from
Counterculture
to
Cyberculture

Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism

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The Shifting Politics of the Computational Metaphor

On December 2, 1964, just before noon, more than five thousand students streamed into an open-air plaza in front of the University of California at Berkeley's Sproul Hall. As they sat down on the pavement, one of their leaders, Mario Savio, stepped up to a microphone. With the towering gray columns of Sproul behind him, he tried to articulate what he and his audience had mobilized to fight. The university, he shouted, was an "autocracy." Its Board of Regents was a "Board of Directors," and its president, Clark Kerr, was a "manager." Extending the corporate analogy, he argued that the faculty were little more than "employees" and the students, "raw material." But, shouted Savio, "we're a bunch of raw material that don't mean . . . to be made into any product, don't mean to end up being bought by some clients of the university. . . . We're human beings." With that, he uttered three sentences that would come to define not only the Free Speech Movement at Berkeley, but the countercultural militancy of the 1960s across America and much of Europe as well: "There's a time when the operation of the machine becomes so odious, makes you so sick at heart, that you can't take part, you can't even tacitly take part. And you've got to put your bodies upon the gears and upon the wheels, upon the levers, upon all the apparatus, and you've got to make it stop. And you've got to indicate to the people who run it, to the people who own it, that unless you're free, the machine will be prevented from working at all."1

Savio's speech conjured up images of predigital industry, of factory floors and wheels and levers and of the bodies that work them. Yet, for Savio and the community of students to whom he spoke, the word machine also referred to a social world that had become increasingly
organized around information and information technologies. Just a year before the unrest of the Free Speech Movement, Clark Kerr had published a series of lectures in which he suggested that the university was "a mechanism—a series of processes producing a series of results—a mechanism held together by administrative rules and powered by money." He argued that this mechanism served two purposes: first, citing economist Fritz Machlup's recent studies on the increasing importance of information to the economy, he argued that the university generated new knowledge and new workers for an emerging "information society." In that sense, both he and his students agreed that the university was an information machine. Second, he suggested that this machine had a particular role to play in the ongoing cold war. "Intelect has . . . become an instrument of national purpose," he wrote, "a component part of the 'military-industrial complex.' . . . In the war of ideological worlds, a great deal depends on the use of this instrument." For the students of the Free Speech Movement, the university's role as knowledge producer could not be separated from its engagement with cold war politics. Moreover, the entanglement threatened many at a deeply personal level. To the protestors, the university was both a knowledge factory in its own right and a microcosm of the rigid, highly rationalized military-industrial complex it served. In that sense it modeled the hierarchical world of cold war corporate adulthood for which many feared they were being trained. And at the time, no machine more commonly represented this stratified, depersonalized social order than the computer. Hal Draper, a librarian at Berkeley in 1964, explained that for a student, "the mass university of today is an overpowering, over-towering, impersonal, alien machine in which he is nothing but a cog going through pre-programmed motions—the IBM syndrome." As Mario Savio later told an interviewer, he and many others felt that "At Cal you're little more than an IBM card." For Savio and the students of the Free Speech Movement, the corporate world, the university, the military, and the punch-card universe of information seemed to be mirrors of one another. Each presented the otherwise whole and authentic individual with a world in which he or she must pare away some part of his or her self in order to participate. In the military or the corporate world, or, for that matter, in the university, people would have to learn to play assigned organizational roles. These roles, many argued at the time, might reduce their otherwise complex and creative natures to the two-dimensional dullness of an IBM card. In a sense, each of these systems threatened to alienate the individual from her or his own lived experience. It became particularly important, therefore, for the students to put their bodies in Sproul Hall, as they did in the sit-in that followed Savio's speech. If the university was a giant machine for the abstracting of individuals into
informational raw material for the knowledge industry, then how could they assert their humanity more powerfully than by laying their bodies across the stairways and office floors of the institution?

Thirty years later, the same aspects of computing that threatened to de-humanize the students of the Free Speech Movement promised to liberate the users of the Internet. On February 8, 1996, John Perry Barlow, an information technology journalist and pundit, and a former lyricist for the house band of the San Francisco LSD scene, the Grateful Dead, found himself at his laptop computer in Davos, Switzerland. While attending the World Economic Forum, an international summit of politicians and corporate executives, he had watched the American Congress pass the Telecommunications Act, and with it a rider called the Communications Decency Act, which aimed to restrict pornography on the Internet. Incensed by what he perceived to be the rider’s threat to free speech, Barlow drafted the “Declaration of the Independence of Cyberspace” and posted it to the Internet. According to Barlow, the “Governments of the Industrial World” had become “weary giants of flesh and steel.” Organized into hyperrationalized bureaucracies devoted to enforcing their laws by military means, these governments, he wrote, belonged to the past. Thanks to the advent of digital technologies,

We are creating a world that all may enter without privilege or prejudice accorded by race, economic power, military force, or station of birth.

We are creating a world where anyone, anywhere may express his or her beliefs, no matter how singular, without fear of being coerced into silence or conformity.

That world existed principally in the exchange of digital signals between interlinked computers—that is, in cyberspace. Speaking directly to the governments of the material world, Barlow argued:

Your legal concepts of property, expression, identity, movement, and context do not apply to us. They are all based on matter, and there is no matter here.

Our identities have no bodies, so, unlike you, we cannot obtain order by physical coercion. We believe that from ethics, enlightened self-interest, and the commonweal, our governance will emerge.6

For Barlow, digital technologies had ceased to be emblems of bureaucratic alienation and had become instead the tools by which bureaucracy and alienation could be overthrown. Echoing the high-flown rhetoric of the Free Speech Movement, Barlow suggested that Americans had once again found themselves at a moment of social revolution. But this time, the forces
of information were on the side of the people. In Mario Savio's view, the power of computers to render the embodied lives of individual students as bits of computer-processed information symbolized the power of the factory to turn people into corporate drones and the power of the militarized state to turn young people into soldiers. For Barlow, though, that same power offered men and women the chance to enter a world of authentic identity and communal collaboration. Freed from the institutions that structured privilege in the material world, the individual in Barlow's cyberspace could join a society much like the one imagined by the Free Speech Movement—a world in which hierarchy and bureaucracy had been replaced by the collective pursuit of enlightened self-interest.

Nor was Barlow alone. For instance, Silicon Valley journalist and venture capitalist Esther Dyson, in her much-read 1997 guide to the social impact of computer networks, *Release 2.0: A Design for Living in the Digital Age*, argued that the Internet would soon dissolve the bureaucracies of the marketplace by stripping away the material bodies of individuals and corporations. Within the electronic confines of the digital marketplace, she claimed, both person and firm would be reduced to packages of information. At the same time, digital technologies would render information about products and markets ubiquitous. Together these features would allow individuals and corporations to negotiate with one another from positions of equality. Dyson was persuaded that digital media would free individuals from the ostensibly tyrannical rule of corporate hierarchies much as they would liberate Barlow's citizens from the impositions of government.

Dyson and Barlow, as well as many other commentators at the time, saw the Internet serving as a rhetorical prototype for new, flexible, and mobile ways of working and living: "Like the Net, my life is decentralized," wrote Dyson, reminding her readers of how much and where she traveled. "I live on the Net," she explained. "It's the medium I use to communicate with many of my friends and colleagues. I also depend on it professionally: It's the primary subject about which I write, talk, and consult, and the basis of most of the companies I invest in, both in the United States and in Eastern Europe." Likewise, Barlow reminded his readers, "I live at barlow@eff.org. That is where I live. That is my home. If you want to find me, that's the only place you're liable to be able to do it, unless you happen to be looking at me at that moment—physically. . . . There really is no way to track me. I have not been in one place for more than 6 days since April." Metaphorically, Barlow and Dyson had become packets of information, shuttling from boardroom to conference to media outlet. Their sense of place had become dislocated and their sense of home, like their notion of a home on the Net, distributed.
For Kevin Kelly, executive editor of Wired, this new way of living and the ways in which digital technologies served and modeled it marked a revolutionary transformation in human understanding. In one of the most widely read business manuals of the 1990s, New Rules for the New Economy, Kelly explained that “the principles governing the world of the soft—the world of intangibles, of media, of software, and of services—will soon command the world of the hard—the world of reality, of atoms, of objects, of steel and oil, and the hard work done by the sweat of brows.” The savvy worker would have to become a networker. “Those who obey the logic of the net, and who understand that we are entering into a realm with new rules,” he intoned, “will have a keen advantage in the new economy.”9 Along with this understanding of work, he argued, a singular, almost mystical understanding of the power of information and information systems had begun to arise: “the computational metaphor.” In 1998 Kelly explained that human beings were slowly but surely moving toward believing that “the universe is a computer.” Already, computer experts had begun to model life in computer science terms on their machines. For some time now, many had believed that “thinking is a type of computation, DNA is software, evolution is an algorithmic process.” Soon enough, he argued, human beings would begin to imagine all of biology as an instantiation of computer logic. “Is this embrace just a trick of language?” he asked. “Yes, but that is the unseen revolution. We are compiling a vocabulary and a syntax that is able to describe in a single language all kinds of phenomenon [sic] that have escaped a common language until now. It is a new universal metaphor. It has more juice in it than previous metaphors: Freud’s dream state, Darwin’s variety, Marx’s progress, or the Age of Aquarius. And it has more power than anything else in science at the moment. In fact the computational metaphor may eclipse mathematics as a form of universal notation.”10

At one level, Kelly’s notion that the material world can be imagined as an information system belongs very much to the 1990s. It underpins his claims that the entrepreneurial networks of the business world resemble the systems of nature. And it runs throughout Dyson’s and Barlow’s arguments that the Internet models a world free from bureaucracy and psychological fragmentation. Yet it also presents a historical puzzle. The idea that the material world could be thought of as an information system and modeled on computers emerged not with the Internet, but much earlier, in and around the government-sponsored research laboratories of World War II, and particularly around the Radiation Laboratory at MIT. These laboratories helped drive the development of computing in America. They also formed the foundations of the same military-industrial-academic complex against which Berkeley students marched in 1964. Somehow, by the 1990s,
a metaphor born at the heart of the military research establishment had become an emblem of the sort of personal integrity, individualism, and collaborative sociability that so many had claimed the very same establishment was working to destroy.

The computational metaphor of the 1990s embraced other contradictions too. For the marchers of the Free Speech movement, disembodiment—that is, the transformation of the self into data on an IBM card—marked the height of dehumanization. For Kelly, Dyson, and Barlow, however, it marked the route to new forms of equality and communion. Somehow, somewhere, disembodiment had come to be seen as a route to a more holistic life. Likewise, for the students who turned toward Mario Savio, the link between computers and commerce represented a threat. As Savio’s speech suggested, the students of the Free Speech Movement were afraid not only of becoming victims of a social machine, but also of becoming fuel for the engines of economic production. In the 1990s, the computer once again served as a metaphor for the organization of production and labor, but this time that link promised to liberate both individuals and society. How was it that the informational economy came to be seen not as an oppressive force, but as a site of political and cultural change?

In order to answer this question, we need to revisit the research world out of which the computational metaphor arose in the 1940s and 1950s and the countercultural world of the 1960s. Contrary to the perceptions of many in the counterculture in the 1960s and of many scholars since, the two worlds had a great deal in common. They shared a celebration of intellectual work, of technology, and of collaborative work styles. Both reveled in the economic and technological abundance of post–World War II America. The research laboratories of World War II, and the military-industrial-academic bureaucracies that grew out of them, were far more flexible, entrepreneurial, and individualistic places than many remember today. By the same token, certain elements of the counterculture embraced the ideas, the social practices, and the machines that emerged inside the world of military research even as they vocally attacked cold war bureaucracies. Even as they sought to find new ways to live psychologically and socially integrated lives, some members of the counterculture turned toward the heart of the technocracy itself in search of tools and models for their work.

The Forgotten Openness of the Closed World

In the wake of Hiroshima and Nagasaki and the decades of nuclear tension that followed, it has become difficult to think of the weapon laboratories of World War II in any but the apocalyptic terms set by the Manhattan Project.
As a generation of cultural historians has shown, the end of World War II and the arrival of the atomic era unleashed a wave of quietism and fear across American society. Gender boundaries stiffened, racial tensions slipped from public discussion, and leaders and citizens alike came to dread a vague but seemingly pervasive Communist menace. As Paul Edwards has demonstrated, computers played a central role as both tools and symbols in this period. In Washington, government planners used computers to model the possible effects of nuclear holocaust; in North Dakota, Alaska, and elsewhere, air force generals used computers to track potential attacks on the United States. In both cases, the planet was transformed into a closed informational system for purposes of military command and control. Cognitive psychologists in turn began to imagine that the brain was a form of digital hardware and its actions a form of software, that thinking was a type of computing and memory simply a matter of data retrieval. Together, such analogies supported what Edwards has called a "closed world discourse." Within this discourse, the mind of the individual man and the command centers of America's nuclear defense establishment both seemed to be mechanized tools of management and control. Both seemed devoted to maintaining firm boundaries — national in the case of the military, masculine in the case of individual military leaders. The world in which they lived and worked seemed to be dominated by large, bureaucratic organizations. Like their leaders and like the information machines on which they depended, these organizations seemed to many to be closed, unfeeling systems.

It was such closed-world visions that the students of the Free Speech Movement rose up against. Yet, even though the computational metaphor provided rhetorical support for the discourse of the closed world, the metaphor had in fact emerged from and would ultimately also help perpetuate an extraordinarily flexible, entrepreneurial, and, for its participants, often deeply satisfying style of research. As numerous historians of technology have pointed out, World War II triggered a transformation in American science. Before the war, science and scientists seemed to stand outside politics. University-based researchers generally drew their funding from their universities or from industry. By and large, they maintained clear distinctions between science and engineering and between military and civilian research. When Germany invaded Poland, however, these relatively independent specialists found themselves thrown into new interdisciplinary and interinstitutional collaborations. In 1940 former MIT professor and administrator Vannevar Bush persuaded Franklin Roosevelt to create the National Defense Research Committee, through which government dollars for military research would be funneled to civilian contractors, and to put him in
charge of it. A year later the committee became the Office of Scientific Research and Development (OSRD). Over the next five years, the OSRD pumped some $450 million into researching and developing war-related technologies.\textsuperscript{16}

In the process, the OSRD knit together a fabric of military-industrial-academic collaborations that has persisted to this day. Much of its wartime funding went to large research universities, such as MIT ($117 million), Caltech ($83 million), and Harvard ($30 million), but a great deal also went to industrial manufacturers such as General Electric ($8 million), RCA, Du Pont, and Westinghouse (who each received amounts less than $6 million).\textsuperscript{17} The need to control the flow of this funding and the need to manage the movement of men and material led to a massive expansion of government bureaucracy. Government agencies, the universities housing military research, and the corporations building new military machines all saw extraordinary and, at the macro level, largely hierarchical growth.\textsuperscript{18} The technologies produced in this manner—including radar, the atomic bomb, submarines, aircraft, and even digital computers—tended to be large, complex, and under centralized command as well. In contrast, the laboratories within which the research and development took place witnessed a flourishing of nonhierarchical, interdisciplinary collaboration. At sites such as Los Alamos and the Oak Ridge National Laboratory, theoretical physicists, experimentalists, and electrical and mechanical engineers began to work together on a daily basis and toward a common end for the first time.\textsuperscript{19}

One of the most effective and most visible laboratories of the war was MIT's Radiation Laboratory. Founded in late 1940 with a half-million-dollar grant from the National Defense Research Committee, the Rad Lab, as it was commonly known, aimed to develop more effective ways to track and shoot down the bombers then plaguing Britain.\textsuperscript{20} Driven first by the urgency of keeping Britain in the war, and then, after Pearl Harbor, by America's own military needs, the Rad Lab grew rapidly. Six months after its founding, it employed some two hundred researchers and technicians; by the end of the war, it employed thirty-nine hundred. Between 1940 and 1945, it developed $25 million worth of equipment for the military.\textsuperscript{21} Before it closed at the end of the war, the laboratory enjoyed the support of government funders, military clients, industrial subcontractors, and an academic host—all of whom represented, from a structural point of view at least, the sort of bureaucracies that would become emblematic of the closed world. Over the next twenty years, engineers and administrators associated with the Rad Lab and with MIT during the war went on to play key roles in a wide variety of Defense Department–sponsored research initiatives. The Rad Lab itself became a model for the sorts of large-scale military
engineering projects that defined the cold war, including the Semi-Automated Ground Environment (SAGE) air defense system and the Atlas and Polaris missile systems.22

Even though it operated with the support of large bureaucracies, however, the Rad Lab was a site of flexible, collaborative work and a distinctly nonhierarchical management style. Its name may conjure up images of a single laboratory room, but the Rad Lab was in fact a collection of interlinked research projects housed together at MIT. Along with work on radar, the Lab developed technologies for long-range navigation, the aiming of anti-aircraft guns, and fire control. It brought together scientists and mathematicians from MIT and elsewhere, engineers and designers from industry, and many different military and government planners. Among these various professionals, and particularly among the engineers and designers, entrepreneurship and collaboration were the norm, and independence of mind was strongly encouraged. Formerly specialized scientists were urged to become generalists in their research, able not only to theorize but also to design and build new technologies.23 At the same time, scientists and engineers had to become entrepreneurs, assembling networks of technologists, funders, and administrators to see their projects through. Neither scientists nor administrators could stay walled off from one another in their offices and laboratories; throughout the Rad Lab, and even after hours, in the restaurants and living rooms of Cambridge, the pressures to produce new technologies to fight the war drove formerly specialized scientists and engineers to cross professional boundaries, to routinely mix work with pleasure, and to form new, interdisciplinary networks within which to work and live.24

The new networks helped generate new ways of thinking and speaking. Drawing on the literature of anthropology, historian of science Peter Galison has described the Rad Lab as a “trading zone.”25 Like members of linguistically distinct tribes who come together to trade goods and services, he argues, the scientists, technologists, and administrators of the Rad Lab developed “contact languages” with which to exchange ideas and techniques toward the common end of producing weapons systems. These languages ranged from “the most function-specific jargons through semispecific pidgins, to full-fledged creoles”; they also included nonverbal elements, such as shared tools, which could be used to demonstrate concepts across disciplinary boundaries or serve as sites for collaborative work.26 According to Galison, scientists, engineers, and administrators in the wartime laboratories worked not so much as members of a single culture, but rather as members of different professional subcultures bound together by common purpose and a set of linguistic tools they had invented to achieve it.27
It was precisely this process and this institutional context that gave rise to the computational metaphor and the new philosophy of technology in which it made its first public appearance: Norbert Wiener's cybernetics. A former mathematics prodigy, Wiener had joined the faculty of MIT in 1919 and soon began collaborating with Vannevar Bush, a professor of electrical engineering at the time. By the 1930s Wiener had achieved substantial renown for his work in mathematics, but he had also continued to venture into other disciplines, including electrical engineering, biology, and the study of computers. He worked especially closely with Bush, for instance, on the development of analog computers in the 1930s. He also began attending a monthly seminar on scientific method conducted by Mexican physiologist Arturo Rosenblueth at the Harvard Medical School. As Wiener recalled in 1948, he and Rosenblueth shared the idea that the most interesting areas for scientific work were the “boundary regions” between disciplines. They had also begun to imagine an institutional structure that would facilitate such work. Wrote Wiener,

We had dreamed for years of an institution of independent scientists, working together in one of these backwoods of science, not as subordinates of some great executive officer, but joined by the desire, indeed by the spiritual necessity, to understand the region as a whole, and to lend one another the strength of that understanding.

We had agreed on these matters long before we had chosen the field of our joint investigations and our respective parts in them. The deciding factor in this new step was the war.

Norbert Wiener began doing war-related research even before the United States entered the fighting, and soon after the Rad Lab was formed, he turned his attention to the problems of tracking and shooting down enemy aircraft. As a mathematician, Wiener worked to devise statistical methods for determining the future course of an airplane based on its location and motion. Together with a young engineer named Julian Bigelow, he also designed a machine that they called a “predictor” that would embody these methods. Early in the process, Wiener and Bigelow recognized that the enemy bomber and the anti-aircraft fire-control system each depended on both mechanical and human components. From a theoretical point of view, this combination of the organic and the mechanical presented a problem. In his 1956 memoir, I Am a Mathematician, Norbert Wiener explained that “in order to obtain as complete a mathematical treatment as possible of the over-all control problem, it is necessary to assimilate the different parts of the system to a single basis, either human or mechanical. Since our
understanding of the mechanical elements of gun pointing appeared to us to be far ahead of our psychological understanding, we chose to find a mechanical analogue of the gun pointer and the airplane pilot.\textsuperscript{32} In other words, Wiener and Bigelow began to imagine the soldiers who controlled the airplanes and the anti-aircraft apparatus as mechanical devices so as to be able to model their behavior using mathematical formulas. The analogue they chose was the servomechanism.\textsuperscript{33} Wiener and Bigelow noticed that both the pilot and the anti-aircraft gunner observed patterns of error in their attempts to attack and escape and regulated their behavior accordingly. In this respect, like the nineteenth-century governor that once regulated steam engines, each responded to what Wiener and Bigelow called "negative feedback."\textsuperscript{34}

By conceptualizing pilots and gunners as servomechanisms, Wiener and Bigelow also found a way to imagine the material world in terms of the computational metaphor. That metaphor in turn encoded two sometimes overlapping, and sometimes competing, socio-technical visions: the automaton and the self-regulating system. By imaginatively transfiguring soldiers into mechanisms, Wiener and Bigelow suggested that human beings were at some level machines.\textsuperscript{35} Underlying all their messy, fleshy, emotional complexity, human beings could be modeled as mechanical information processors. Moreover, if this was the case, they could be replaced by faster and more reliable mechanical devices. With their anti-aircraft predictor, Wiener and Bigelow helped lay the foundation for a vision of the automated human being and the automated organization that would haunt American public life well into the 1960s.

At the same time, however, by means of the same imaginative transformation of men into information processing devices, Wiener and Bigelow offered up a picture of humans and machines as dynamic, collaborating elements in a single, highly fluid, socio-technical system.\textsuperscript{36} Within that system, control emerged not from the mind of a commanding officer, but from the complex, probabilistic interactions of humans, machines, and events around them. Moreover, the mechanical elements of the system in question—in this case, the predictor—enabled the human elements to achieve what all Americans would agree was a worthwhile goal: the shooting down of enemy aircraft. In the predictor, Wiener and Bigelow presented an example of a system in which men and machines collaborated, amplifying their respective capabilities, sharing control, and ultimately serving the human good of stopping the Nazi onslaught. Over the coming decades, this second vision of benevolent man-machine systems, of circular flows of information, would emerge as a driving force in the establishment of the military-industrial-academic complex and as a model of an alternative to that complex.
Wiener and Bigelow began almost immediately to generalize their vision of a self-directing system governed by feedback to other fields. In early 1942, Wiener and Bigelow had begun to think about the biological realm and approached Arturo Rosenblueth. Their discussions led to the 1943 publication of a paper, "Behavior, Purpose, and Teleology," in which they suggested that behavior and purpose in biological systems proceeded according to the same feedback dynamics that governed the sorts of mechanical and biomechanical systems Wiener and Bigelow had been developing in the Rad Lab. But this was only the beginning. Within a year, Wiener began to imagine duplicating the human brain with electrical circuits. By 1948 he had transformed the computational metaphor into the basis of a new discipline. In his book Cybernetics; or, Control and Communication in the Animal and the Machine, he defined cybernetics as a field focused on "the study of messages as a means of controlling machinery and society," with machinery seeming to include, by analogy at least, biological organisms. For Wiener, the world, like the anti-aircraft predictor, was composed of systems linked by, and to some extent made out of, messages. Drawing on Claude Shannon's information theory (published in 1948, but likely familiar to Wiener much earlier), Wiener defined messages as "forms of pattern and organization." Like Shannon's information, Wiener's messages were surrounded by "noise," yet they somehow maintained their integrity. So too did organisms and machines: incorporating and responding to feedback through structural mechanisms, Wiener explained, both kept themselves in a state of homeostasis. In that sense, Wiener believed that biological, mechanical, and information systems, including then-emerging digital computers, could be seen as analogues of one another. All controlled themselves by sending and receiving messages, and, metaphorically at least, all were simply patterns of ordered information in a world otherwise tending to entropy and noise.

Wiener also believed that these systems could serve as models for social institutions and for society at large. Two years after publishing Cybernetics, Wiener published the far more accessible and intellectually more expansive volume The Human Use of Human Beings: Cybernetics and Society. There he argued that society as a whole, as well as its constituent organizational parts, functioned much like organisms and machines. That is, society could be seen as a system seeking self-regulation through the processing of messages. In Wiener's analogy, for instance, public information systems such as the media served as servomechanisms. The TV screen became to the society as a whole what the radar screen was to the World War II gunner—a system through which to measure and adjust the system's performance. Wiener believed that the media ideally served to "correct" the actions of public leaders by offering them accurate information about the performance of society
as a whole. Likewise, within the smaller unit of the government agency or the corporation, Wiener argued that leaders should actively solicit feedback from their colleagues and employees. In particular, they should avoid adhering to a strictly top-down style of communication: “Otherwise,” wrote Wiener, “the top officials may find that they have based their policy on a complete misconception of the facts that their underlings possess.”38

Both Cybernetics and The Human Use of Human Beings were best sellers, and together with Claude Shannon and Warren Weaver’s 1949 Mathematical Theory of Communication, they sparked a decade’s worth of debate about the proper role of computers in society. Given the many pages they devoted to analyzing complex mathematical formulas, Cybernetics and The Mathematical Theory of Communication would not seem to be likely candidates for popular acclaim. Yet, in an America that had recently defeated Nazi Germany and Hirohito’s Japan and invented a weapon that could eradicate life on earth, the computational metaphor that underlay these books gave voice to two issues then much in the public eye: the sudden importance of science and its ambiguous social potential. On the one hand, as Wiener himself pointed out, cybernetics suggested that digital processes might lead to a malevolent automation of human and biological processes. At the end of Cybernetics, for example, he described a computer of the future that could play chess.39 Though such computers have become commonplace today, to readers of the early cold war era, Wiener’s image suggested that a human being could be substantially translated into a system of wires and electrodes—at least for the purposes of playing a board game. His image conjured up the swarm of recent propaganda images of hyperrational, unfeeling Nazis. Like a Hollywood Nazi, the computer played chess efficiently, but without feeling. It sought only to dominate and control. This vision sparked several fears, as Wiener saw it. Computers, he suggested, might step beyond the reaches of human control and begin to act on their own.40 On the other hand, they might become the tools of unfeeling politicians and capitalists and those individuals’ desire to automate the social institutions they dominated. Over the next fifteen years, Wiener remained particularly afraid of industrial automation and even sought out union leader Walter Reuther to suggest how workers might combat the threats it posed.41

Wiener’s fear of automation would echo down through the 1950s and would reappear both in technical discussions of the potential social impact of computing and in radical critiques of postwar society. Yet, in his vision of organisms, machines, and society itself as overlapping systems of information exchange, Wiener also offered a much more benevolent view of the political implications of information technology. Following Shannon, Wiener viewed information as pattern within noise and therefore as a model
of material and social order. In Wiener's own words, disorganization and randomness, whether in the realm of information or in the realm of politics, was something "which without too violent a figure of speech we may consider evil." Information systems, in part simply by virtue of being systems, exemplified organization. What is more, because of their feedback mechanisms, Wiener believed they sought to maintain order within themselves. In both senses, Wiener viewed information systems as sources of moral good. Moreover, to an America that had just spent five years combating a dictatorial German regime and that would soon confront a new dictator in the person of Joseph Stalin, a systems view of information offered an appealingly nonhierarchical model of governance and power. Cybernetic systems as Wiener saw them were self-regulating and complete in and of themselves, at least in theory. They had only to process information by means of their constituent parts and respond to the feedback offered, and order would emerge. Embedded in Wiener's theory of society as an information system was a deep longing for and even a model of an egalitarian, democratic social order. To the readers of Cybernetics, computers may have threatened automation from above, but they also offered metaphors for the democratic creation of order from below.

At the same time, for scientists and technologists, cybernetics and the systems theories that followed it remained the preeminent language of collaboration in the multidisciplinary world of cold war research. Vannevar Bush had feared the long-term consequences of government influence on civilian research and development and had hoped that the military-industrial-academic collaborations he helped establish would not outlive World War II. Nevertheless, as soon as the war ended, they became the basis for a series of massive military research projects, including the Intercontinental Ballistic Missile, the SAGE air defense system, and the Polaris Intermediate Range Missile. All of these projects depended heavily on computers, on interdisciplinary and interinstitutional collaborations, and on a systems approach to engineering. Over the next twenty years, cybernetics and systems theory more generally provided a rhetoric and a conceptual framework with which to link the activities of each of these actors to the others and to coordinate their work as a whole.

The power of cybernetics and systems theory to facilitate interdisciplinary collaboration emerged in large part thanks to the entrepreneurship of Norbert Wiener and the research climate of World War II. Wiener did not create the discipline of cybernetics out of thin air; rather, he pulled its analytical terms together by bridging multiple, if formerly segregated, scientific communities. Wiener borrowed the word homeostasis from the field of physiology and applied it to social systems; he picked up the word feedback
from control engineering; and from the study of human behavior, he drew
the concepts of learning, memory, flexibility, and purpose.\textsuperscript{55} Wiener could as-
ssemble pieces from such diverse sources because he was in steady collabo-
rateive contact with representatives from each of these domains at the Rad
Lab, in his famous hallway wanderings at MIT, and in his sojourns to the
Harvard Medical School. In the course of these peregrinations, he discussed
physiology with Arturo Rosenblueth, feedback with the engineers of the
Rad Lab, and, very likely, human behavior with both. Like the anti-aircraft
predictor itself, the rhetoric of cybernetics was the product of interdiscipli-
nary entrepreneurial work. Thus, the key terms of early cybernetics can be
seen to have emerged as elements of a local contact language in and around
the multiple trading zones of World War II Cambridge.

The rhetoric of cybernetics not only embodied, but also actively facili-
tated, networking and entrepreneurship. At the local level of the Rad Lab,
cybernetics offered a contact language through which work on weapons de-
vices could be organized; devices such as the anti-aircraft predictor offere-
d sites for collaboration. Yet, as Geoffrey Bowker has argued, the locally de-
volved tactics of cybernetic rhetoric also allowed it to spread across mul-
tiple fields of research and to become a “universal discipline.”\textsuperscript{46} Because of
the changes in scientific practice brought about by World War II, specialists
in one discipline began to do things that had previously been considered
the proper domain of specialists in other areas. They could justify such leaps
across disciplinary boundaries by drawing on the rhetoric of cybernetics. If
biological principles were at work in machines, then why shouldn’t a physi-
ologist contribute to work on computers? If “information” was the lifeblood
of automatons, human beings, and societies alike, why shouldn’t a mechani-
cal engineer become a social critic? With such justifications, Wiener and a
string of later cyberneticians and systems theorists reached across disci-
plinary boundaries and claimed a universal relevance for their new “science.”

In this process, two rhetorical tactics played especially important roles:
the use of prototypes and what Bowker has called “legitimacy exchange,”
a term that refers to the process by which experts in one area draw on the
authority of experts in another area to justify their activities. As Bowker ex-
plains, “An isolated scientific worker making an outlandish claim could gain
rhetorical legitimacy by pointing to support from another field—which in
turn referenced the first worker’s field to support its claim. The language of
cybernetics provided a site where this exchange could occur.”\textsuperscript{47} Legitimacy
exchange helped transform cybernetics from a relatively local contact
language suited to the particular needs of scientists in wartime Cambridge
into a discourse commonly used for coordinating work across multiple re-
search projects and multiple professional communities. As Bowker suggests,
cybernetics facilitated not only the interlinking of research, development, and production activities, but also the development of new interpersonal and interinstitutional networks and, with them, the exchange and generation of a networked form of power. To the extent that members of two or several disciplines could succeed in creating a relatively closed system of interlegitimation, they could make it extraordinarily difficult for nonexperts (e.g., noncyberneticians) to challenge their individual agendas. They could and did stake claims for research funding, material resources, and popular attention. Working together, in pairs and networks, each acquired a legitimacy that none could have had alone without the exchange of legitimacy afforded by cybernetic rhetoric.

Legitimacy exchange drew not only on rhetoric, but on material artifacts as well. Andrew Pickering has pointed out that cyberneticians created a variety of "monsters"—artifacts that seemed to straddle the line between mechanical devices and living systems. These artifacts included Wiener and Bigelow's anti-aircraft predictor, a homeostat developed by British psychiatrist and cybernetic theorist Ross Ashby, and a number of others.\(^49\) In each case, the artifact served as a prototype of other sorts of systems and of cybernetic principles more generally. In Wiener's case, the anti-aircraft predictor modeled not only the behavior of aircraft, but also the probabilistic nature of biological, mechanical, and social systems of all sorts. Ashby's homeostat modeled processes of self-regulation that could be observed in biological and social domains as well. As Katherine Hayles has observed, such devices "functioned as exchangers," bringing "man and machine into equivalence."\(^49\) In the process, they served to exemplify in real, concrete terms—and thus to legitimate—the claims of cyberneticians and systems theorists that just as information itself spanned multiple domains, their theory could be deployed in multiple disciplines.

Over the two decades following World War II, such claims found a home in massive military research projects; in a variety of academic disciplines, including management theory, clinical psychology, political science, biology, and ecology; and ultimately in the urban renewal projects of Lyndon Johnson's Great Society.\(^50\) As Katherine Hayles and Steve Heims have shown, cybernetics's migration into the social and, to some extent, the physical and biological sciences was driven in large part by the Macy Conferences.\(^51\) Sponsored by the Macy Foundation in the late 1940s and early 1950s, these meetings brought together biologists, physicists, and mathematicians, including cyberneticians such as Arturo Rosenblueth and Warren McCulloch, psychiatrists such as Ross Ashby, and sociologists and anthropologists such as Gregory Bateson and Margaret Mead. Over time, the Macy Conferences helped refine a number of cybernetic concepts, including the relationship
between a system and its observers and the nature of feedback. They also sent individual participants back to their home disciplines with a deep systems orientation toward their work and a habit of deploying the information and systems metaphors. In this way the Macy meetings helped transform cybernetics into one of the dominant intellectual paradigms of the postwar era.\textsuperscript{32}

As important as they were, though, these conferences were only one force driving the spread of systems thinking. At the same time that the Macy meetings were introducing cybernetics into new intellectual circles, the military research projects of the cold war were turning its systems orientation into everyday practice. Like the Macy Conferences, these projects brought together specialists from a variety of disciplines, and for the specialists involved, systems theory became a way of life. The SAGE air defense project, for example, began as an attempt to establish an early warning system against Soviet bombers armed with nuclear weapons. Like the Rad Lab before it, SAGE was based at MIT; involved a complex range of military, industrial, and academic players; and organized its work in a highly collaborative fashion. Far from implementing a rigid command hierarchy, the managers of SAGE coordinated the project’s many elements through a set of distributed, interdisciplinary meetings. The air defense system they developed depended on a series of geographically distributed radar sets, linked to computers that could monitor and coordinate the information they sent back. For this work, the SAGE planners turned to the Whirlwind computer already under development in a project led by MIT professor Jay Forrester. The Whirlwind was about to become the first interactive digital computer to be used (by SAGE personnel) primarily for information management and control rather than computation.\textsuperscript{33} At the same time, they helped turn the computational metaphor into a tool with which to imagine, manage, and facilitate such highly interdisciplinary, networked forms of cooperation. The power of this metaphor can be seen in an influential 1950 report written by the Truman administration’s Defense Systems Engineering Committee—the same committee that would ultimately press to integrate the Whirlwind computer into the nation’s air defense system. In their report, the committee outlined the means by which air defense ought to be organized: not only in terms of armaments and airplanes, but in terms of the computational metaphor of cybernetics. “The Air Defense system,” they wrote,

is an organism. . . . What then are organisms? They are of three kinds: animate organisms, which comprise animals and groups of animals, including men; partly animate organisms which involve animals together with inanimate devices such as in the Air Defense System; and inanimate organisms such as
vending machines. All these organisms possess in common: sensory components, communication facilities, data analyzing devices, centers of judgment, directors of action, and effectors, or executing agencies. . . .

It is the function of an organism . . . to achieve some defined purpose.54

Before the system was deployed in 1958, the SAGE project would train an entire generation of computer engineers, scientists, and technicians. These men (and they were almost exclusively men) would go on to found numerous university computer science departments, to set up MIT’s Project MAC (which introduced computer time-sharing), to help establish key computer companies (such as the Digital Equipment Corporation), and even to help initiate the ARPANET, which would become the basis of the Internet.55 As they created the military-industrial-academic infrastructure out of which individualized and networked computing would emerge, these engineers, along with their colleagues on the ICBM and Polaris projects and on dozens of other military command-and-control system development projects, brought with them not only a habit of entrepreneurship and interdisciplinary collaboration, but also the discourse of cybernetics and systems theory and the computational metaphor on which it depended. Even as they built the large military research projects and the massive weapons that would come to symbolize cold war technocracy, the researchers of SAGE and later projects carried forward a collaborative style and a rhetoric of collaboration born in the weapons laboratories of World War II.

The Countercultural Embrace of Technology and Consciousness

Even though it grew out of and facilitated interdisciplinary forms of cooperation, the computational metaphor did not yet carry with it the visions of a disembodied, egalitarian polis and the postinstitutional, peer-to-peer marketplace with which it would be associated in the mid-1990s. On the contrary, those social ideals emerged as key features of a nationwide youth movement that rose up in the 1960s in large part against the institutions within which cybernetics served as a lingua franca.

By the late 1950s, many Americans had begun to fear that the military, industrial, and academic institutions that had brought the atomic bomb into being were beginning to transform all of American life. Under the shadow of nuclear war, the often freewheeling, collaborative practices of cold war research and development almost disappeared from public view.56 What remained was a vision of expertise and hierarchy and, for critics on the left, of a society dominated by pyramidal organizations run by buttoned-down, psychologically fragmented men. "As the means of information and of
power are centralized," wrote sociologist C. Wright Mills in 1956, "some
cmen come to occupy positions in American society from which they can
look down upon . . . and by their decisions mightily affect, the everyday
worlds of ordinary men and women." Under the controlling eye of this
"power elite," Mills argued, ordinary Americans found themselves trapped
in corridors and offices, unable to envision, let alone take charge of, the
entirety of their work or their lives. Ordinary people lacked the ability to
"reason about the great structures—rational and irrational—of which their
milieux are subordinate parts," he explained. So too, in a way, did the men
at the top. For critics like Mills, both the masters of bureaucracy and their
minions suffered from a paring away of emotional life and a careful separa-
tion of psychological functions. After World War II, rationalization had be-
gun to give rise to "the man who is 'with' rationality but without reason,
who is increasingly self-rationalized and also increasingly uneasy." This
man, continued Mills, was a "Cheerful Robot." Mill's critique could be heard echoing throughout the 1960s in works as
varied as Jacques Ellul's *The Technological Society* (1964), John Kenneth Galbraith's *The New Industrial State* (1967), Herbert Marcuse's *One-Dimensional Man* (1964), Lewis Mumford's *The Myth of the Machine* (1967), Theodore Roszak's *The Making of a Counterculture* (1969), and Charles Reich's *The Greening of America* (1970). Like Mills, these authors suggested that society was undergoing a rapid process of centralization and rationalization, a process both supported by new technologies and designed to help build them. The resulting social order went by a variety of names—the "technostructure" (Galbraith), the "technological society" (Ellul), and "technocracy" (Roszak). In each case, critics pointed to computers and automation as forces driving the rise of this new way of life. Though little read today, for instance, Lewis Mumford was among the most eloquent and popular of the anti-
automationists. In *The Myth of the Machine*, he turned a cold eye on post-
World War II technological research. While noting that the era had given
rise to a new "experimental mode" and to such varied technologies as nu-
clear energy and supersonic transportation, Mumford argued that it had also
brought into being a new generation of technocrats and a new generation
of technologies through which they might rule: "With this new 'megatech-
nics' the dominant minority will create a uniform, all-enveloping, super-
planetary structure, designed for automatic operation. Instead of function-
ing actively as an autonomous personality, man will become a passive,
purposeless, machine-conditioned animal whose proper functions, as tech-
nicians now interpret man's role, will either be fed into the machine or
strictly limited and controlled for the benefit of de-personalized, collective
organizations."
Such visions of the social world as an automated machine found a large and passionate audience on the college campuses of the 1960s. The generation that came of age early in the decade had been born into a world of extraordinary contradictions. On the one hand, the children of the cold war years witnessed an astonishing growth in American affluence. Teenagers found themselves surrounded by appliances and automobiles and opportunities for education and employment that their parents, growing up in the Depression, could hardly have imagined. As many commentators remarked at the time, this affluence transformed adolescence into a true interregnum between the freedom of childhood and the employment and family demands of adulthood.\textsuperscript{61} For the ever-increasing numbers of middle- and upper-class youths in particular, adolescence became a time for personal exploration.

On the other hand, universities became sites where adolescents could do that work together. In the postwar years, thanks in no small part to government funding for scientific and technological research, the American university system expanded at an exponential rate. The years immediately before the war saw only 14 percent of college-age youth attending universities. By 1961 the percentage had risen to 38, and by 1970 it had topped 50.\textsuperscript{62} In 1959 a little over 3 million Americans were enrolled in college; by 1973 the number had climbed to 8.5 million.\textsuperscript{63} These shifts represented not only the extension of formal education to whole new segments of the population, but also a broader movement toward meritocracy in education, especially at elite institutions. Until the mid-1950s, universities such as Harvard and Yale often admitted students on the basis of family connections. By the mid-1960s, largely due to the rise of educational testing, more merit-based standards had taken hold, and students from a wider range of social backgrounds found themselves on campuses that had been off-limits to their parents.\textsuperscript{64}

Even as their horizons widened, though, the youth of the late 1950s and early 1960s found themselves beset by fears of the atomic bomb and of growing up to take their place in the sort of closed social world that they imagined had brought it into being. Elaine Tyler May has pointed out that the dominant social style of the middle and upper classes during the postwar years could be described as "containment." As the interpersonal corollary to the closed-world visions of military and government planners, containment referred to a way of being in which men and women sought to constrain their emotions, maintain their marriages, and build safe, secure, and independent homes. Like the air force soldiers who scanned America's borders for incoming Soviet bombers, many Americans took to monitoring the boundaries of their own lives. These efforts, however, did not keep nuclear nightmares at bay. On the contrary, for Americans in the 1950s, and
especially American children, nuclear warfare remained a terrifying and imminent prospect. In 1967 social psychologist Kenneth Keniston interviewed a group of young men and women who had taken part in a series of anti-Vietnam War efforts. Hoping to uncover the roots of their activism, he asked them to recall their earliest memories. One young woman described the day an encyclopedia salesman sold her mother volume A of the *Encyclopedia Britannica*: "I remember reading it and seeing a picture of an atomic bomb and a tank going over some rubble. And I think I became hysterical. I screamed and screamed and screamed."65

This woman was hardly unique. As schoolchildren, she and her classmates had been taught to "duck and cover" under their desks if they should happen to see a nuclear flash. They had been shown government-sponsored films in which children their own age sprinted through neighborhoods that been reduced to atomic rubble, hunting for the local fallout shelter.66 Ever since the Soviet Union first tested an atomic bomb in 1949, Americans, and particularly young Americans, had suffered under a thick cloud of nuclear anxiety. For the college students of the early 1960s, that anxiety fused with fears for their own professional futures. Thanks to the power of postwar industry, they would have no trouble finding jobs. Yet many feared that to take those jobs would be to enter the bleak ranks of the bureaucracy that had brought forth nuclear weapons and, later, the Vietnam War. "There are models of marriage and adult life, but . . . they don't work," recalled the same young woman who had discovered the atomic bomb in the encyclopedia. "There is that whole conflict about being professional, leading a middle-class life which none of us have been able really to resolve. How do you be an adult in this world?"67

In response to this question, and to the threat of technological bureaucracy more broadly, the youth of the 1960s developed two somewhat overlapping but ultimately distinct social movements.68 The first grew out of the struggles for civil rights in the Deep South and the Free Speech Movement and became known as the New Left. Its members registered formerly disenfranchised voters, formed new political parties, and led years of protests against the Vietnam War. The second bubbled up out of a wide variety of cold war–era cultural springs, including Beat poetry and fiction, Zen Buddhism, action painting, and, by the mid-1960s, encounters with psychedelic drugs. If the New Left turned outward, toward political action, this wing turned inward, toward questions of consciousness and interpersonal intimacy, and toward small-scale tools such as LSD or rock music as ways to enhance both. By the end of the decade, as youth everywhere adopted its drug habits and its sartorial styles, this branch of the youth movement, and ultimately youthful protestors as a whole, came to commonly be called "the counterculture."
Today, it is the counterculture's hedonism that many Americans remember best. Since the publication of the book that first put the term into mass circulation, Theodore Roszak's 1969 *The Making of a Counterculture*, commentators have taken that hedonism as evidence that the youth movements of the era represented a clean break with cold war society. For those on the right, the drug use and open sexuality of long-haired youths marked a deep challenge to mainstream America. In 1976, for instance, sociologist Daniel Bell pronounced that the counterculture had brought with it the end of the Protestant ethic. For many on the left, the counterculture seemed to threaten the end of traditional political struggle. To former members of the New Left such as Todd Gitlin, hippies were a seductive force, tempting the leaders of the antiwar movement to abandon their organizing for the theatrical politics of the Yuppies. Historians who have followed his lead have pointed to the ways in which the counterculture opened the doors of the youth movement to the complex delights of consumer culture. To others, such as Herbert Marcuse and a subsequent generation of cultural theorists, the hippies' hedonism marked the birth of a new, performative sensibility with which to challenge the social and emotional rigidities of mainstream culture.69

Even as these critiques have acknowledged the power of the cultural dimensions of activism in the 1960s, however, they have obscured the intellectual underpinnings of the hippie style of protest and the ways in which that style echoed ideas, social practices, and attitudes toward technology that had emerged in the center of the cold war research world. For many in the counterculture, though by no means all, the work of expanding consciousness and increasing interpersonal intimacy was not an end in itself; it was a means by which to build alternative, egalitarian communities. Although historians and pundits alike remain fascinated with the sex, drugs, and rock and roll of the era, few today recall that in 1967 many of the hippies who made San Francisco's Haight-Ashbury neighborhood the epicenter of the famed "Summer of Love" left the city early that fall and, together with thousands of others, helped launch the largest wave of communalization in American history. In the two centuries before 1965, historians and sociologists have estimated that Americans established between five hundred and seven hundred communes.70 Between 1965 and 1972, they have estimated that somewhere between several thousand and several tens of thousands of communes were created, with most appearing between 1967 and 1970.71 Judson Jerome, perhaps the most rigorous surveyor of the movement, has estimated that in the early 1970s, some 750,000 people lived in a total of more than ten thousand communes nationwide.72
Many of these new communities sprang up on hillsides and wooded lots far from America's urban capitals. Former hippies from the Haight, for instance, helped establish farms and rural homesteads in northern California, Colorado, New Mexico, and Tennessee. Other communes came to life in the apartments and row houses of Berkeley, Cambridge, and many other cities, often in direct confrontation with long-standing ordinances prohibiting cohabitation by groups of unmarried adults. As Timothy Miller has explained, many communes were organized along religious lines, some came together around a shared political orientation, and still others formed around a shared sexual orientation. By far the most visible of the communes at the time, however, were those founded by the hippies of San Francisco and their confreres on the East Coast. For them, the mind-expanding turn toward sexuality and toward the small-scale technologies of psychedelia and music was not only a turn away from the constrained cultural style of middle-class cold war America; it was a turn toward what they imagined could become a new nation, a land of small, egalitarian communities linked to one another by a network of shared beliefs.

For this reason, I will call both those who actually established such communes and those who saw the transformation of consciousness as the basis for the reformation of American social structure New Communalists. In doing so, I hope to tease apart an important strand of countercultural thought and practice that has become so thoroughly entangled with the terms counterculture and New Left over the years as to have been rendered nearly invisible. By identifying the intellectual roots, the social ambitions, and the extensive historical influence of those who turned toward technology and mind as foundations of a new society, I also hope to clear up two historical misconceptions. Many historians today still read the youth movements of the 1960s as a generational rejection of the cold war world into which they were born. Among New Communalists, though, this was simply not the case: even as they set out for the rural frontier, the communards of the back-to-the-land movement often embraced the collaborative social practices, the celebration of technology, and the cybernetic rhetoric of mainstream military-industrial-academic research. More recently, analysts of digital utopianism have dated the communitarian rhetoric surrounding the introduction of the Internet to what they have imagined to be a single, authentically revolutionary social movement that was somehow crushed or co-opted by the forces of capitalism. By confusing the New Left with the counterculture, and the New Communalists with both, contemporary theorists of digital media have often gone so far as to echo the utopians of the 1990s and to reimagine its peer-to-peer technologies as the rebirth in hardware
and software of a single, "free" culture that once stood outside the mainstream and can do so again.\textsuperscript{76}

A closer look at the New Left and the New Communalists, however, reveals critical differences between the two movements and suggests that neither achieved a complete break with the society it aimed to change. From its earliest days, the New Left was a primarily political movement, albeit one with communitarian strains. In June 1962, fifty-nine student radicals gathered in Port Huron, Michigan, and penned what would become the founding document of the Students for a Democratic Society (SDS). SDS did not constitute the whole of the New Left by any means, but its Port Huron Statement still stands as one of the clearest expressions of the movement's appeal to college-educated youth of the time. The authors of the document identified two forces driving their desire to organize. One was the rise of the civil rights movement, which revealed a level of bigotry in the American South that by 1962 had compelled many of the white college students gathered in Port Huron to become engaged in nonviolent forms of resistance. The other was the cold war and the threat of nuclear annihilation. "Our work," they explained, "is guided by the sense that we may be the last generation in the experiment with living." As the founders of SDS saw it, the denigration of African Americans and the possibility of destroying the human species had emanated from the same source: a highly bureaucratized society whose structures virtually required individuals to become psychologically fragmented and thus capable of atrocious behavior.\textsuperscript{77} If bigotry was to end and the world was to survive, a new kind of social structure would have to be built.

In this new world, they explained, "the goal of man and society should be finding a meaning in life that is personally authentic."\textsuperscript{78} For many in the New Left, as for many New Communalists, the bureaucracies of cold war America and the nuclear cloud that hung over it seemed to threaten to destroy the individual's sense of his or her own reality. As historian Douglas Rossinow has shown, the founders of the New Left carried with them a deep anxiety, a ferocious sense of their own "weightlessness" in the face of world events, and a "deadening alienation" from the culture within which they were about to become adults.\textsuperscript{79} They responded to this experience by developing two forms of political activism. The first, and by far the dominant mode, was straightforward organizing for political change. Across the 1960s, New Left activists demonstrated on behalf of Free Speech rights and Black Power. They protested the industrial activities and bureaucratic organization of the universities, and, most visibly of all, they led demonstrations against the Vietnam War. In each area, the New Left did what insurgent
political movements have often done: they wrote statements, formed parties, chose leaders, and marched.

Many members of the New Left took activism to be the fundamental mission of the movement. To eliminate individual alienation and bring about a less violent and more psychologically satisfying society, they believed, the movement would need to engage in political struggle. At the same time, within SDS and the New Left more broadly, many hoped that they might begin to live out some of the new political structures they were working to create. If, as the Port Huron Statement suggested, an effective democracy facilitated individual participation and individual independence, then SDS should do the same. SDS became a party that elected its leaders and staged annual conventions, but its members often tried to make decisions by consensus and, at least in some quarters, retained a distrust of hierarchical organization. And as they came together, first in the Civil Rights and Free Speech Movements and later in protests against the Vietnam War, members of the SDS experienced a feeling of solidarity and community that many had not known before. In its early years, wrote Todd Gitlin, who was elected president of SDS in 1963, “the SDS circle had founded a surrogate family, where for long stretches of time horizontal relations of trust replaced vertical relations of authority.” These relations intensified for others as the decade wore on. In 1966 Greg Calvert, who was elected national secretary of SDS that year, argued that SDS should not only “destroy the power which had created the loveless anti-community” of mainstream America, but actively seek to create a new community within its own ranks. “We would ourselves create the community as love,” he said.80

Within SDS, then, and within the New Left as a whole, the young, predominantly white, middle- and upper-class rank and file did go some way toward building an alternative community structure. At the same time, though, especially in its early years, the New Left retained an allegiance to mainstream political tactics and an antipathy to the psychedelic mysticism common to the counterculture. The New Left may have sought to build a new world, but it did so using the traditional techniques of agonistic politics. If elements within the New Left began to experience forms of solidarity like those they helped to build into the world outside the movement, they did so as an after-effect of their own organizing. Within the New Left, true community and the end of alienation were usually thought to be the result of political activity, rather than a form of politics in their own right.

The reverse was true among the New Communalists. For the protohippies, artists, and mystics who began coming together in Manhattan and San Francisco after World War II, political activism was at best beside the
point and at worst part of the problem. Like the founders of the New Left, these early counterculturalists wanted to challenge the social order of the cold war and, by doing so, bring about a new, less violent, and more psychologically authentic world. Unlike many in the New Left, however, most retained a deep distrust not only of traditional politicians, but of any and all formal chains of command. In late 1967 the San Francisco–based underground newspaper the Seed published a poem that gives a feel for the attitude toward politics that would soon inform the New Communalist movement:

Beware of leaders, heroes, organizers.
Watch that stuff. Beware of structure freaks.
They do not understand.
We know the system doesn’t work because we’re living in its ruins. We know that leaders don’t work out because they have all led us only to the present, the good leaders equally with the bad. . . . What the system calls organization—linear organization—is a systematic cage, arbitrarily limiting the possible. It’s never worked before. It always produced the present.41

For the New Communalists, the key to social change was not politics, but mind. In 1969 Theodore Roszak spoke for many when he argued that the central problem underlying the rationalized bureaucracy of the cold war was not political structure, but the "myth of objective consciousness." This state of mind, wrote Roszak, emerged among the experts who dominated rationalized organizations, and it was conducive to alienation, hierarchy, and a mechanistic view of social life. Its emblems were the clock and the computer, its apogee "the scientific world view, with its entrenched commitment to an egocentric and cerebral mode of consciousness." Against this mode, Roszak and others proposed a return to transcendence and a simultaneous transformation of the individual self and its relations with others: "This . . . is the primary project of our counter culture: to proclaim a new heaven and a new earth so vast, so marvelous that the inordinate claims of technical expertise must of necessity withdraw in the presence of such splendor to subordinate and marginal status in the lives of men. To create and broadcast such a consciousness of life entails nothing less than the willingness to open ourselves to the visionary imagination on its own terms."42

Roszak’s call echoes the Romantic nineteenth-century voices of Emerson and Whitman and, before them, the millennial ambitions of the early American Puritans. Perhaps no dream in American culture has recurred as often as the one in which a group of spiritual adepts remake the world they
have inherited in the image of their own ideals. For Roszak and the New Communalists, this dream entailed a rejection of industrial-era technocratic bureaucracy. As they drove their funky school buses off into the hills of Marin County and the deserts of New Mexico, the back-to-the-landers intended to build self-sufficient retreats in which they might rediscover what they imagined to be pre-industrial forms of intimacy and egalitarian rule. At the same time, though, the countercultural dream of transcendence signaled a move toward the embrace of knowledge and collaborative styles of knowledge work that had emerged at the heart of mainstream American research and industrial culture during World War II.

This can be seen especially clearly in a book that, along with Roszak’s *The Making of a Counterculture*, helped to define the intellectual framework of the New Communalist movement: Charles Reich’s *The Greening of America*. Reich argued that socioeconomic history could be divided into three phases, each with its own associated consciousness. Consciousness I, he explained, emerged during the agricultural era of the nineteenth century and represented the values of farmers and small businessmen. By the middle of the twentieth century, Consciousness I had been replaced by Consciousness II, in which industrial bureaucracies sought to manage people and nature through complex organizations and new technologies of control and communication. Like Roszak and other critics of technological bureaucracy, Reich held this second era responsible for the global threat of nuclear disaster and the highly localized experience of psychological distress. Under the industrial regime, Reich wrote, “it is impossible to know, talk to, or confront the whole man, for that wholeness is precisely what does not ‘exist.’”

Consciousness III would create the missing wholeness. Unlike its predecessors, Consciousness III rejected “relationships of authority and subservience” in favor of bureaucratically leveled communities, harmonious collaborations in which each citizen was “honest” and “together” with every other. Within such communities, citizens would serve as examples to one another; the communities in turn would serve as examples to the world. That the citizens in question would largely be white, affluent, and young was beside the point: “Today there is only one class,” wrote Reich. “The economic class struggle has been transcended by the interest of everyone in recapturing their humanity.” In Reich’s view, men and women of all classes were locked in a struggle to reclaim their consciousnesses; the affluent young represented the vanguard of this struggle; when they succeeded first in changing their minds and then in building new communities around those new minds, the technocratic machine would finally be brought to a halt.
By turning to consciousness as a source of social change, Reich and the New Communalists who put his ideas into practice turned away from the political struggles that preoccupied both the New Left and the Democratic and Republican parties. But even as they did, they opened new doors to mainstream culture, and particularly to high-technology research culture. If the mind was the first site of social change, then information would have to become a key part of a countercultural politics. And if those politics rejected hierarchy, then the circles-within-circles of information and systems theory might somehow make sense not only as ideas about information, but also as evidence from the natural world for the rightness of collective polity. Finally, if the self was the ultimate driver of social change, and if class was no more, then individual lifestyle choices became political acts, and both consumption and lifestyle technologies—including information technologies—would have to take on a newly political valence.

For both the New Left and the New Communalists, technological bureaucracy threatened a drab, psychologically distressing adulthood at a minimum and, beyond that, perhaps even the extinction of the human race. For the New Left, movement politics offered a way to tear down that bureaucracy and simultaneously to experience the intimacy of shared commitment and the possibility of an emotionally committed adulthood. For the New Communalists, in contrast, and for much of the broader counterculture, cybernetics and systems theory offered an ideological alternative. Like Norbert Wiener two decades earlier, many in the counterculture saw in cybernetics a vision of a world built not around vertical hierarchies and top-down flows of power, but around looping circuits of energy and information. These circuits presented the possibility of a stable social order based not on the psychologically distressing chains of command that characterized military and corporate life, but on the ebb and flow of communication.

In the summer of 1967, a long-haired poet named Richard Brautigan transformed this vision into blank verse. Walking through the streets of Haight-Ashbury, he handed his fellow pedestrians a broadsheet on which he had printed the following poem:

All Watched Over by Machines of Loving Grace

I like to think (and
the sooner the better!)
of a cybernetic meadow
where mammals and computers
live together in mutually
programming harmony
like pure water
touching clear sky.

I like to think
(right now, please!)
of a cybernetic forest
filled with pines and electronics
where deer stroll peacefully
past computers
as if they were flowers
with spinning blossoms.

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over
by machines of loving grace.

As Brautigan’s poem suggests, by the end of the 1960s, some elements of the counterculture, and particularly that segment of it that headed back to the land, had begun to explicitly embrace the systems visions circulating in the research world of the cold war. But how did those two worlds come together? How did a social movement devoted to critiquing the technological bureaucracy of the cold war come to celebrate the socio-technical visions that animated that bureaucracy? And how is it that the communitarian ideals of the counterculture should have become melded to computers and computer networks in such a way that thirty years later, the Internet could appear to so many as an emblem of a youthful revolution reborn?

For answers to these questions, we need to turn to the biography of Stewart Brand and the history of the Whole Earth network.
Chapter 1

1. Mario Savio quoted in Draper, Berkeley, 98.
2. Lubar, "Do Not Fold, Spindle, or Mutilate."
3. Kerr, Uses of the University, 20.
4. Ibid., 124.
5. Draper, Berkeley, 153; Savio, "California's Angriest Student," 100–101, quotation on 100.
7. For other examples of this phenomenon, see Mitchell, City of Bits; and Negroponte, Being Digital.
8. Dyson, Release 2.0, 286, 3; Barlow, "@home.on.the.ranch."
11. For entry points into this literature, see Boyer, By the Bomb's Early Light; Kuznick and Gilbert, Rethinking Cold War Culture; May, Homeward Bound; Whitfield, Culture of the Cold War.
13. Ibid., 161, 1, quotation on 1.
14. For an introduction to this literature, and to the ways in which shifts in the organization of science during World War II helped shape the cold-war world, see Leslie, Cold War and American Science, 1–13.
15. Ibid., 2. For the specific case of physics, see Galison, "Trading Zone," 149–52. There were, of course, important exceptions to this pattern. For examples, see Seidel, "Origins of the Lawrence Berkeley Laboratory"; and Galison, Hevly, and Lowen, "Controlling the Monster," 46–77.
16. Leslie, Cold War and American Science, 8.
17. Ibid., 7.
18. Edwards, Closed World, 47.
22. Leslie, Cold War and American Science, 20–43; Hughes, Rescuing Prometheus, 15–140.
23. Buder, Invention That Changed the World, 254. See also Bryant et al., Rad Lab.
24. For a compelling examination of entrepreneurship at the Rad Lab, see Mindell, "Automation’s Finest Hour." For a portrait of the social life surrounding the Rad Lab, see Buder, Invention That Changed the World, 129–30. The freewheeling, collaborative life of the war years spilled over into the cold war as well. Louise Licklider lived in Cambridge with her husband, J. C. R. Licklider, whose work ultimately helped drive the development of the Internet, in the years immediately after the war. She later recalled that "Cambridge was like an anthill. Everybody was getting involved with everybody else—finding different challenges, taking up different ideas. I use the word cross-fertilization because there was an awful lot of that going on. And quite a lot of socializing, too." Quoted in Waldrop, Dream Machine, 66.
25. Galison, "Trading Zone."
26. Ibid., 138.
27. Ibid., 157. On the laboratory floor, this led to an egalitarian ethic of collaboration and a "hybrid of practices" in Galison’s terms, known as "Radar Philosophy" (152).
28. As several historians have pointed out, the "systems" approach taken by cybernetics predated the invention of the term itself by a little more than a decade. In 1928, for instance, John Von Neumann published his "Theory of Parlor Games," thus inventing game theory. Heims, John Von Neumann and Norbert Wiener, 84. In the 1930s in England, Robert Lilienfeld has argued, the invention of radar led to the need for the coordination of machines and thus the invention of the "total point of view" characteristic of systems thinking. Lilienfeld, Rise of Systems Theory, 103. Cybernetics emerged as a self-consciously comprehensive field of thought, however, with the work of Norbert Wiener. For a fuller account of Wiener’s career and the emergence of his cybernetics, see also Galison, "Ontology of the Enemy"; and Hayles, How We Became Posthuman.
29. Wiener, Cybernetics, 8.
30. Ibid., 9.
32. Wiener, I Am a Mathematician, 251–52.
33. For a critical analysis of this choice, and especially its relationship to conceptions of the Other in contemporary cultural theory, see Galison, "Ontology of the Enemy."

34. Wiener, I Am a Mathematician, 252.

35. For Wiener, as Peter Galison put it, "Servomechanical theory would become the measure of man." Galison, "Ontology of the Enemy," 240.


38. Wiener, Human Use of Human Beings, 49.


40. "Long before Nagasaki and the public awareness of the atomic bomb," he wrote, "it had occurred to me that we were here in the presence of another social potentiality of unheard-of importance for good or evil." Ibid., 36.

41. Heims, John Von Neumann and Norbert Wiener, 343. After World War II, Wiener became increasingly afraid of the ways science could be used to undermine human goals. For a particularly explicit example of his views, see Wiener, "Scientist Rebels."

42. Wiener, Human Use of Human Beings, 11.

43. By the mid-1960s, the systems orientation of cybernetics had spread throughout the natural and social sciences. In 1968 Ludwig von Bertalanffy, a biologist who promoted an organismic view in biology as early as 1940, tried to distinguish systems theory from cybernetics: "Systems theory also is frequently identified with cybernetics and control theory. This again is incorrect. Cybernetics, as the theory of control mechanisms in technology and nature and founded on the concepts of information and feedback, is but a part of a general theory of systems; cybernetic systems are a special case, however important, of systems showing self-regulation." Bertalanffy, General System Theory, 3. For Bertalanffy, cybernetics was only one root of systems theory, albeit an important one. Others included the servo-mechanisms of the nineteenth century, Claude Shannon's information theory, Von Neumann and Morgenstern's game theory, and the increasing need in the post–World War II world to monitor and control large systems for social functions such as traffic and finance. For a critical analysis of the relationship between cybernetics and other systems theories, see Lilienfeld, Rise of Systems Theory.

44. Rau, "Adoption of Operations Research," 57, 6. For a fascinating demonstration of the ways systems analysis helped set the aesthetic terms of planning for nuclear war, see Ghamari-Tabrizi, Worlds of Herman Kahn, esp. 54–57, 128–30.


47. Ibid., 116.

48. Pickering, "Gallery of Monsters." For more on Ashby's homeostat, see Hayles, How We Became Posthuman, 65–66.

49. Hayles, How We Became Posthuman, 62.
50. See Lilienfeld, *Rise of Systems Theory*. For a fascinating study of the roles defense planners and cybernetics played in cold war attempts at urban renewal, see Light, *From Warfare to Welfare*.

51. Hayles, *How We Became Posthuman*; Heims, *Social Science for Post-War America*.

52. According to Hayles, these meetings ultimately helped bring into existence a new cultural category, the "posthuman." Within this view, she writes, the world consists of information patterns and the boundaries of the individual body and mind are highly porous, and because of these facts, the human being can be "seamlessly articulated with intelligent machines." Hayles, *How We Became Posthuman*, 3.

53. Paul Edwards has pointed out that in addition to researchers at MIT and government officials, SAGE involved heavy contributions from IBM (which built some fifty-six SAGE computers for approximately $30 million each) and the RAND Corporation (which wrote much of the computers' software). Edwards, *Closed World*, 101–2. Hughes, *Rescuing Prometheus*, 16, 4.


56. As Sharon Ghamari-Tabrizi has noted, there were important exceptions to this trend. On May 11, 1959, for instance, *Life* magazine published a photo essay on the RAND Corporation. Although most of the images depicted "people doing something iconically scientific," the final image showed a group of analysts in suits, reclining together on the floor, surrounded by "the mise en scene for the modern intellectual," including "futuristic chairs and a Japanese paper kite dangling from the ceiling." Ghamari-Tabrizi, *Worlds of Herman Kahn*, 57. In this case at least, the photographer hinted, the scientific experts might be cool.


59. Ibid., 169, 171.


61. See, e.g., Keniston, *Young Radicals*, 229–47.


63. Galbraith, *New Industrial State*, 295. Galbraith also notes that in 1960 there were some 381,000 professors in America; by 1972 that number had risen to 907,000 (294).


68. The relationship between these two movements has been subject to extensive (and heated) investigation. For historiographies of the issue, see Rossinow, "New Left in the Counterculture"; and Gosse, "Movement of Movements." See also Breines, *Community and Organization in the New Left*; and Rossinow, *Politics of Authenticity*.

70. Hugh Gardner, one of the most thorough commune analysts working in the early 1970s, estimated the number at slightly over 600, in Children of Prosperity, 3. Historian Foster Stockwell has estimated the number of communes established between 1663 and 1963 at 516. Stockwell, Encyclopedia of American Communes. See also Holloway, Heavens on Earth; and Miller, American Communes.

71. Miller, 60s Communes, xx. For a comprehensive review of scholarly and journalistic attempts to establish the number of communes in this period, see ibid., xviii—xx.


73. Miller, 60s Communes, xiii—xiv. Sociologists at the time and since have been fascinated by the principles around which communes were organized. See Berger, Survival of a Counterculture; Case and Taylor, Co-ops, Communes, and Collectives; Gardner, Children of Prosperity; Jerome, Families of Eden; Kanter, Commitment and Community; Kanter, Communes; Zablocki, Alienation and Charisma; Zicklin, Countercultural Communes.

74. Miller, 60s Communes, 13. There are many contemporary accounts of life on these communes, some written by journalists, some by residents. Journalists tended to wander from commune to commune, building a first-person narrative as they went. Work in this genre includes Fairfield, Communes U.S.A.; Hedgepeth, Alternative; and Houriet, Getting Back Together. The founders of communes and early residents often wrote vivid portraits of their communities as they lived in them. Books in this vein include Diamond, What the Trees Said; Gaskin, Hey Beatnik!; Gravy, Hog Farm and Friends; Mungo, Total Loss Farm; Rabbit, Drop City.

75. See, e.g., Barbrook and Cameron, "Californian Ideology."

76. See, e.g., Bey, T.A.Z., 95–114.

77. For a persuasive attempt to locate the SDS and the youth movements of the 1960s within a broader New Left framework and a multidecade framework, see Gosse, "Movement of Movements." SDS, "Port Huron Statement," 163–72, quotation on 164. As historian Douglas Rossinow put it, "Whatever else it was, the New Left was a response to the deepening symptoms of life under advanced, bureaucratic capitalism." Rossinow, Politics of Authenticity, 20.


79. Rossinow, Politics of Authenticity, 162.

80. Sociologist Wini Breines has distinguished between two political modes within SDS, modes she calls "strategic" and "prefigurative." Strategic politics represented the work of changing traditional political structures by means of activism; prefigurative politics denoted the desire on the part of many in SDS to live out and exemplify their political ideals. See Breines, Community and Organization in the New Left, 7. Gitlin, Sixties, 107; Greg Calvert, "The Beloved Community," New Left Notes, November 25, 1966; quoted in Breines, Community and Organization in the New Left, 48.


82. Roszak, Making of a Counter Culture, 208, 50, 240.

83. Reich, Greening of America, 78.

84. Ibid., 204, 204, 223.

85. Ibid., 272. Reich's statement bears an uncanny resemblance to Manuel Castells's words almost twenty years later: "There is not, sociologically and economically, such a thing as a global capitalist class." Castells, Rise of the Network Society, 474.