the role of the computer in predicting our future, even in priority to our own embodied experience. And that future is both immanent and progressive. The technology cannot be stopped and is evolving with us. The past is less evolved and less progressive; the present is always about to be better.

Bolter, too, recognizes this rejection of history and the focus on the future. "[T]he computer man is less aware of history than his predecessor and is not likely to see the historical currents in which he is caught. He tends to project the present indefinitely in both directions" (Bolter, 1984: 225). Memory is also a key notion for Bolter as he recognizes that there are implications to the framing of computer data recall in terms of human memory.

> To speak of these logic machines and algorithms as 'memory' is an implied comparison to the human act of memory. The comparison comes naturally, for electronic technology is alive and flexible that it seems to many to not merely rival human memory but to explain it. The urge to understand human memory by reference to computer's storage devices has proven irresistible to modern psychology (Bolter, 1984: 151-2).

Looking toward the future, perhaps to Deleuze, Bolter suggests that databases "... will be an electronic embodiment of the conviction that memory is knowledge and knowledge power" (Bolter, 1984: 164).

History becomes the humanist history outlined by Kathleen Biddick which dissociates process from remembering. She suggests that,

> [h]umanist history deterritorializes memory as re-membering and reterritorializes it as archive. It has served as the institutional discipline of memory, marking and remarking who is remembered, what is remembered, and in what way. In deterritorializing memory, history then produces humanist memory as an object, as imprinted image locatable in its fixity, recoverable in its plenitude ... (Biddick, 1993: 48).

The humanist history named by Biddick is given material life in the cybernetic understanding of memory and its representation in the form of the computer. The model of computer re-membering emerges as a social model, of social memory. The database, the archive of memory, takes on pivotal importance; the past is measured by bits. The gaze is always forward. How many encyclopaedia can be stored on a disk becomes more important than reading those encyclopaedia. It is enough to quantify history, to save it; we do not need to know it. The gaze is always forward.

The future irrevocably links progress and the computing machine; the relationship is framed as causal through the computer's ability to see the future, to protect us from the risks of the future. But the first industrial revolution resulted in an overall improvement of the human condition, or so we remember. Why should the second be any different? Our social reality is defined as technologically immanent. Technology is always about to be better, faster, smarter (thus sustaining the computer industry for forty years); more particularly, our society is always about to be better, through technology. As Jennifer Daryl Slack suggests (1989), technology and progress become articulated together in a way which implies, without demonstrating, their relationship. Past, less than positive experiences with technology are elided in the joyous fusion of technology and progress. It is a bloodless conflict; nobody dies in the information revolution.

d. Information, reprise

> *These wartime developments, together with other advances that followed after peace was restored, led to a new understanding of what is meant by 'information' and the methods for conveying it. A whole new field of communications theory was born* (Ross, 1958: 18-19).

Normalized in the thinking machine, through the shared human behaviour of computing, numbers already have a significance in the cybernetic imaginary. But numbers (and mathematics) become the underlying medium (and logic) of information transfer. Communication is reduced to the successful transference of information. Information, however, is redefined in numerical terms, devoid of meaning. Its technical circulation becomes privileged over its semantic or experiential modes, because they cannot be quantified, measured, bought, and sold. This redefinition takes place expressly as part of an effort to make information a universal, quantifiable medium, for technical purposes. As N. Katherine Hayles suggests:

> [i]nitially messages were separated from contexts because such a move was necessary to make information quantifiable. Once this assumption was used to formulate a theory of information, information technology developed very rapidly. And once this technology was in place, the disjunction between message and context which began as a theoretical premise became a cultural condition (Hayles, 1990: 27).

Knowledge becomes disembodied as information becomes a measure of value, a measure of order.

Language becomes a central contested figure, with its implicit notion of translation. Computers must communicate with each other – and therefore, have language. Computers and men must also communicate with each other, and thus require a shared language. Computers are further humanized through their ability to manipulate symbolic representation in the form of language. As well, certain experts, those who can speak the language of the computer, take on increased social and economic status as the computer becomes an inevitable and inexorable tool of business and government. Again, however, language marks an inside and outside. Problems which are too complex, or which reflect a different communicative logic and cannot be represented in computer language, in binary code, cannot be spoken, cannot be solved. Further, the language of the computer is composed of yes/no binary digits; there is no room for "maybe" in binary code. Binary digits – bits -- are therefore the ideal universal measure of the amount of information. The value of communication then becomes a measure of the amount of information. The value of communication becomes the number of bits. Content and meaning are completely evacuated in this manoeuvre. Who is speaking, why, to whom, and with what purpose, are all elided from this new philosophy of communication.

Bolter writes extensively about the notion of language and the computer. He suggests that computer language is "... as the logicians had hoped, the triumph of structure over content; to be more precise, it is a reinterpretation of content (what linguists call 'semantics') in terms of structure" (Bolter, 1984: 146).[2] Edwards also feels that it was the original Turing test which implied that written language stand in for all forms of human communication, creating the initial linguistic equivalence between computers and humans. "Under the regime of the [Turing] test, written natural language must be seen as an adequate representation of human communication. ... The Turing test makes the linguistic capacities of the computer stand in for the entire range of human thought and behaviour" (Edwards, 1996: 159). Agreeing with Hayles' argument about the disembodied notion of information and her related claims about the divorce of communication from context, Edwards argues that communication content becomes separated from form. "The content of a communication process is thus assumed to be independent of its form in the same way, the content of intelligent thought is assumed to be independent of its form" (Edwards, 1996: 159).

Information emerges as neutral, as objective, as not about power. Hayles argues this becomes a wider cultural idea with the circulation of the "... assumption that the production of information is good in itself, independent of what it means. Having opened this possibility by creating a formal theoretical framework that implied it, information and communications technologies actualized it in everyday life" (Hayles, 1990: 6-7). The computer is also then a neutral device.

Information is thus poised within its event to become a universal medium. Cybernetics' claim that all systems – human or machine – are defined by their activities of communication, namely their effective transfer of information, sets the ground for the redefinition of the human, the machine, and their society, as information processing systems. Information and communication theory then offers the theory of the universal medium, a new philosophy of human and machine.

Marike Finlay suggests that information theory becomes the ideology of the information age. She writes, "... one might wish to point to systems or information theory as the principle 'condition of possibility' of discourses on and of new communications technology" (Finlay, 1987: 162). While I do not accept that it was the only significant discourse contributing to information technology discourse, Finlay is correct in identifying the wider play of information theory as more than a technical knowledge. It sought and in part achieved a status as a theory of the social and not merely the technical, and in this process, the social becomes technicized and informated.

3. Events in Interaction: The Cybernetic Imaginary

> *For indeed practical embodiments of the cybernetic world view have spread to virtually all fields of power, knowledge, and culture* (Pfohl, 1997: 119).

The thinking machine, the game, the future, and information work together to diagram the coming into being of the cybernetic imaginary and begin to outline the workings of the society of control. They work as a set of publicly negotiated, shared truths, struggled over in discourse, redefined, figured, and illustrating shared cultural understandings. The subsequent development of information technologies, the computer in particular, the automated work place, video games, the Internet, and our overall relationship with our technologies of play and work take place in conversation with this cybernetic imaginary. It is not static; it mutates and develops over time. It does not map out the same way now as it did by the late 1950s, but neither are its earlier moments irrelevant to us. It is in this formative period that certain debates are silenced, certain notions are redefined, and certain reductions become normalized. Certain notions become articulated together, establishing a seemingly irrefutable and necessary relationship between two not necessarily related ideas, and producing power effects in that process.

I have detailed some of these reductions, redefinitions and articulations in my treatment of my events as discrete items. Yet is important to realize that the four events do not unfold chronologically in relation to each other, nor independently, as treating them individually for the purposes of analysis might suggest. They were happening simultaneously and in dynamic interaction. While it is important to pull apart the threads of the cybernetic imaginary in order to see how the patterns were created, it is equally as important to weave those threads back together so the jacquard pattern is visible as a whole in the fabric of the cybernetic imaginary.

One of the first overall patterns to emerge in the cybernetic imaginary is a sense of wonder. This wonder applies both to the computing machines and cybernetic ideas. Perhaps buoyed by a general cultural optimism coming out of the war, an unprecedented prosperity, and an enthusiastic faith in the benefits of big science, the computing machine and cybernetics are celebrated as revolutionary. A sense of expectation, of immanent discovery, pervades the four events. It manifests most directly in the future and its technological immanence, but is a general mood reflected in the interaction of the other events as well.

This has several effects – it immediately casts critique or questioning as pessimistic and lacking in trust and vision. (Perhaps even un-American.) Any technology or knowledge with a relationship to science can ride the wave of the embrace of science as an overall belief system. Finally, a sense of the speeding up of the social takes place. With this, the notion of long-term social planning becomes problematic and planning for the immediate future becomes imperative. The future will be better and the future is now, emerge from this sense of wonder.

Related to this sense of wonder is a sense that more and more of our world can be rendered in knowledge; more and more of our world can be seen to be rational, and thus known by scientific principles. The sense of wonder is not so much about what we don't know as about what we do, not so much about our world as about ourselves. The field of application of scientific ideas expands dramatically in this time period. Scientists become general knowledge holders and the line between social knowledge and scientific knowledge becomes blurred as science offers its epistemological foundation to all manner of social interaction. We can see this operating through each event, and accumulating across all of them. Science and the scientists who wield it, are the privileged expertise and experts, respectively. They become visible and we are glad to see them. In knowing more and more of our world, there is a sense in the public discourse that we are increasingly in control of the unknown, in both men and nature. It is a bold time, with very few self-limits being put on claims to knowledge.

A third overall pattern forms a backdrop to the play of the four events, namely the shifting development of computing machine technology from military to industrial to commercial sites. A larger process of legitimation is taking place within the cybernetic imaginary whereby the computer is cast as an appropriate and necessary tool for white collar business. Even though at this time, computing machines were not cost effective for many smaller businesses, the computing machine as office worker is nonetheless established at this time. The computing machine is granted useful agency. This process is not unrelated to the emergence of a fledgling computer industry and its marketing efforts. The cybernetic imaginary, through the four events, establishes an equivalence between machine and human workers, renders decision-making work as information manipulation work and offers the smart machine as the more efficient worker, the more efficient decision-maker.

In addition to the normalization of the displacement of the human worker by the machine, the computer is also normalized as a market commodity along with the value it manages – bits of information. The computer shifts from being a novelty, a military tool, or a device used only by government to being an office tool and, more accurately, an office worker. The numericized information that the machine handles, as well as the work of the machine, become items to be bought and sold. Public opinion of the machines, becomes market opinion, and thus becomes important. By the end of the emergence of the cybernetic imaginary in the period of question, the computer must start to worry about its public image. Just as scientists were becoming visible scientists, the computer was becoming a visible technology.

A fourth pattern which emerges is a move towards a shared and particular language. At the end of the negotiations which comprise the four events, certain language, which continues to this day, had undergone a process of signification and resignification. Terms like digital, the computer, information, feedback, binary, automation, progress, programs, bits, computer code and so on became a shared language with which we would continue to articulate this particular machine and its activities. The notions enter the discourse in quotation marks, but with the unfolding of these events, the quotation marks come off.

This shared, but specific language marks computers and their science as a unique and powerful domain requiring its own, more sophisticated communication system. It elevates certain individuals (those who could speak the language) as "in-the-know" and others as marginal, as mere "users." Yet, unlike some other specialized languages, these terms came into signification in a wider public process. This facilitates their use and application, not only within the specific domain of computing science, but also within broader culture. The computer language is often our language as well. It is we who adapt our language, who translate ourselves, our behaviours, and our questions, into the *lingua machina*.

Finally, I want to trace several processes of articulation which take place in the unfolding of my four events, the effects of which are never neutral. Computers and brains become articulated resulting in each of the thinking and the smart machine. Mind-machine metaphors are normal, expected, useful within the cybernetic imaginary. Computers can then be articulated with a host of other mind concepts – thinking, learning, remembering and so on. These processes become reduced to a binary choice of "yes" or "no." Clearly these machines are unique in human history; they are more than mere machines. They share an evolutionary path with human beings, locating them outside of a history of technology.

As Slack suggests, technology and progress are linked together in information society. More particularly, through the interaction of my four events, computers become articulated with revolution and evolution, thus ensuring their treatment as an historical break, as unique, as unstoppable, and as purposeful. This works to link the computer to a view of the future which is progressive. It helps contain the risk of a clearly superior technology moving at breakneck speed – at least we know we are moving toward something better. The pattern fits within an already well established vision of technological progress in North America, but is given the twist of the smart machine in the cybernetic imaginary. Never before has a technology been so much like us.

The social and the scientific are articulated together. Management and social sciences can and should seek to be more scientific through the quantification of their informational content. Information is a universal medium permitting this movement. The objectivity of science can be applied in the social domain to produce social knowledge which is also objective. This has the effect of rendering the exercise of social power within the cybernetic imaginary as neutral. Control, as a cybernetic form of regulation, can emerge as a totalizing form of social power, an invisible form of power, mobilized in the very nature of communicative action. So, how do these effects of power help us to better map out Deleuze's societies of control?

4. Control and Communication in the Human and the Machine

> *... given the omnipresence of cybernetic control mechanisms across a wide range of contemporary institutions, it is vital to remember the ritual origins of this logic and its limits* (Pfohl, 1997: 120).

> *What is the status of a particular object when it is transformed into the organizing principle of a technology of power?* (de Certeau, 1984: 48-9).

What we see emerging from the play of the four events, in the production of the cybernetic imaginary, are prescriptions for living, ideals for society, suggestions for how we should be, which I argue give some flesh to suggestions that we are living, after World War II, in societies of control. Inspired by a variety of scholars exploring notions of control, in this section I theorize the power effects of my four events, power effects which contribute to knowing how power is organized in our society. Ulric Neisser, in exploring the social impacts of cybernetics in the early 1960s suggests that the brain is like a computer, that man is like a machine, and that society is like a feedback system (Neisser, 1966: 73). My telling of the cybernetic imaginary suggests that within the public imagination, the connections were more than simile, more than metaphor. In the society of control I map, the brain is a computer, man is a machine, and society is a feedback system.

Control moves as a cybernetic notion through the four events. Its most frequent appearances are as the successful effect of a cybernetic feedback system, thus as a synonym for negative entropy or order, and as a synonym for the process of automation within the factory, as the replacement of human decision-making with machine power. Control within the public discourse is about order, stability, and predictability. The computer emerges as the ultimate control machine. Yet this appearance of the notion of control on the surface of the discourse is not what I mean by control as a mode of governance.

Control. as a mode of social power is much more than automation or a cybernetic process. By it I mean. how do we understand what the cybernetic imaginary enables and what it denies? One can believe that machines are like humans, but what are the social possibilities created and denied in that belief? One can believe that information is valuable and that people can be translated into information, but what social institutions and models does that belief privilege or disclaim? I suggest that subjectivity. epistemology. history. and communication all become rewritten within the cybernetic imaginary. marking the initial boundaries and limits of societies of control.

The subject of a society of control. is a dividual. according to Deleuze and I suggest that dividuals can be read as the effects of coding. Coding is the process whereby all processes. individuals and objects can be and are rendered as information in the cybernetic sense. namely rendered as numbers without intrinsic meaning. Within the communicative process. therefore. everything can be represented and becomes representable. Humans become representable within the same medium as the computer. We define ourselves as an agglomeration of useful data. of information. of bits.

Numbers emerge as significant to this process of coding, with the quintessential numbers manipulator being the computer. Bolter recognizes the role of the computer in assigning a new importance to numbers. "[Computers] have also given a new significance to numbers. The computer allows. indeed seems to demand quantification of all kinds of data ..." (Bolter, 1984: 53-4). This quantification becomes a measure of speed. of amount, and ultimately of value. Our value as subjects is determined by our value as information. Society is produced as a series of inter-locked databanks of useful knowledge and that which cannot be rendered informationally, that which cannot be coded, is rendered valueless.

Yet coding captures more than the informating of social life. Coding has encryption implications. Computers neither speak nor work in human language; they have their own special computer languages. In order to communicate with these machines, our speech must be translated into computer code. Codes necessarily imply secrets and secrets are only that if a majority of people is unaware of them. Coding elevates access to information to a marking of privilege. We become obsessed as a society with protecting our information -- our personal identification number becomes our access point to money, services, and the data profile which defines our identity in our society of control. Perhaps Y2K is also an identity crisis.

Coding renders all informational. Individuals can be constructed, rendered, and managed as contingent bundles of data, as temporary eddies in the stream of entropic disorder. As C. Colwell argues in his analysis of Deleuze's notion of the dividual:

> [f]rom an electronically discursive standpoint, dividuals are constructed in databanks, each aspect of the person assembled in separate computer files, each file available for a different purpose, the parameters of each file organized around that purpose. ... But the multiplicity of databanks and their interconnection in the network generate the ability to assemble an individual out of the electronic text that documents a person's dividual nature. Indeed, control is more interesting, and dangerous, in this sense as it enables the assembling of more than one individual out of the same person (Colwell, 1996: 212).

Thus subjectivity is technicized but further, because information is at the heart of that technology, because the thinking machine thinks by computing, subjectivity is numericized. We think because we compute; we are because we can be computed.

Because knowledge is power, particularly in the information age, epistemology becomes a strategic exercise. Epistemology, or the way of knowing within the cybernetic imaginary, becomes science and mathematics, the manipulation of numbers. Computation emerges to define not only decidability, but knowability. Intelligence, thinking, learning, remembering, all become subsumed by a model of reason, and further, a model of reasoned behaviour. Rationalism, or the belief that knowledge can be produced solely from the exercise of reason, marks the production of knowledge in the cybernetic imaginary. Yet it is a calculated rationalism. Chance, differences of interest, the future, the mind, human interaction, are all rendered knowable and thus controllable. Further, the language of numbers, of science, is a language of truth. That which can be rendered numerically is "true," because numbers do not lie. Thus, knowledge from the computer is always, already "true." It need not be questioned.

The transcendental nature of certain human activities, and indeed of humanity, is elided in the equivalence with the machine – rendering humans also knowable. Life and its various activities become a series of games to be played out, according to clearly defined rules, where we accept the stakes of winning and losing as not debatable. But who sets the rules, particularly in games such as economics and government? Presumably those who are the most rational, those who wield the tools of science and mathematics. But the question of who makes the rules is ultimately outside of the game; it is irrational; it is irrelevant. The cybernetic imaginary has already established that life is a game; all that remains is to play it out.

The world of the society of control is thus smaller. It has been rendered less wondrous, denatured through its subjection to rational knowledge. Yet even more than this, the same knowledge form, the same language of knowing, can be applied to individuals, to their communities, to the machines. As Paul Edwards suggests, "[l]ike the Turing machine, the cybernetic principles were putative universals capable of describing any activity at all" (Edwards, 1996: 187). Cybernetic rationalism becomes a universal epistemology. The computer, as the superior rational being, becomes a true universal machine, to put an ironic twist on Turing's 1950 claim.[3]

Edwards' use of "activity" is not incidental; reason manifests, within the cybernetic imaginary, in behaviour, in external actions. Knowledge becomes a zero-sum game, a measure of the results of behaviour designed to produce knowledge. In describing his Turing man, Bolter asserts "Turing's man analyzes not primarily to understand but to act. . . . For Turing's man, knowledge is a process, a skill. A man or a computer knows something if he or it can produce the right answer when asked the right question" (Bolter, 1984: 222). Colwell also notes that control within a Deleuzian understanding is directed at behaviour rather than identity. "Control is directed at the exterior, at activity. It is concerned less with how we construe ourselves than with how we act" (Colwell, 1996: 212). Thus, knowledge becomes divorced from its content. The goal is no longer enlightenment, engagement, growth, but effective and efficient action, always making the correct choice, yes or no.

The third major characteristic of a society of control visible through the cybernetic imaginary is the historical telos that is produced. History is redefined in accordance with a techno-evolutionary model which projects the present into the future, renders the future as now, and is inevitably purposeful and progressive. The past becomes irrelevant, discredited as old news.

The speed of the computer sets the pace for all social organization in the society of control. We are moving rapidly towards the future; we are at a significant historical juncture. Yet the future should not cause us concern for a number of reasons. First, because it is bound to be better than the present or the past. Our technologies are evolving into ever more powerful and effective useful agents. Society as a whole is progressing, moving towards a utopian vista which is much closer than in the past. And that progress is integrally linked to our relationship with computer technology.

Finally, we should not fear the future because we can know, and thus control it. As reason becomes the means of knowing all, the future also becomes a knowable domain. Prior to the rise of the cybernetic imaginary, the future had been murky, unknowable, and potentially troublesome. With the development of statistical probability analysis, improved data manipulations and projections, the veil of mystery over the future is removed. In societies of control, we know the future. Yet societies of control are less engaged in knowing *the* future as constructing *a* future. It is this very particular future which I suggest can be called a perpetual present; it is a future which is always about projecting fears and uncertainties from the present into the near future for their immanent resolution. Ultimately the future can be controlled if it is never really in question in the first place.

The risks of the future, of the unknown, can be managed, and the task of governance becomes about that diagnosis of future risk and its protection in the present. Ülrich Beck suggests that our society can be called risk society, where we are more concerned with risk production than wealth production as an organizing logic of society. The question of governance becomes "[h]ow can the risks and hazards systematically produced as part of modernization be prevented, minimized, dramatized, or channelled?" (Beck, 1992: 19). Incidentally, I would add to the list, controlled. While Beck's focus, and that of other risk scholars in this tradition, is primarily on environmental risks, I find the notion useful as a way to describe the effect of the cybernetic imaginary towards the controlling of chance and the future with knowledge techniques based in mathematics.

Within the cybernetic imaginary, within societies of control, one can see strategies of risk management emerging, particularly in the decision-making procedures of games theory and in the prediction techniques of operations research in the figuring of the future. The science of management within societies of control, with the tool of the computer ever available, is a means to control the risks and unknowns which the future might otherwise pose.

Yet the collapse of time which is occurring in societies of control -- its speeding up, its widening, its digitalization -- also eliminates the critical distance necessary to evaluate and perhaps oppose the telos of our cybernetic history. History is rendered an archive, a collection of information, moved out of the domain of experience. History is useful only so far as it provides data for the more accurate extrapolation of the future. Colwell argues that societies of control exercise their control over the individual through the temporal denial of the conditions for individuality.

> It is precisely this focus on short term success that opens up human beings to the sort of control that Deleuze is describing. By focusing not on the temporally enduring individual, but on what one is doing or can do right here, right now, a form of power is exercised that prevents the person from becoming an individual, from forming an identity that can construct an overall response to, or appropriation of, the demands of the immediate situation (Colwell, 1996: 213).

The time for resistance is eliminated. With the past denied, the future predicted, and the present always already about the next moment, where is the capacity for the historical distance necessary for critique? Societies of control render as anachronistic and archaic, its critics and the very act of critique. The progressive telos of our technofuture is well established and there is no looking back.

Finally, communication is the central, all-consuming activity of the society of control, as it is the universal practice, the universal behaviour, of all individuals, organisms, machines, and societies. Communication takes on unprecedented importance in societies of control; it defines the nature of being. (An ironic statement in the era of cell phones). Yet at the same time, this communication is a process of information exchange, quantifiable, measurable, valuable, and divorced from context, from its own interior content, from agency. It is a play along the surface, a behaviourist measure of exterior action, rather than a process of interior contemplation, understanding, meaning-making. It is an exchange of goods rather than a sharing of meaning. Communication is the basis of the underlying identity which permits the society of control, which produces the cybernetic imaginary.

Shared communication permits the treatment of individuals and societies according to the same rules. It allows society to be defined as a feedback system. Causality, within this understanding becomes circular. Control becomes an effect of successful communication and thus a seamless part of the feedback systems in which we are embroiled. Communication becomes a very particular way of understanding our selves and our world. Our relations become about interactive feedback, negative or positive, but always useful. The model of interactive feedback at the heart of the understanding of communications within the cybernetic imaginary draws comment from Stephen Pfohl.

> On the one hand, it celebrates the control of some subjects over others. On the other hand, it decenters the communicative practices these subjects use to exert control within a dynamic web of interactive feedback, shaped, in part, by the communicative actions of those being controlled. In other words, cybernetics substitutes for a simplistic one-way command model a vision of message-sending and message-receiving "subject-objects," each mediated by the agency of communicative practice itself (Pfohl, 1997: 117).

It is in this very redefinition of communication, and our place within communicative systems, that control as a more subtle form of power is exercised, with our active participation. In communicating, we are already integrated into the circuit. We celebrate our identity with the machine through the embrace of cybernetics as a philosophy. Communications becomes our ontology and we share it with the machines.

The thinking machine, the game, the future, and information mark moments of cultural negotiation in the postwar era, an era which was attempting to come to terms with some radical ideas about communication and information and an incredible new technological form. This coming to terms was an inherently public process. These events mark the public coming to terms with cybernetics, computing machines and their interaction. The events work individually and together to describe a structure of feeling, a cultural sensibility: the cybernetic imaginary. The cybernetic imaginary produces certain knowledge about our selves, our society, and our technology. And as with all cultural knowledge, the cybernetic imaginary is not neutral – it has power effects within our society. I traced four power effects – subjectivity, epistemology, history and ontology -- as ways in which the cybernetic imaginary begins to diagram our society as a society of control. Control can be used to name an organization of power centred around coding, information exchange, communicative practices, behaviourism, cybernetic causality, and the role of the machine in our lives. These shared truths of the cybernetic imaginary, in this culturally and historically specific incarnation, continue to resonate with current formulations of cyberculture. Our current experience of the cybernetic imaginary is indebted to the ways in which the cybernetic imaginary which I detail in this thesis begins to write and rewrite control and communication in the human and the machine.

Endnotes

I. Introduction

1 Although I cannot develop the argument fully here, it is my contention, based on the work I detail here and in Chapter II in my more detailed exploration of cybertheory, that the stream of postmodern cybertheory has adopted stylistic techniques and an overall aesthetic influenced by cyberpunk. Certain cultural practices such as virtual reality encounters and hacking take on very high status, as do certain artist and practices, such as the Survival Research Laboratory and Japanese comics. The writing is more colloquial, but full of techno-terminology. Cyberpunk fiction, with its gritty urban realism, new future vision, plug-in technologies, and portrayals of cyberspace offers an aesthetic guide to this writing.

2 I am making this claim only with respect to scholarship in English language scholarship. I cannot state whether or not there were any major interventions into theorizing and analyzing cyberculture prior to Escobar's piece within French language scholarship.

3 Steve Joshua Heims offers a truly seminal work on these conferences, having reviewed all of the transcripts and archives. He is the recognized authority on them. See Heims, David, *The Cybernetics Group* (1991).

4 Hayles claims that the second period in her treatment of cybernetics, from 1960 to 1980, also called "second-order cybernetics", reformulated many of the ideas around notions of reflexivity. Finally, she suggests we are presently in a third order of cybernetics, beginning in 1980 and continuing until the present, which focuses on virtuality and the emergent discipline of artificial life (Hayles, 1999: 6-7).

5 There are many histories of the computer, which I do not treat extensively here. (See Noble 1977, 1986 and Goldstein, 1977, for example. Edwards treats many of these in his text (1986).

6 Sources I drew upon for this timeline included Berger (1984), Hanson (1982), Iaciofano (1984), Lubar (1993), Zientara (1984), and McCorduck (1979).

7 This triumvirate has become a quartet with the addition of Lady Ada Lovelace, a colleague of Charles Babbage, through the work of feminist scholars recovering the history of the computer (See for example, Sadie Plant, 1997). Interestingly, in 1984 when David Bolter was writing, for example, Lovelace had not become the well-known figure that she is now and she does not appear in his historical treatment. I suggest that due to the work of scholars like Plant, she would now.

8 The interplay between the commercial laboratories, the government, and the development of technology has been treated elsewhere, by Noble (1977) and others, but it is definitely an interesting problematic. The role of the commercial laboratory as site of research should not be underestimated.

9 Interestingly, Colossus was the name given to the American supercomputer, which ultimately runs amok, in the early film, *Colossus: "the Forbin" Project*, a classic in conjuncture of computer and Cold War tensions. It was directed by Joseph Sargent and released in 1970.

10 I also query whether or not Hayles does not collapse culture and society in this formulation. She does not strongly theorize the relationship between culture and society. Society as a feedback system seems to derive unproblematically from culture. Admittedly, this is a tendency in much work looking at culture.

11 While not a unique idea, it was Marike Finlay (1987: 162) who first got me thinking about information theory as the ideology of the information age.

II. Exploring Cybertheory: Theorizing about, and in, Cyberculture

1 In addition to a plethora of individual articles, the 'movement' is evidenced by special issues of journals such as *Science Fiction Studies* (1991), *Genders* (1993), *The South Atlantic Quarterly* (1992), *The Mississippi Review* (1988), *Whole Earth Review* (1990), and *Discourse* (1987 & 1992), edited collections such as Larry McCaffery's *Storming the Reality Studio: A Casebook of Cyberpunk and Postmodern Fiction* (1991), Michael Benedikt's, *Cyberspace: First Steps* (1992), Sardar and Ravetz's *Cyberfutures* (1996), Featherstone and Burrows', *Cyberspace, Cyberbodies, Cyberpunk* (1995), Brian D. Loader's, *The Governance of Cyberspace* (1997), or single-author works such as Claudia Springer's *Electronic Eros: Bodies and Desire in the Postindustrial Age* (1996), Anne Balsamo's *Technologies of the Gendered Body: Reading Cyborg Women* (1996), Bukatman's *Terminal Identity: The Virtual Subject in Postmodern Fiction* (1993), Brian McHale's *Postmodernist Fiction* (1987) and *Constructing Postmodernism* (1992), Mark Dery's *Escape Velocity: Cyberculture at the End of the Century* (1996), Michael Heim's, *The Metaphysics of Virtual Reality* (1993) and others.

2 William Gibson is generally credited with coining the term "cyberspace."

3 Just as the ghost of cybernetics lives on in social theory, so does the ghost of cyberpunk live on in SF literary theory. Although it has been declared dead often, eloquently, and almost unanimously (see for example, Csicsery-Ronay, Jr., 1988 for one of the earliest and most eloquent pronouncements), it continues to serve as the basis for many analyses. Obviously the role that cyberpunk played and continues to play in cybertheorizing requires more extensive work.

4 Here I am playing with the title of Bruce Sterling's marketing marvel and early collection of cyberpunk stories, *Mirrorshades* (1986). Sterling was drawing upon the tendency of many characters in cyberpunk fiction to wear "mirror-shades" or mirrored lens sun glasses. The masking of the eyes and the reflection of the gaze were some of the implications of this metaphor which came to represent the cyberpunk aesthetic.

5 Interestingly, and appropriately, these works reflect a large degree of intertextual awareness. The works I examined include: "Cybernetics, Information, Life: The Emergence of Scriptural Representations of Heredity" (1997) by Lily E. Kay; "The High Cost of Information in Post-World War II Evolutionary Biology: Ergonomics, Semiotics, and the Sociobiology of Communication Systems" (1981-2) by Donna Haraway; "The Body of a New Machine: Situating the Organism between Telegraphs and the Computer" (1994) by Evelyn Fox Keller; "How to be Universal: Some Cybernetic Strategies, 1943-70" (1993) by Geof Bowker; "Feedback and Cybernetics: Reimaging the Body in the Age of Cybernetics" (1995) by David Tomas; "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision" (1994) by Peter Galison, and "Cyborg History and the World War II Regime" (1994), by Andy Pickering.

6 Woodward does not really define her term, *belles lettres*, that effectively and only offers one example, but seems to be trying to capture the notion of erudite and popular science writing which has or has the potential to have a significant social impact.

7 Interestingly, like Grossberg in many ways Williams is also suggesting that culture is about material aesthetic practices, an overall way of life, and social and economic relations.

8 For example, Foucault, 1994b; Gordon, 1980; Rose, 1993; Castel, 1991; Beniger, 1988. This claim can be found particularly in scholars studying current neoliberalism and in governmentality studies.

9 Beniger as well suggests that the "control revolution" which characterizes the postwar moment is "... a complex of rapid changes in the technological and economic arrangements by which information is collected, stored, processed, and communicated, and through which formal or programmed decisions might effect societal control" (Beniger, 1986: vi). Hardt (1995) also argues that the mobility, speed and flexibility which are the characteristics of societies of control, are approximated in that "infinitely programmable machine, the ideal of cybernetics", the computer.

10 Unfortunately in Spitzer's work, the productivity of control begins to sound like liberal free choice. Productive power becomes about what is permitted, what we can choose to do. Spitzer also frames the issue as about oppressing and enabling, a positive and a negative; Foucault is attempting to break out of a binary of positive and negative and suggest that power enables. It may enable some things which we consider negative, or some things which we consider positive, but power itself it neither positive nor negative.

11 The word assemblage in Hardt is often how the French term dispositive, used both Foucault and interpreted by Deleuze to make reference to the structured relations of power which are produced through regimes of truth and power/knowledge.

III. Eventful Discourses: Methodology and Method

1 The quotation marks around captures and object are Tuchman's as she specifically problematizes their positivist implications. She recognizes the impossibility of capturing the object of study fully but uses the term as general descriptors of methodology. I do not want my select use of her phrase to suggest a more positivist perspective on methodology than she has; she is seeking rigour without the implications of empiricist and positivist work.

2 I realize the paradoxical implications of suggesting that I will find my events in the everyday. In some senses, the everyday is defined by its event-less-ness. For me, events are discursive, they are about encountering new ideas, which do are not always heralded as big moments. Perhaps the biggest events are among the quietest events.

3 I reference his name for his method, but in accordance with the sophisticated analysis and criticisms of Virginia Nightingale (1993) of work whose claims to be ethnographic are methodological only and not conceptual, I am not invested in the language of ethnography here as a means of describing my own methodology.

4 Altheide offers twelve steps, as follows. I found his five larger categories more manageable.

Step 1. Pursue a specific problem to be investigated.
Step 2. Become familiar with the process and context of the information source (e.g., ethnographic studies of newspapers or television stations). Explore possible sources (perhaps documents) of information.
Step 3. Become familiar with several (6 to 10) examples of relevant documents, noting particularly the format. Select a unit of analysis (e.g., each article), which may change.
Step 4. List several items or categories (variables) to guide data collection and draft a protocol (data collection sheet).
Step 5. Test the protocol by collecting data from several documents.
Step 6. Revise the protocol and select several additional cases to further refine the protocol.
Step 7. Arrive at a sampling rationale and strategy – for example, theoretical, opportunistic, cluster, stratified, random. (Note that this will usually be a theoretical sampling).
Step 8. Collect the data, using preset codes, if appropriate, and many descriptive examples. Keep the data with the original documents, but also enter data in a computer-text-word processing format for easier search-find and text coding. Midpoint analysis: About halfway to two thirds through the sample, examine the data to permit emergence, refinement, or collapsing of additional categories. Make appropriate adjustments to other data. Complete data collection.
Step 9. Perform data analysis, including conceptual refinement and data coding. Read notes and data repeatedly and thoroughly.

Step 10. Compare and contrast "extremes" and "key differences" within each category or item. Make textual notes. Write brief summaries or overviews of data for each category (variable).
Step 11. Combine the brief summaries with an example of the typical case as well as the extremes. Illustrate with materials from the protocols.
Step 12. Integrate the findings with your interpretation and key concepts in another draft.

5 I use the term "material" rather than "data" for a number of reasons. First, data is too scientific. Other terms such as "corpus" imply a whole, and it is tied to an organismic model. Material is more generic and is also in a way a way of denoting the material traces of discourse. Material makes fewer claims to holism and acknowledges the sporadic nature of collections without suggesting haphazardness. Again, archive is a much more semiotically-laden term which has implications which may not be relevant here.

6 Wark recognizes this as well. He writes, "[e]vents have no particular scale, duration, or topos. The media render equivalent a tiny gesture or a major battle. ... The time frame of an event can be as flexible as the scale" (Wark, 1994: 21).

IV. The Thinking Machine

1 In particular, the stories in Damon Knight's collection are to a one focusing on the computer as threat. Secondary research in science fiction encyclopaedia under the search terms of cybernetics also confirms the preponderance of plot development with a computer which takes over society, where humanity has given up its soul to a machine environment, or where machines which begin as noble, eventually run amok. See also Vonnegut (1952). Rare is the story of a benevolent cybernetic machine.

2 Some writers recognize this at the time, for example Standen in *The Commonweal*, 1949.

3 Wiener wrote two autobiographies during his lifetime, *Ex-Prodigy: My Childhood and Youth* (1953) and *I am a Mathematician: The Later Life of a Prodigy* (1956). He also published frequently in both academic and public for a. There is interesting work to be done on further exploring Wiener's role as a public intellectual in the Cold War period

4 For work on metaphor see Max Black, 1962, 1993.

5 Alison Adam offers an interesting discussion of gender in relation to the development of artificial intelligence in her book, *Artificial Knowing: Gender and the Thinking Machine* (1998). Unfortunately, her analysis tends to essentialism. I have developed these ideas myself elsewhere and am currently working on a publication entitled, "Gendering the Computer Geek: Computer Technology and Expertise." Of particular interest would be a detailed analysis of the photographic imagery of the time period.

6 Learning has emerged as a very strong concept in recent management writing, with the learning organization being the hallmark of 1990s restructuring discourse. It would be

interesting to trace the notion of learning through business management writing which is heavily indebted to cybernetics.

7 For example, Frank Ross in his introduction to automation regales readers with this narrative (in its classic gendered form).

"You may never have heard of Erma, but the chances are that you have come into contact with the kind of work she does – in the bank statements, electric bills, or insurance premium notices your family receives. Erma represents the first of a new type of office clerk that is rapidly appearing in private business and government offices throughout the country. The latest hair-do or dress style fail to disturb her. Nor is she concerned with what her clerical neighbour did over the week-end. There is a reason for her anti-social attitude. Erma, you see, is a robot – an electronic brain weighing several tons. ...

Although Erma must have human attendants, she can operate with such speed and accuracy that she does the work formerly accomplished by fifty clerks. But this electronic robot has not coldly shouldered the human workers out of their jobs. The bank has transferred them to other duties, many far more interesting than the monotonous, repetitive tasks they had to do in handling checks" (Ross, 1958: 153-5).

8 There is an assumption in my material that human work techniques must adapt to the machine. *Newsweek* notes that we need to train ourselves in stating our questions in ways that the machine can understand (*N* 1949d). *Fortune* magazine also recognizes the need to rethink. "More difficult than the adaptation of electronic brains to business uses is the equally necessary adaptation of business minds and methods to the new machines" (*F* 1952: 117).

9 Again, I note that I am working on project to examine these representations. See 5 above.

V. The Game

1 Incidentally, Wiener predicted in 1964 that in 10-25 years scientists would perfect the chess-playing machine to the extent that it would be able to play at the master chess level and then he foresaw a concomitant loss of interest by humans in the game. It will be interesting to see what the next test is.

2 Turing also played chess and his mother, in her biography of her son, tells an amusing story. Turing used to play a complicated game of chess with a Professor of his. In the game, after a player completed his move, he had to run once around the extensive garden; if he arrived back at the board before his opponent had moved, he was allowed to have an extra move. Sarah Turing notes that it was Turing's fleetness of foot that likely kept him

competitive because he was not a very good chess player (Turing, 1959 in McCorduck, 1979).

3 Again, this relationship, framed through the lens of the production of useful knowledge and the emergence of the university as a site for useful knowledge production is something that I have explored in other research.

4 The corporate owners of the machines are quick to justify the failure as attributable to problems in the construction of the rules of the game, rather than as a failure of the machine, itself.

5 Turing also endorses chess playing as a measure of potential intelligence. "We may hope that machines will eventually compete with men in all purely intellectual fields. But which are the best ones to start with? Even this is a difficult decision. Many people think that a very abstract activity, like the playing of chess would be best" (Turing, 1950: 460).

6 Shannon admits, "[o]ther methods of attempting to play perfect chess seem equally impracticable; we resign ourselves, therefore, to having the machine play a reasonably skillful game, admitting occasional moves that may not be the best. This, of course, is precisely what human players do: no one plays a perfect game" (*SA*, 1950b: 49).

7 Hayles speculates, but does not claim, that Turing's being gay may have had an impact on his ideas about gender. Turing's life ended tragically when he was charged criminally for his homosexual activities and was sentenced to hormone treatments to "cure" him (see Strathern, 1997).

8 This move is exemplified in the rather chilling claim made by Harold Lasswell in 1955 to test machine intelligence and further rationalize the decision-making process by using "decision machines" in the judicial system. All decision-making becomes a weighing of alternatives based on available information, according to pre-determined objective criteria (Lasswell, 1955).

9 Wiener wrote an open letter denouncing military research to a number of journals and continued to write editorials and commentaries on the impact of military investment in research. He has been criticized for the fact that he remained at MIT for his entire career, however, the institution which received the most military funding during the period of WWII and Cold War research.

10 The author continues, "[b]ut Wiener does not trust the motives of even the brightest war-making machines. 'If the rules for victory in a war game' he says, 'do not correspond to what we actually wish for our country, it is more likely that such a machine may produce a policy which will win a nominal victory on points at the cost of every interest we have at heart, even that of national survival'" (*Time*, 1960: 32)

11 For this citation and discussion, I am indebted to Paul Edwards' (1996) discussion of operations research.

12 A significant introduction to the notion of game theory and decision-making is found in *Scientific American*'s treatment of the issue in its February, 1955 issue. The article opens "Game Theory and Decisions [i]n which Smith plays a game with Jones and Columbus plays a game with nature to illustrate how this comparatively new mathematical tool can be used to grapple with problems involving uncertainties" (*SA*, 1955b: 78). This sort of decision-making is ultimately mathematical. "The theory of games and the theory of decision-making meet on the territory of statistical inference" (*SA*, 1955b: 78).

The article explores the decision Columbus faced at one point in the epic tale of discovery, whether to continue on to the New World, risking death at sea, or to return to Spain. The decision is resolved in favour of North America according to games theory principles. Incidentally, in the process, levels of personal optimism and fear of death are given numerical value.

VI. The Future

1 Beckwith (1984) offers an interesting history of scientific futurology, dating back to the late 1700s.

2 In fact, Ross goes so far as to suggest that writers like Toffler provided the explanatory rhetoric for the subsequent embrace by corporate organizations of discourses of flexibility in post-Fordist production.

3 Stephen Pfohl speaks to the shift in the nature of causality and its move to circularity through cybernetics. He suggests, "[i]nside and out, cybernetics offers a model of 'circular causation.' Can you picture it? Wiener did. Which comes first: the cybernetic chicken or a golden egg? The answer, of course, is neither. Both are circularly caused: interactively, dynamically, reciprocally. Not mechanically, but in information-governed energetic exchange" (Pfhol, 1997: 118).

4 As communications scholars well know, there is a long history of communications technologies, their introduction, and their relationship with the future. See Carolyn Marvin, *When Old Technologies Were New*.

5 Biddick is analyzing the cyberpunk fiction of William Gibson in order to make a larger claim about the model of history it embraces, a recuperation of humanist history.

6 As Carey and Quirk argue, "[i]nvariably the newest technologies of communication and transportation are seen as means for the lasting solution to existing problems and a radical departure from previous historical patterns" (Carey and Quirk, 1992: 180).

7 Certain implications flow from this, as recognized by *Newsweek*. "It may be hard to forecast the weather, but it is easy to predict that any large-scale tinkering with it will

have political repercussions" (*N*, 1947a: 57). "Because weather control now looms as a serious scientific possibility, and because the atmosphere knows no state or national boundaries, the next few years may well see the development of new agencies for meteorological diplomacy" (*N*, 1947a: 57).

8 For example, an article entitled "Mastermind" in *Newsweek*, 1954 opens with a series of questions:

Do you want to ascertain the best wing-structure for a supersonic airplane? Analyze market trends? Make long-range weather forecasts? Design flood-control dam systems? Assure automatic and constant control of the catalytic cracking of crude oil? If so, just plug in a snug new analog computer, and watch the miracles of mechanized mathematics unfold (*N*, 1954b: 59).

VII. Information

1 This is apparent in Shannon's discussion of entropy at pp. 48-57. For example, he writes at page 50: "Quantities of the form H ... play a central role in information theory as measures of information, choice and uncertainty. The form of H will be recognized as that of entropy as defined in certain formulations of statistical mechanics ..." (Shannon, 1949: 50). William Ross Ashby recognizes the potential confusion in Wiener's and Shannon's treatment of entropy and information in his discussion at 177-178. The confusion occurred as a result of a difference in positive or negative values in the formula for entropy. As Ashby notes, however, "[t]here need be no confusion, for the basic ideas are identical. Both regard information as 'that which removes uncertainty,' and both measure it by the amount of uncertainty it removes" (Ashby, 1956: 178). Ultimately within the public discourse, information is defined as negative entropy and something which is not predictable (*SA*, 1952m: 133). It is possible that Hayles is overstating the distinction in her analysis, but it is not possible to take up this debate here. I merely raise it because I wanted readers to be clear that in this period, information functions as a measure of the production of order in the public discourse and readers familiar with Hayles' arguments might have been confused.

2 The term is even reinforced when it is not used. "We shall use words instead of 'bits' – binary digits – as the measure of memory capacities in this article" (June 1955, SA: 94).

3 "These people will be the first real library scientists. Perhaps they will not be called 'librarians' but 'language engineers' or 'information retrieval specialists'. Certainly they will prepare themselves by studying mathematics and electrical engineering. On the job they will apply information theory – the new science which already enables us to measure the amount of information in a T.V. picture, or in a map, or on a Library of Congress card (*SR*, 1956b: 71).

4 The author proclaims: "[t]he workers directly affected by paperwork automation are primarily girls just out of high school. This is the most volatile segment of the labour

force – turnover now sometimes exceeds 100% a year. So, when the machines take over, the office won't have to resort to wholesale firing – they'll simply not fill vacancies. The one who is displaced is next year's girl graduate" (*BW* 1955: 92).

Roszak confirms the overall negative status of people in government, law, insurance and so on who dealt with data for their work in the pre- and post-war periods. Even when certain automatic technologies were introduced, their status did not improve.

"For the most part, the data minders of the economy were 'office girls' who might have been trained in high school or at business college and who toiled at their monotonous jobs without hope of promotion. If anything, the work they did was still usually seen more humanistic sensibilities as a sorry example of the ongoing massification of modern life" (Roszak, 1985: 5).

5 The reduction of the evaluation of the work process to a measurement of quantifiable information continues to the present day. For example, Gareth Morgan notes commonsensically that "[i]f one thinks about it, every aspect of organizational functioning depends on information processing of one kind or another" (Morgan, 1986: 80-1). In the assertion that "[o]rganizations are information systems. They are communications systems" (Morgan, 1986: 81), communication is being equated with information and all functioning in a complex labour organization is being reduced to a problem of information.

VIII. The Cybernetic Imaginary

1 Information theory, while certainly its own domain scientifically, is at the core of cybernetic theorizing about communication and within the public discourse the two are often linked and collapsed. Most often, one will read about "information and communication theory" as an attempt to bring both notions together. When I refer to cybernetics here, I am also including its related theories, such as information theory.

2 Bolter makes an interesting claim that the structuralist turn in linguistics and the adoption of a language of coding was also happening at the same time (Bolter, 146-7).

3 Turing writes: "[t]his special property of digital computers, that they can mimic any discrete state machine, is described by saying that they are universal machines. The existence of machines with this property has the important consequence that, considerations of speed apart, it is unnecessary to design various new machines to do various computing processes. They can all be one with one digital computer, suitably programmed for each case. It will be seen that as a consequence of this all digital computers are in a sense equivalent" (Turing, 1950: 441-2).

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1952i "Frankenstein, Q.E.D." September (187): 68.

1952j "An Automatic Chemical Plant" (Eugn Ayres), September (187): 82-96.

1952k "An Automatic Machine Tool" (William Pease), September (187): 101-115.

1952l "The Role of the Computer" (Louise N. Ridenour), September (187): 116-18.

1952m "Information" (Gilbert W. King), September (187): 132-142+.

1952n "Machines and Man" (Wassily Leontief), September (187): 150-160.

1952o "Beyond Automatic Control: A Physicist's Statistical Examination of Man's Future" (James R. Newman), September: 165-170.

1952p "Bibliography" September (187): 192-3.

1953a "The Practice of Quality Control" (A.G. Dalton), March (188): 29-33.

1953b "What is Probability" (Ruldolf Carnap), September: 128-138.

1954a "Computers in Business" (Lawrence P. Lessing) January (190): 21-5.

1954b "Automatic Gambler" July: 48.

1954c "Linear Programming" (William W. Cooper and Abraham Charnes), August (191): 21-3.

1954d "Friendly Machine" September (191): 74-5.

1954e "New Commissioner" December (191): 52.

1955a "Bigger and Better" February (192): 62.

1955b "Game Theory and Decisions" (Leonid Hurwicz), February (192): 78-83.

1955c "Ears for Computers" (Edward E. David, Jr.), February: 92-8.

1955d Advertisement, March: 22.

1955e "Man Viewed as Machine" (John G. Kemeny), April (192): 58-67.

1955f "Computer Memories" (Louis D. Ridenour), June: 92-100.

1955g "Memory on Film" September (193): 74-5.

1955h "Information Transfer in the Living Cell" (George Gamow). October: 70-8.

1956a "Translation by Machine" (William N. Locke), January (194): 29-33.

1956b "Information and Memory" (George A. Miller): 42-6.

1956c "Tin Pan Computer" September (195): 120.

1956d "Information Theory and Melody" (Richard C. Pinkerton): 77-86.

1956e "The Amateur Scientist" December (195): 169-76.

1957 "Review of Faster, Faster" January (196): 125-9.

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Time
1943 "Calculator's Calculations" October 25: 86-7.

1944 "Mathematical Robot" August 14: 72.

1946 "Eniac" February 25: 90.

1947 "A Robot's Job" January 20 (49): 48.

1948 "In Man's Image" December 27: 45.

1949a "Where is Man? A Mid-Century Appraisal" April 11.

1949b "A New Ingredient" April 11: 75-6.

1949c "600 Men and a Machine" September 26: 65-6.

1950a "The Thinking Machine" January 23: 54-60.

1950b "Crystal Memory" July 10: 52-5.

1950c "Come the Revolution" November 27: 66-68.

1951a "Feedback to Idiocy" January 8: 52-3.

1951b "The Mature Machine" January 15: 65-6.

1952a "Fast Student" January 28: 42.

1952b "Crystal Memory" November 3 (60): 68.

1953 "Small Wonder" March 30: 88+.

1954a "Electronic Translator" January 18: 82-4.

1954b "Computomat" July 19 (64): 44-5.

1954c "According to Mark IV" August 9: 68-9.

1954d "Appointment for a Gamesman" November 1: 20.

1954e "Let NORC do it" December 13: 61.

1955 "The Brain Builders" March 28: 81-3.

1956a "Intelligence Amplifier" May 7: 70.

1956b "Sacred Electronics" December 31: 45.

1960 "Revolt of the Machines" January 11: 32.

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Appendix I

Key to Periodical Citations

Name of Periodical	Abbreviation Used for Citation
America	A
The American Mercury	AM
American Scholar	AS
The Atlantic	AT
Atlantic Monthly	ATM
Aviation Week	AW
Business Week	BW
Collier's Weekly	CW
The Commonweal	C
The Economist	E
The Financial Post	FP
Fortune	F
General Systems	GS
Library Journal	LJ
Life	L
Mind	M
The Nation	NA
Nation's Business	NB
New Republic	NR
Newsweek	N
Popular Mechanics	PM
Reporter	R
The Saturday Review	SR
Science	S
Science Digest	SD
Science Illustrated	SI
Science Monthly	SM
Science News Letter	SNL
Scientific American	SA
The Survey	SY
Time	T

Appendix II

Periodical Sources Cited in the Thinking Machine

American Mercury, The

1953	"Will Machines Replace the Human Brain?" (Serge Fliegers) 76: 53-61.

American Scholar

1950	"Brains and Calculating Machines" (John E. Pfeiffer), January, 19(1): 21-30.

Atlantic Monthly

1954	"The Thinking of Men and Machines" (John H. Troll), July, 194: 62-5).

Business Week

1949	"Machines That Think" February 19: 38-44.
1954	"No Genius But It's Smart" May 15: 75-6.
1955	"Electronics Counts the Stock" February 5: 57-8.
1956a	"The Computer Age" April 7: 52-77.
1956b	"Electronic Eating" June 30: 126.
1956c	"Briefcase Job for a Computer" July 28: 66-74.

Commonweal, The

1949	"Mind and/or Machine" (Anthony Standen), May 27 (50): 176-7.

Economist, The

1958a	"Reckoning with the Robot" November 19: 793-4.
1958b	"A New Automation?" and "Frankenstein of the Fifties" November 29: 824.

Fortune

1949	"Mechanical Brains" (Lewis N. Ridenour), May (39): 108-10+.
1952	"Office Robots" January: 82-7+.

Life

1954	"X-Rac" May 24 (36): 109-110+.

Mind

1950 "Computing Machinery and Intelligence" (A.M. Turing), October. LIX(236): 422-460.

Nation's Business

1944 "Superbrain" September: 8-9.

1951 "If Robots Run the Works" March: 31-33+.

New Republic, The

1947 "Custom-Built Genius" (James R. Newman), June 23: 14-18.

Newsweek

1946 "Answers by Eny" February 18: 76.

1947 "Calculation Ad Inifinitum" February 20: 58.

1948 "The Brain is a Machine" November 15: 89.

1949a "Talking Zephyr" June 13: 52.

1949b "Magnets with Memories" August 1: 49.

1949c "Sublime and Ridiculous" August 19: 51-2.

1949d "Revolution in Robotland" September 26: 58.

1950 "Error Eliminator" April 24: 56-7.

1955 "The $100,000 Brain" August 1: 70-1.

New Yorker, The

1950a "Never Stumped" March 4: 20-1.

1950b "Mind in Matter" (Irwin Edman), October 14: 139-142.

1954 "Smart" December 4: 105-7.

1955 "Mental" August 6: 16-17.

Reporter, The

1956 "Thimk" [sic] February 9 (14): 4.

Saturday Review, The

1949 "The Machine in Man's Image" (Harrison Smith), January 8 (32): 22.

1950 "Mechanical Masterminds" (Henry C. Link), February 25 (33): 15-16.

1953 "A Visit to Los Alamos" (Norman Cousins), May 16 (36): 22.

1954 "The Electronic Case for Peace" (Norman Cousins), June 5 (37): 22-23.

1956a "The Election and the New 'Number' Illiteracy" (J. Lear), November 3 (39): 45-6.

1956b "The Literature Scientist" December 1(39): 69-73.

Scientific American

1948 "Cybernetics" (Norbert Wiener), November (179): 14-19.

1950a "A Chess-Playing Machine" (Claude E. Shannon), February (182): 48-51.

1950b "Mathematical Machines" (Harry M. Davis), May: 29-39.

1950c "An Imitation of Life" (W. Grey Walter), May: 42-45.

1950d "Simple Simon" (Edmund C. Berkeley), November: 40-43.

1952a "Self-Correcting Machine" September (187): 27-8.

1952b "Frankenstein, Q.E.D." September (187): 68.

1954 "Friendly Machine" September (191): 74-5.

1955a "Ears for Computers" (Edward E. David, Jr.), February: 92-8.

1955b Advertisement, March: 22.

1955c "Man Viewed as Machine" (John G. Kemeny), April (192): 58-67.

1956 "The Amateur Scientist" December (195): 169-76.

Science News Letter

1953 "Rest, Shock, Operate to Make 'Brains' Work" May 9: 295.

1956a "Build Intelligent 'Brain'" May 5: 277.

1956b "Electronic 'Brains' are Growing Up" May 12: 296.

Time

1947 "A Robot's Job" January 20 (49): 48.

1948 "In Man's Image" December 27: 45.

1950a "The Thinking Machine" January 23: 54-60.

1950b "Crystal Memory" July 10: 52-5.

1950c "Come the Revolution" November 27: 66-68.

1952a "Fast Student" January 28: 42.

1952b "Crystal Memory" November 3 (60): 68.

1955 "The Brain Builders" March 28: 81-3.

1956 "Intelligence Amplifier" May 7: 70.

1960 "Revolt of the Machines" January 11: 32.

Appendix III

Periodical Sources Cited in The Game

Commonweal, The

1949 "Mind and/or Machine" (Anthony Standen), May 27 (50): 176-7.

Economist, The

1958 "Reckoning with the Robot" November 29: 793-4.

General Systems

1959 "Games, Decisions, and Organizations" (Russel L. Ackoff): 145-150.

Mind

1950 "Computing Machinery and Intelligence" (A.M. Turing), October LIX (246): 422-460.

New Republic

1947 "Custom-Built Genius" (James Newman), June 23: 14-18.

New Yorker, The

1946 "Minority Report" December 14 (22): 34.

1957 "Chess to Come" January 5: 18-19.

1958 "Runner Up: Chess Playing Computer" November 29: 43-4.

Newsweek

1948 "Horses and Calculus" June 14: 54-5.

1949 "Computer Confusion" March 21: 55-6.

1949 "Sublime and Ridiculous" August 29: 51-2.

Saturday Review, The

1954 "The Electronic Case for Peace" (Norman Cousins), June 5 (37): 22-3.

1956 "The Election and the New 'Number' Illiteracy" (J. Lear), November 3 (39): 45-6.

Science Digest

1951 "Chess by Machine" March (29): 65-6.

Science Illustrated
1949 "Machine that plays gin rummy" (J. Pfeiffer). March (4): 46-8+.

Science Monthly
1952 "On game-learning machines" (P.I. Richards). April (74): 201-5.

Science News Letter
1948 "Machines Play Chess" August 21 (54): 123.

1950 "Machines can play chess but human should win" December 30 (58): 418.

1956 "Build Intelligent 'Brain'" May 5: 277.

1956 "Gambling Robot Wins High" August 18: 102.

1958 "Electronic Machine Plays Chess" June 7: 360.

Scientific American
1949 "The Theory of Games" (Oskar Morgenstern). May (180): 22-5.

1950 "A Chess-Playing Machine" (Claude E. Shannon). February (182): 48-51.

1950 "Mathematical Machines" (Harry M. Davis). May: 29-39.

1952 "Frankenstein. Q.E.D." September (187): 27-8.

1952 "Information" (Gilbert W. King). September (187): 132-142+.

1954 "Automatic Gambler" July: 48.

1954 "Linear Programming" (William W. Cooper and Abraham Charnes). August (191): 21-3.

1955 "Game Theory and Decisions" (Leonid Hurwicz). February (192): 78-83.

1955 "Information Transfer in the Living Cell" (George Gamow). October: 70-8.

1956 "The Amateur Scientist" December (195): 169-176.

1958 "Computer v. Chess Player" (Alex Bernstein). June (198): 96-8+.

Time

1947 "A Robot's Job" January 20 (49): 48.

1950 "The Thinking Machine" January 23: 54-60.

1951 "The Mature Machine" January 15: 65-6.

1954 "Appointment for a Gamesman" November 1: 20.

1960 "Revolt of the Machines" January 11: 32.

Appendix IV

Periodical Sources Cited in The Future

American Mercury, The

1953 "Will Machines Replace the Human Brain?" (Serge Fliegers), 76: 53-61.

American Scholar

1950 "Brains and Calculating Machines" (John E. Pfeiffer), January 19(1): 21-30.

Aviation Week

1954 "Digital Computers Take to the Air" May 10: 62-8.

1954 "Electronic Computers to Forecast Weather" September 6: 16.

Business Week

1948 "Business Predicter" June 5: 75-6.

1948 "Machines Predict What Happens in Your Plant" September 25: 68-74.

1949 "Machines that Think" February 19: 38-44.

1954 "Building Up More Brain Power" February 20: 82.

1955 "Report to Readers on Automation" October: 74+.

Economist, The

1958 "Reckoning with the Robot" November 29: 793-4.

Fortune

1949 "Mechanical Brains" (Louise N. Ridenour) May (39): 108-110+.

1953 "Can Computing Machines" October (48): 129.

Nation's Business

1951 "If Robots Run the Works" March: 31-3, 80-1.

New Republic

1947 "Custom-Built Genius" (James R. Newman), June 23: 14-18.

New Yorker, The
1950 "Mind in Matter" (Irwin Edman), October 14: 139-142.

1956 "Brain: Univac on Election Night" November 17 (32): 44-5.

Newsweek
1946 "Answers by Eny" February 18: 76.

1947 "Weather on Order" February 10: 56-7.

1949 "Talking Zephyr" June 13: 52.

1954 "Mastermind" July 19: 59.

1956 "Electronic Eggheads" January 9: 21-3.

Reporter, The
1954 "Univac" November 18 (11): 4-5.

Saturday Review, The
1956 "The Election and the New 'Number' Illiteracy" (J. Lear), November 3 (139): 45-6.

Science News Letter
1953 "Weather by Giant 'Brain'" November 14: 309.

1954 "Will Forecast Weather Routinely by Brain" May 1: 281.

1954 "Predict Hurricane Paths?" October 2: 211.

1954 "Computers Predict Rain" December 4: 358.

1955 "The Monte Carlo Method" (Daniel B. McCracker), May: 90-6.

1956 "Airplane Flight Paths Calculated by Computer" February 4: 72.

1956 "Cut Time for Computing 1956 Election Results" October 27: 163.

Scientific American
1950 "Mathematical Machines" (Harry M. Davis), May: 29-39.

1950 "Probability" (Warren Weaver), October (183): 44-7.

1952 "Faster Computers" August (187): 36-7.

1952 "Beyond Automatic Control: A Physicist's Statistical Examination of Man's Future" (James R. Newman), September: 165-170.

1953	"The Practice of Quality Control" (A.G. Dalton), March (188): 29-33.
1953	"What is Probability" (Ruldolf Carnap), September: 128-138.

Time

1948	"In Man's Image" December 27 (148): 45.
1949	"600 Men and a Machine" September 26: 65-6.
1950	"The Thinking Machine" January 23: 54-9.
1950	"Come the Revolution" November 27: 66-7.
1954	"Computomat" July 19 (64): 44-5.
1955	"The Brain Builders" March 28: 81-3.

Appendix V

Periodical Sources Cited in Information

American Scholar

1950	"Brains and Calculating Machines" (John E. Pfeiffer), January 19 (1): 21-30.

Business Week

1947	"Whiz at Figures" May 17: 20.
1949	"Machines That Think" February 19: 38-44.
1953	"Up-To-The-Second Inventory" October 3: 118-120.
1954	"Making Decisions by Math" November 13: 104-5.
1956	"GE Turns to Computing Machine to Find Men for Job Openings" November 3: 105.

Commonweal, The

1950	"Machines and Men" (Anthony Standen), September 1 (52): 512-514.

Economist, The

1958	"Reckoning with the Robot" November 29 (58): 793-4.
1958	"Frankensteins of the Fifties" November 29 (58): 824.

Fortune

1953	"Can Computing Machines" October (48): 129.
1953	"The Information Theory" (Francis Bello), December (48): 136-140+.

Mind

1950	"Computing Machinery and Intelligence" (A.M. Turing), October, LIX (236): 433-60.

Nation's Business

1947	"Your Personality Sits for Its Photo" (Gerard Piel), April: 51-6.

New Republic

1947	"Custom Built Genius" (James R. Newman), June 23: 14-18.

Newsweek

1946 "Answers by Eny" February 18: 76.

1950 "Error Eliminator" April 24: 56-7.

1954 "Mastermind" July 19: 59.

1956 "Electronic Eggheads" January 9: 21-3.

Saturday Review, The

1954 "The Electronic Case for Peace" (Norman Cousins), June 5 (37): 22-3.

1956 "The Election and the New 'Number' Illiteracy" (J. Lear), November 3 (39): 45-6.

1956 "The Literature Scientist" December 1 (39): 69-73.

1956 "Information on a Theorist" December 1 (39): 73.

Science

1949 "Cybernetics: A New Discipline" (Churchill Eisenhart), April 22 (109): 397-8.

Science News Letter

1954 "Language Translation by Electronic 'Brain'" January 23: 59.

Scientific American

1948 "Cybernetics" (Norbert Wiener), November (179): 14-19.

1949 "The Mathematics of Communication" (Warren Weaver), July (181): 11-15.

1950 "Mathematical Machines" (Harry M. Davis), May: 29-39.

1950 "Simple Simon" (Edmund C. Berkeley), November: 40-3.

1952 "Logic Machines" (Martin Gardner), March: 68-73.

1952 "Information" (Gilbert W. King), September (187): 132-142+.

1954 "Linear Programming" (William W. Cooper and Abraham Charnes), August (191): 21-3.

1955 "Ears for Computers" (Edward E. David, Jr.), February: 92-8.

1955 "Computer Memories" (Louis D. Ridenour), June: 92-100.

1955 "Information Transfer in the Living Cell" (George Gamow). October: 70-8.

1956 "Translation by Machine" (William N. Locke), January (194): 29-33.

1956 "Information and Memory" (George A. Miller): 42-6.

1956 "Information Theory and Melody" (Richard C. Pinkerton): 77-86.

Time

1947 "A Robot's Job" January 20 (49): 48.

1949 "600 Men and a Machine" September 26: 65-6.

1951 "The Mature Machine" January 15: 65-6.

1954 "Computomat" July 19 (64): 44-5.

Appendix VI

Other Periodical Sources Used

America

1955 "How's Your 'Cybernetics'?" March 5: 580.

American Journal of Sociology

1950-1 "Review of The Human Use of Human Beings" (Hugh Dalziel Duncan) 56: 599-601.

1950-1 "Review of Cybernetics" (N. Kashevsky) 56: 199-200.

American Sociological Review

1949 "Review of Cybernetics" April (14: 2): 332.

Atlantic Monthly, The

1950 "Too Damn Close" (Norbert Wiener), July (186): 50-2.

Aviation Week

1950 "Project Typhoon Aids Missile Designers" December 18: 40-1.

1951 "Low Cost Computer for Small Business" June 25: 48-9.

1952 "Digital Computer Trend Seen" (Philip Klass), December 29: 27-30.

1953 "Big Brain to Solve Aviation Problems" (Philip Klass), February 9: 61-6.

1953 "Giant 'Brains' Could Aid Air Defence" May 11: 67-73.

1953 "Magnet Blocks Aid Computer Design" June 29: 39.

1954 "New Jobs for Digital Computers" February 1: 45-6.

1954 "Thermal Element Activates Computers" March 29: 45.

1954 "New Digital Computers Developed" April 12: 60-1.

1954 "Fast Computer Handles Fluctuating Data" October 4: 52-3.

1954 "Navy Ordinance Gets High Speed Computer" December 20: 54.

1954 "Computer Results Shown in Window" December 27: 30-1.

Atlantic Monthly
1947 "A Scientist Rebels" January (179): 46.

Business Week
1945 "New Robot Calculates Dividends and Writes Cheques" July 14: 70.

1946 "Robot Calculator" February 16: 50-1.

1948 "An Electronic 'War Production Board'" October 9: 22-4.

1949 "Electronic Calculator" April 30: 50-1.

1950 "Rem-Rand Scores" March 4: 20.

1950 "Work Rates By Electronics" April 15: 63.

1950 "Gift of Tongues" September 2: 44.

1951 "Automative Arithematic" March 31: 54.

1952 "Electronic Brains Take on New Jobs" April 19: 38.

1952 "Sarah's Debut" July 19: 70-2.

1953 "Computers Go Commercial – By Degrees" November 21: 68-72.

1954 "Selling the Analog Computer" May 22: 90-9.

1954 "Computer Need" June 5: 158-9.

1954 "How a Big Computer Takes Over" July 24: 58-62.

1954 "Mechanical Brain for Rent" July 24: 138-145.

1954 "Sidewalk Supervision for Electronic Brain" August 7: 114.

1955 "Computing 32 Hours a Day" January 1: 32-3.

1955 "New Tools for Managers Catch on Fast" February 12: 88-92.

1955 "Electronic Bookeeping" March 12: 62-3.

1955 "Computer Will Sprout Jet Wing" March 19: 98.

1955 "Brokers Turn to Automation" April16: 118-19.

1955 "Fitting Computers into a Business" July 30: 40-4.

1955 "Night Course to Teach Ways to Use Computer" August 6: 106-7.

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1955 "Airlines Electronic Brain to Keep Tabs on Reservations" September 10: 120-121.

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