From Counterculture to Cyberculture

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

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Introduction

In the mid-1990s, as first the Internet and then the World Wide Web swung into public view, talk of revolution filled the air. Politics, economics, the nature of the self—all seemed to teeter on the edge of transformation. The Internet was about to "flatten organizations, globalize society, decentralize control, and help harmonize people," as MIT's Nicholas Negroponte put it.[1] The stodgy men in gray flannel suits who had so confidently roamed the corridors of industry would shortly disappear, and so too would the chains of command on which their authority depended. In their place, wrote Negroponte and dozens of others, the Internet would bring about the rise of a new "digital generation"—playful, self-sufficient, psychologically whole—and it would see that generation gather, like the Net itself, into collaborative networks of independent peers.[2] States too would melt away, their citizens lured back from archaic party-based politics to the "natural" agora of the digitized marketplace. Even the individual self, so long trapped in the human body, would finally be free to step outside its fleshy confines, explore its authentic interests, and find others with whom it might achieve communion. Ubiquitous networked computing had arrived, and in its shiny array of interlinked devices, pundits, scholars, and investors alike saw the image of an ideal society: decentralized, egalitarian, harmonious, and free.

But how did this happen? Only thirty years earlier, computers had been the tools and emblems of the same unfeeling industrial-era social machine whose collapse they now seemed ready to bring about. In the winter of 1964, for instance, students marching for free speech at the University of California at Berkeley feared that America's political leaders were treating them as if they were bits of abstract data.

One after another, they took up blank computer cards, punched them through with new patterns of holes—"FSM" and "STRIKE"—and hung them around their necks.[3] One student even pinned a sign to his chest that parroted the cards' user instructions: "I am a UC student. Please do not fold, bend, spindle or mutilate me."[4] For the marchers of the Free Speech Movement, as for many other Americans throughout the 1960s, computers loomed as technologies of dehumanization, of centralized bureaucracy and the rationalization of social life, and, ultimately, of the Vietnam War. Yet, in the 1990s, the same machines that had served as the defining devices of cold war technocracy emerged as the symbols of its transformation. Two decades after the end of the Vietnam War and the fading of the American counterculture, computers somehow seemed poised to bring to life the countercultural dream of empowered individualism, collaborative community, and spiritual communion. How did the cultural meaning of information technology shift so drastically?

As a number of journalists and historians have suggested, part of the answer is technological. By the 1990s, the room-sized, stand-alone calculating machines of the cold war era had largely disappeared.[5] So too had the armored rooms in which they were housed and the army of technicians that supported them. Now Americans had taken up microcomputers, some the size of notebooks, all of them available to the individual user, regardless of his or her institutional standing. These new machines could perform a range of tasks that far exceeded even the complex calculations for which digital computers had first been built. They became communication devices and were used to prepare novels and spreadsheets, pictures and graphs. Linked over telephone wires and fiber-optic cables, they allowed their users to send messages to one another, to download reams of information from libraries around the world, and to publish their own thoughts on the World Wide Web. In all of these ways, changes in computer technology expanded the range of uses to which computers could be put and the types of social relations they were able to facilitate.

As dramatic as they were, however, these changes alone do not account for the particular utopian visions to which computers became attached. The fact that a computer can be put on a desktop, for instance, and that it can be used by an individual, does not make it a "personal" technology. Nor does the fact that individuals can come together by means of computer networks necessarily require that their gatherings become "virtual communities." On the contrary, as Shoshanna Zuboff has pointed out, in the office, desktop computers and computer networks can become powerful tools for integrating the individual ever more closely into the corporation.[6] At home, those same machines not only allow schoolchildren to download citations from

the public library; they also turn the living room into a digital shopping mall. For retailers, the computer in the home becomes an opportunity to harvest all sorts of information about potential customers. For all the utopian claims surrounding the emergence of the Internet, there is nothing about a computer or a computer network that *necessarily* requires that it level organizational structures, render the individual more psychologically whole, or drive the establishment of intimate, though geographically distributed, communities.

How was it, then, that computers and computer networks became linked to visions of peer-to-peer ad-hocracy, a leveled marketplace, and a more authentic self? Where did these visions come from? And who enlisted computing machines to represent them?

To answer these questions, this book traces the previously untold history of an extraordinarily influential group of San Francisco Bay area journalists and entrepreneurs: Stewart Brand and the Whole Earth network. Between the late 1960s and the late 1990s, Brand assembled a network of people and publications that together brokered a series of encounters between bohemian San Francisco and the emerging technology hub of Silicon Valley to the south. In 1968 Brand brought members of the two worlds together in the pages of one of the defining documents of the era, the *Whole Earth Catalog*. In 1985 he gathered them again on what would become perhaps the most influential computer conferencing system of the decade, the Whole Earth 'Lectronic Link, or the WELL. Throughout the late 1980s and early 1990s, Brand and other members of the network, including Kevin Kelly, Howard Rheingold, Esther Dyson, and John Perry Barlow, became some of the most-quoted spokespeople for a countercultural vision of the Internet. In 1993 all would help create the magazine that, more than any other, depicted the emerging digital world in revolutionary terms: *Wired*.

By recounting their history, this book reveals and helps to explain a complex intertwining of two legacies: that of the military-industrial research culture, which first appeared during World War II and flourished across the cold war era, and that of the American counterculture. Since the 1960s scholarly and popular accounts alike have described the counterculture in terms first expressed by its members—that is, as a culture antithetical to the technologies and social structures powering the cold war state and its defense industries. In this view the 1940s and 1950s are often seen as a gray time shaped by rigid social norms, hierarchical institutions, and the constant demands of America's nuclear face-off with the Soviet Union. The 1960s seem to explode onto the scene in a Technicolor swirl of personal exploration and political protest, much of it aimed at bringing down the cold war military-industrial bureaucracy. Those who accept this version of events

tend to account for the persistence of the military-industrial complex today, and for the continuing growth of corporate capitalism and consumer culture as well, by arguing that the authentically revolutionary ideals of the generation of 1968 were somehow co-opted by the forces they opposed.

There is some truth to this story. Yet, as it has hardened into legend, this version of the past has obscured the fact the same military-industrial research world that brought forth nuclear weapons—and computers—also gave rise to a free-wheeling, interdisciplinary, and highly entrepreneurial style of work. In the research laboratories of World War II and later, in the massive military engineering projects of the cold war, scientists, soldiers, technicians, and administrators broke down the invisible walls of bureaucracy and collaborated as never before. As they did, they embraced both computers and a new cybernetic rhetoric of systems and information. They began to imagine institutions as living organisms, social networks as webs of information, and the gathering and interpretation of information as keys to understanding not only the technical but also the natural and social worlds.

By the late 1960s, so too did substantial elements of the counterculture. Between 1967 and 1970, for instance, tens of thousands of young people set out to establish communes, many in the mountains and the woods. It was for them that Brand first published the *Whole Earth Catalog*. For these back-to-the-landers, and for many others who never actually established new communities, traditional political mechanisms for creating social change had come up bankrupt. Even as their peers organized political parties and marched against the Vietnam War, this group, whom I will call the New Communalists, turned away from political action and toward technology and the transformation of consciousness as the primary sources of social change. If mainstream America had become a culture of conflict, with riots at home and war abroad, the commune world would be one of harmony. If the American state deployed massive weapons systems in order to destroy faraway peoples, the New Communalists would deploy small-scale technologies—ranging from axes and hoes to amplifiers, strobe lights, slide projectors, and LSD—to bring people together and allow them to experience their common humanity. Finally, if the bureaucracies of industry and government demanded that men and women become psychologically fragmented specialists, the technology-induced experience of togetherness would allow them to become both self-sufficient and whole once again.

For this wing of the counterculture, the technological and intellectual output of American research culture held enormous appeal. Although they rejected the military-industrial complex as a whole, as well as the political process that brought it into being, hippies from Manhattan to Haight-Ashbury read Norbert Wiener, Buckminster Fuller, and Marshall McLuhan.

Through their writings, young Americans encountered a cybernetic vision of the world, one in which material reality could be imagined as an information system. To a generation that had grown up in a world beset by massive armies and by the threat of nuclear holocaust, the cybernetic notion of the globe as a single, interlinked pattern of information was deeply comforting: in the invisible play of information, many thought they could see the possibility of global harmony.

To Stewart Brand and later to other members of the Whole Earth group, cybernetics also presented a set of social and rhetorical resources for entrepreneurship. In the early 1960s, not long after graduating from Stanford University, Brand found his way into the bohemian art worlds of San Francisco and New York. Like many of the artists around him at the time, and like Norbert Wiener, in whose writings on cybernetics they were immersed, Brand quickly became what sociologist Ronald Burt has called a "network entrepreneur."[7] That is, he began to migrate from one intellectual community to another and, in the process, to knit together formerly separate intellectual and social networks. In the *Whole Earth Catalog* era, these networks spanned the worlds of scientific research, hippie homesteading, ecology, and mainstream consumer culture. By the 1990s they would include representatives of the Defense Department, the U.S. Congress, global corporations such as Shell Oil, and makers of all sorts of digital software and equipment.

Brand brought these communities together in a series of what I will call *network forums*. Drawing on the systems rhetoric of cybernetics and on models of entrepreneurship borrowed from both the research and the countercultural worlds, Brand established a series of meetings, publications, and digital networks within which members of multiple communities could meet and collaborate and imagine themselves as members of a single community. These forums in turn generated new social networks, new cultural categories, and new turns of phrase. In 1968 Brand founded the *Whole Earth Catalog* in order to help those heading back to the land find the tools they would need to build their new communities. These items included the fringed deerskin jackets and geodesic domes favored by the communards, but they also included the cybernetic musings of Norbert Wiener and the latest calculators from Hewlett-Packard. In later editions, alongside discussions of such supplies, Brand published letters from high-technology researchers next to firsthand reports from rural hippies. In the process, he offered commune-based subscribers a chance to see their own ambitions as commensurate with the technological achievements of mainstream America, and he gave technologists the opportunity to imagine their diodes and relays as tools, like those the commune dwellers favored, for the

transformation of individual and collective consciousness. Together, the creators and readers of the *Whole Earth Catalog* helped to synthesize a vision of technology as a countercultural force that would shape public understandings of computing and other machines long after the social movements of the 1960s had faded from view.

In the 1980s and 1990s, as computers became ever smaller and more interconnected, and as corporations began to employ increasingly flexible modes of production, Brand and his colleagues repeated this process at the WELL, in the Global Business Network, through *Wired,* and in a series of meetings and organizations associated with all three. In each case, a network entrepreneur (often Brand himself) gathered members of multiple communities within a single material or textual space. The members of those networks collaborated on the various projects at hand and developed a shared language for their work. Out of that language emerged shared understandings—of the potential social impact of computing, of information and information technologies as metaphors for social processes, and of the nature of work in a networked economic order. Often enough, the systems on which network members appeared became models in their own right of these new understandings. Even when they did not, members often took the insights they had gleaned back into their social and professional worlds. In this way ideas born within *Whole Earth*–derived network forums became key frames through which both public and professional technologists sought to comprehend the potential social impact of information and information technologies. Over time, the network's members and forums helped redefine the microcomputer as a "personal" machine, computer communication networks as "virtual communities," and cyberspace itself as the digital equivalent of the western landscape into which so many communards set forth in the late 1960s, the "electronic frontier."

At the same time, and by means of the same social processes, members of the Whole Earth network made themselves visible and credible spokesmen for the socio-technical visions that they had helped create. Traditionally, sociologists have depicted journalists in terms set by the professional norms of newspapers and magazines: as reporters of a consensus achieved among communities from which they were analytically, if not actually, separated. In this view, a reporter's prestige depends on her or his ability to dig up new information, report it in a compelling way, and make it visible to a broad public (which itself is seen as analytically distinct from either the community of sources or the community of journalists). Brand and other writers and editors associated with the Whole Earth publications developed extraordinary reputations as journalists, winning, among other prizes, the National Book Award (for the *Whole Earth Catalog*) and the National Magazine Award (for *Wired*).

They did so, however, by building the communities on whose activities they were reporting. Within Whole Earth–sponsored network forums, and within the books and articles they spawned, representatives of the technological world met leaders from politics and business, as well as former counterculturalists. Together, their conversations turned digital media into emblems of network members' own, shared ways of living, and evidence of their individual credibility. Again and again, Brand, and later Kevin Kelly, Howard Rheingold, John Perry Barlow, and others, gave voice to the techno-social visions that emerged in these discussions.

As they did, they were welcomed into the halls of Congress, the boardrooms of major corporations, and the hotels of Davos, Switzerland, home of the World Economic Forum. By the mid-1990s, throughout much of the mainstream press and in business and government as well, the networked entrepreneurship of the Whole Earth group and its self-evident financial and social success had become evidence for the transformative power of what many had begun to call the "New Economy." According to a raft of politicians and pundits, the rapid integration of computing and telecommunications technologies into international economic life, coupled with dramatic rounds of corporate layoffs and restructuring, had given rise to a new economic era. Individuals could now no longer count on the support of their employers; they would instead have to become entrepreneurs, moving flexibly from place to place, sliding in and out of collaborative teams, building their knowledge bases and skill sets in a process of constant self-education. The proper role of government in this new environment, many argued, was to pull back, to deregulate the technology industries that were ostensibly leading the transformation, and, while they were at it, business in general.

Proponents of this view included telecommunications executives, high-tech stock analysts, and right-wing politicians. Kevin Kelly, a former editor of the quarterly *Whole Earth Review,* which had grown out of the original *Catalog,* helped to bring them all to the pages of *Wired.* As the magazine's executive editor, he argued that the world was a series of interlocking information systems, all of which were working to corrode the bureaucracies of the industrial era. To Kelly and the other creators of *Wired,* the suddenly public Internet appeared to be both the infrastructure and the symbol of the new economic era. And if it was, they suggested, then those who built their lives around the Net and those who sought to deregulate the newly networked marketplace might in fact be harbingers of a cultural revolution. In the pages of *Wired,* at least, this new elite featured the citizens of the WELL, the members of the Global Business Network, and the founders of the Electronic Frontier Foundation—all groups well woven into the fabric of the Whole Earth community—as well as Microsoft's Bill Gates, libertarian

pundits such as George Gilder, and, on the cover of one issue, conservative Republican Congressman Newt Gingrich.

To those who think of the 1960s primarily as a break with the decades that went before, the coming together of former counterculturalists, corporate executives, and right-wing politicians and pundits may appear impossibly contradictory. But as the history of the Whole Earth network suggests, it isn't. As they turned away from agonistic politics and toward technology, consciousness, and entrepreneurship as the principles of a new society, the communards of the 1960s developed a utopian vision that was in many ways quite congenial to the insurgent Republicans of the 1990s. Although Newt Gingrich and those around him decried the hedonism of the 1960s counterculture, they shared its widespread affection for empowering technologically enabled elites, for building new businesses, and for rejecting traditional forms of governance. And as they rose to power, more than a few right-wing politicians and executives longed to share the hip credibility of people like Stewart Brand.

This book, then, does not tell the story of a countercultural movement whose ideals and practices were appropriated by the forces of capital, technology, or the state. Rather, it demonstrates that the New Communalist wing of the counterculture embraced those forces early on and that in subsequent years, Stewart Brand and the Whole Earth network continued to provide the intellectual and practical contexts within which members of the two worlds could come together and legitimate one another's projects. At the same time, however, this book is not a biography of Stewart Brand. Brand certainly deserves a biography, and one will no doubt be written in the years to come, but this book makes relatively little effort to understand Brand's personal history except insofar as it illuminates his role in reshaping the politics of information. Brand has had a substantial influence in other areas, especially ecology and architectural design, as well as a fascinating personal life, but these will have to wait for other chroniclers. My aim here is to make visible Brand's impact, and that of the networks he helped build, on our understandings of computing and its possible relations to social life. Within this story, Brand is both an influential actor in his own right and an exemplary promoter of a new, networked mode of techno-social life; so too are the journalists, consultants, and entrepreneurs of the Whole Earth network, which is by now far-flung. My challenge in writing this book has been to keep in view simultaneously Brand's unique individual talents, the networking tactics he employed, and the increasing influence of the networks he helped build.

For that reason, I begin with an overview of the broad transformation in popular perceptions of computing that has occurred over the past forty

years, and a reminder of the forgotten affinities between cold war research culture and the counterculture of the New Communalists. I then turn to following Stewart Brand, first into the early 1960s art scene, then to the communes of the Southwest, into the back rooms of Bay area computer science in the 1970s, and on into the corporate world in the 1980s and 1990s. Along the way, I pause to examine in some detail the networks and network forums that Brand has built. As these explorations suggest, Brand's influence on popular understandings of technology has depended not only on his considerable talent for spotting the forward edges of social and technological change, but also on the richness and complexity of the networks he has assembled. I conclude by arguing that Brand's entrepreneurial tactics, and the now-widespread association of computers and computer-mediated communication with the egalitarian social ideals of the counterculture, have become important features of an increasingly networked mode of living, working, and deploying social and cultural power.

Although it is tempting to think of that mode as a product of a revolution in computing technology, I argue that the revolution it represents began long before the public appearance of the Internet or even the widespread distribution of computers. It began in the wake of World War II, as the cybernetic discourse and collaborative work styles of cold war military research came together with the communitarian social vision of the counterculture.

approached the event's master of ceremonies, Scott Beach, and handed him $20,000 in $100 bills. Beach stepped up to the microphone and explained: "About fifteen minutes ago, Stewart Brand gave me one of the tools that the *Whole Earth Catalog* has used. This is $20,000, and he gave it to the people here to be used as a tool. . . . Use this as a seed. The *Whole Earth Catalog* ceases. The seeds have been planted already. Your consensus will decide what will be done with this money. There are microphones, there are causes, there are lots of possibilities."[64] Over the next hour, more than fifty people stepped to the microphone, proposing an equal number of solutions. Brand stood on stage in his monk's robes, writing down each suggestion on a blackboard. As the evening wore on, the crowd gradually dwindled and so did the cash. By early the next morning, more than $5,000 had simply disappeared. The audience seemed no closer to a solution. Finally, the audience voted to give the remaining $14,905 to one Frederick L. Moore, who promised to put the money in a bank and reconvene the last twenty people at the party in a month to decide what to do with it.

What ultimately became of the money remains unclear, but Moore's fate does not. In the spring of 1975, along with Gordon French, he founded the Homebrew Computer Club.

CHAPTER 4

Taking the Whole Earth Digital

In a 1995 special issue of *Time* magazine entitled "Welcome to Cyberspace," Stewart Brand wrote an article arguing that that the personal computer revolution and the Internet had grown directly out of the counterculture. "We Owe It All to the Hippies," claimed the headline. "Forget antiwar protests, Woodstock, even long hair. The real legacy of the sixties generation is the computer revolution." According to Brand, and to popular legend then and since, Bay area computer programmers had imbibed the countercultural ideals of decentralization and personalization, along with a keen sense of information's transformative potential, and had built those into a new kind of machine.[1] In the late 1960s and the early 1970s, Brand and others noted, computers had largely been mainframes, locked in the basements of universities and corporations, guarded by technicians. By the early 1980s, computers had become desktop tools for individuals, ubiquitous and seemingly empowering. One had only to look at the machines themselves to see that the devices through which the leaders of government and industry had sought to manage the world had been wrested from their hands. The great machines of empire had been miniaturized and turned over to individuals, and so transformed into tools with which individuals could improve their own lives.

Like many myths, this one contains several grains of truth. The 1970s did in fact witness the rise of a new form of computing, and Bay area programmers, many with countercultural leanings, played an important part in that process. And as they were distributed, some of the new computers—particularly the 1984 Apple Macintosh—were explicitly marketed as devices one could use to tear down bureaucracies and achieve individual intellectual freedom. Yet, the notion that the

counterculture gave rise to personal computing and computer networking obscures the breadth and complexity of the actual encounter between the two worlds. As Stewart Brand's migrations across the 1960s suggest, New Communalist visions of consciousness and community had become entangled with the cybernetic theories and interdisciplinary practices of high-technology research long before computers were miniaturized or widely interlinked.

In the 1970s, the same rejection of agonistic politics that had fueled the rise of New Communalism undermined the day-to-day governance of all but the most rule-bound communes, and the movement itself melted away. Yet, Stewart Brand and the *Whole Earth Catalog* continued to link information technology and cybernetics to a New Communalist social vision. This linking proceeded in three stages. In the first phase, between 1968 and 1972, two communities began to mingle within blocks of the *Whole Earth Catalog* offices in Menlo Park. One, centered around the Stanford Research Institute and composed primarily of engineers, was devoted to the ongoing pursuit of increased human-computer integration. The other, clustered around the *Catalog* and the countercultural communities it served, focused on the pursuit of individual and collective transformation in a New Communalist vein. Stewart Brand positioned himself between these worlds and, in a variety of ways, brokered their encounter. In the second phase, which spanned the middle of the 1970s, Brand turned away from the computer industry per se and toward the cybernetics of Gregory Bateson. Drawing on Bateson's vision of the material world as an information system, Brand and others began to imagine a new kind of home for themselves—space colonies. Fifteen years later, such fantasies of technologically sustained communities would reappear in celebrations of "cyberspace," but in the late 1970s, they marked the dissolution of the back-to-the-land movement's rustic technophilia, and with it the collapse of New Communalism as a social movement. Finally, confronted by this collapse and by the increasing presence of desktop computers, Brand turned back toward the computer industry and its founders in the early 1980s. Computer engineers, he argued, and not the failed back-to-the-landers, were the true heirs of the New Communalist project. By that time the New Communalist movement had vanished from the scene. Yet, thanks in large part to Brand's entrepreneurship, its ideals seemed to live on in the surging computer industry, and Brand himself became a key spokesman for this new and ostensibly countercultural group.

Making the Computer "Personal"

When Brand turned back toward the computer industry, he leaned on a legitimacy that he had established a decade earlier. With the *Whole Earth Catalog,* Brand offered a generation of computer engineers and programmers an

alternative vision of technology as a tool for individual and collective transformation. In the late 1960s and early 1970s, he also moved back and forth between the Bay area's burgeoning counterculture and its centers of computer research. Between his networking and his publishing efforts, Brand helped synthesize and legitimate multiple visions of "personal" computing. In the process, he established himself as a voice for an emerging technological community, as he had done with the back-to-the-landers.

As historian Paul Ceruzzi has detailed, the 1960s witnessed a transformation in computing equipment.[2] Between 1959 and 1969, the computer industry managed to shrink the room-sized mainframes of the early 1950s into minicomputers that could fit beneath a desk. In the late 1950s, computers processed information in batches of punched cards; a computer user had to prepare those cards and submit them to the managers of the machine for processing. A decade later, users could find their way to time-sharing machines like Digital Equipment Corporation's PDP-10, where they could store files on tape and access their own files without the intervention of other personnel. Perhaps most importantly, they could now feel as if they had the machine to themselves even as other users might be logged on from terminals elsewhere. As Ceruzzi has shown, many of the technical features that we now associate with "personal" computing, including small computers, microprocessors, keyboard-based interfaces, individual usability, and the sensation of interactivity, were all in place by 1972.[3]

These technological developments, however, did not in and of themselves spawn the ethos of personalness to which small computers have since become attached. Before the early 1970s, small computers suitable for individual use were usually called *mini-, micro-,* or *desktop* computers. The word *personal* had been used for some time to describe small-scale consumer technologies such as radios and televisions, and by the early 1970s it was occasionally applied to computers and calculators as well. But when it was, it retained its earlier connotations: a "personal computer" was a calculating device made small enough for use by a single person.[4] The notion that computers might empower individuals and so transform their social worlds did not simply grow up alongside shifts in computing technology; rather, it had to be linked to the machines themselves.[5] Scholars have offered two dominant accounts of how this happened. Many have argued that shifts in the computing interface facilitated shifts in use patterns, which in turn allowed users to imagine and build new forms of interfaces. Thus, Thierry Bardini has suggested that computers have seen the development of a "dynamic of personalization" since the 1940s, in which both computers and computer users have become progressively more individualized. Paul Ceruzzi has claimed that "personal" computing emerged when time-sharing computers

made it possible to imagine giving public users direct access to computers. Against these accounts, others have argued that the notion of the computer as a tool for personal and communal transformation first came to life outside the computer industry, among an insurgent group of hobbyists with countercultural loyalties. Members of this group, they point out, built the Homebrew Computer Club and ultimately not only Apple Computer, but a number of other important personal computer companies as well.[6]

A close look at the computing world of the Bay area in the late 1960s and early 1970s reveals that both of these accounts are true but that neither is complete. As journalist John Markoff has shown, industry engineers and hobbyists lived and worked side-by-side in this period, and both were surrounded by countercultural activities and institutions.[7] Two of the most influential of these groups in the region maintained offices within a few square blocks of each other and of the offices of the *Whole Earth Catalog* in Menlo Park. One of the groups consisted of the researchers associated with Douglas Engelbart's Augmentation Research Center (ARC) at the Stanford Research Institute (SRI) and later Xerox's Palo Alto Research Center (PARC), and the other was made up of computer hobbyists affiliated with the *People's Computer Company* and, later, the Homebrew Computer Club. Stewart Brand moved back and forth between these communities, and the *Whole Earth Catalog* served as inspiration to members of both. In the Bay area in this period, the dynamic of personalization that had long been at work within some parts of the computer industry and the ideals of information sharing, individual empowerment, and collective growth that were alive within the counterculture and the hobbyist community did not so much compete with as complement each other.

In Douglas Engelbart's ARC group, computers had long seemed to be natural tools with which to expand the intellectual capacity of individuals and their ability to share knowledge. This vision had grown out of the research cultures of World War II and the early cold war. In 1946, for instance, while stationed in the Philippines as a Navy radar technician, Engelbart had read Vannevar Bush's now-legendary *Atlantic Monthly* article "As We May Think." In it Bush argued that the same scientists who had just helped win World War II would now have to harness the power of the cheap electronics they had invented to develop a new form of information management. Having built the nuclear weapons that might destroy mankind, scientists should now turn to building technologies with which to "encompass the great record" of human activity and so facilitate a growth "in the wisdom of race experience."[8] By way of example, Bush described a hypothetical desktop machine he called the Memex. Designed for individual use, the Memex featured a keyboard, a translucent screen, microfilm inputs, and the ability

to call up reams of stored data by means of a few keystrokes. This machine would turn the ordinary office into a site at which the whole of human history might in theory be called up. The executive equipped with this new knowledge base would not only expand his own intellectual capacities but also enhance his ability to control the world around him.

Bush's article helped interest the young Engelbart in working with computers.[9] During the war, Engelbart noted, following Bush, the American military had developed technologies with which it might destroy the world. In its wake, scientists and technologists had begun to fan out around the globe, seeking to use their knowledge to eradicate disease and increase food production, often in an effort to win the cold war loyalties of Third World nations. Engelbart had read about these efforts and saw that they often backfired. Rapid food production led to the depletion of the soil; the eradication of insects led to ecological imbalances. In Engelbart's view, humans had begun to face extraordinarily complex problems, and they needed to solve them urgently. They would need to improve the management of information and the control of human organizations in order to do so. During World War II, in the airplane-tracking projects of Norbert Wiener, the integration of man and machine had presented a way to win the war. Now the battlefield had shifted to the workplace. Like Wiener, Engelbart would go on to pursue questions of man-machine integration. And like the weapons researchers of the war era more broadly, he would conceive of his work in world-saving terms. To augment the mind of the individual office worker was not only to improve his or her efficiency, but also to expand his or her ability to serve the human race.

Engelbart joined the Stanford Research Institute in 1957. Over the next decade, he and his staffers at the Augmentation Research Center invented some of the most ubiquitous features of contemporary computers, including the mouse. Between 1966 and 1968, the group developed a collaborative office computing environment known as the On-Line System, or NLS. The NLS featured many of the elements common to computer systems today, including not only the mouse, but a QWERTY keyboard and a CRT terminal. More importantly, the system offered its users the ability to work on a document simultaneously from multiple sites, to connect bits of text via hyperlinks, to jump from one point to another in a text, and to develop indexes of key words that could be searched. The NLS depended on a time-sharing computer, yet it functioned within the office environment much like a contemporary intranet. At a time when many inside and outside the industry still thought of computers as massive calculating machines, the NLS offered a vision of computers as text processors and tools for collaboration. Unlike their cold war ancestors, the computers of Engelbart's ARC group were

communication devices and, in that sense, direct antecedents of the personal computers to come.

The NLS and Engelbart's understanding of the social potential of computers also owed a great deal to World War II research culture and to cybernetics in particular. Engelbart described the NLS as a system that would augment human intellectual capacities, but the system itself demanded a high degree of integration between the user and the machine. Like the Memex, each terminal served as a tool that would allow the person it served to call up and manage information. Beyond that, it would recursively leverage the knowledge of other workers on the system. In Engelbart's view, each individual's comprehension would be increased by the participation of others through a process of collective feedback facilitated by the computer.[10] Within the ARC group, this process of collective feedback was elevated to a principle of social organization. At the level of technological engineering, Engelbart promulgated a philosophy of "bootstrapping," in which each experimental transformation of the socio-technical system that was the NLS would feed back into the system itself, causing it to evolve (and presumably to improve). At the level of the group's social life, Engelbart worked to create an environment in which individual engineers might see themselves as both elements and emblems of a collaborative system designed to amplify their individual skills. Engelbart saw the individual and the computer, like the group and the computer system, as complementary elements in a larger information system—a system that would use cybernetic processes of communication and control to facilitate not only better office communication, but even the evolution of human beings.

This cybernetic framework aligned the ARC mission with the goals of two seemingly antithetical communities: the defense establishment and the counterculture. Starting in 1963, much of the ARC group's work was funded by the Defense Department's Advanced Research Projects Agency (ARPA). ARPA was founded in 1958 with the aim of sparking new research into defense-oriented technologies. In 1962 it established the Information Processing Techniques Office, headed by Joseph C. R. Licklider; this was the office that would ultimately drive the development of the Internet. In many ways, ARPA marked an extension of the defense-oriented military-university collaborations that began in World War II. Likewise, Licklider's vision of computing grew out of the cybernetic ideal of human-machine integration. After World War II, Licklider became a professor of psychology at MIT, where he worked on a variety of projects descended from MIT's wartime commitments. He was steeped in the cybernetic theories of his colleague Norbert Wiener, and it showed. In a highly influential 1960 paper entitled "Man-Computer Symbiosis," Licklider imagined a form of human-machine

collaboration that surpassed even Vannevar Bush's vision for the Memex: "The hope is that, in not too many years, human brains and computing machines will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today." Licklider, like Bush and Engelbart, envisioned the computer becoming a communications device; along with the user and as part of a whole information system, it might, properly deployed, be of use to humanity as a whole. "Man-computer symbiosis," he suggested, should produce "intellectually the most creative and exciting [period] in the history of mankind."[11]

At one level, then, Engelbart's vision for the NLS owed a great deal to the work of Bush and Licklider and to the research culture of World War II and its cold war offshoots. Engelbart's own allegiance to that community was strong: by 1969 SRI had become one of the first four nodes on the ARPANET, which would develop into the Internet, and Engelbart's own ARC group, hoping to spark widespread adoption of the NLS, had become hosts to the ARPANET's Network Information Center. At another level, Engelbart's humanitarian ideals and his group's emphasis on the augmentation of human intellectual capacities resonated well with the New Communalist emphasis on transforming human consciousness. Engelbart's group bore a strong resemblance to groups like USCO and the Merry Pranksters. Like those groups, the Augmentation Research Center featured a relatively leveled community led by a visionary. Also like those groups, ARC was devoted to changing the prospects for humankind by using small-scale technologies to augment human consciousness. Moreover, individual members of ARC maintained substantial connections to various elements of the counterculture. In the late 1960s, Engelbart and others experimented with LSD and visited several communes; in 1972 they attended sessions of Werner Erhard's Erhard Seminar Training (EST) movement. As Engelbart later recalled, he was "very empathetic to the counterculture's notions of community and how that could help with creativity, rationality and how a group works together."[12]

Brand had met various members of the ARC group through Dick Raymond at the Portola Institute and through parties at the house of Bill English, ARC's chief engineer and builder of the first computer mouse.[13] As members of the ARC group became more intrigued by the burgeoning commune movement, Brand helped bring the two communities together. Steve Durkee, of USCO and the Lama Foundation, began to visit the ARC offices. Doug Engelbart and Bill English later traveled to New Mexico and the Libre commune, where they met with Steve Baer, the *Whole Earth Catalog*'s foremost authority on geodesic domes. In the fall of 1969, Dave Evans,

a member of the ARC group, staged a three-day event called Peradam in the woods near Santa Barbara, in which he brought together technologists and members of the New Communalist movement. Participants represented research institutes such as SRI and the Ecology Center and countercultural organizations such as Zomeworks (builders of domes), Portola, and the Hog Farm commune. They also included high school students (from Pacific High) and office designers (from Office Design). Stewart Brand, who also attended the event, featured it in the January 1970 supplement to the *Whole Earth Catalog*.[14]

Even as Brand was helping introduce the members of ARC to the commune-based readership of the *Whole Earth Catalog,* his connections to the group introduced him to the future of computing. In 1968 Dave Evans recruited Brand to serve as a videographer for an event that would become known as the "mother of all demos."[15] On December 9 of that year, at the Association for Computing Machinery / Institute of Electrical and Electronics Engineers (ACM/IEEE)–Computer Society's Fall Joint Computer Conference in San Francisco, Engelbart and members of the ARC team demonstrated the NLS system to three thousand computer engineers. Engelbart sat on stage with a screen behind him depicting both himself and the text he was working on. His system was linked via telephone lines and microwave channels to a terminal at SRI. In the course of the presentation, Engelbart demonstrated the key features of the personal computer interface to come—including the mouse-keyboard-screen combination we now take for granted—for the first time ever in public. Moreover, he showed that computers could be used for complex group communications over long distances and for the enhancement of individual and collective learning. By all accounts, the audience was electrified.[16] For the first time, they could see a highly individualized, highly interactive computing system built not around the crunching of numbers but around the circulation of information and the building of workplace community.

Stewart Brand later remembered his role on that day as "just a gig, a one-shot deal."[17] Yet the *Whole Earth Catalog,* which Brand had started only months before, would ultimately embody many of the ARC group's assumptions about the ideal relationship between information, technology, and community. Like the NLS, the *Catalog* would link multiple, geographically distributed groups and allow them to collaborate—albeit not in real time. And like the hyperlinked texts of Engelbart's system, the *Whole Earth Catalog* presented its readers with a system of connections. In the *Catalog,* no text stood apart from every other; each was part of an informational or social system, and each offered a doorway through which the reader could enter one of those systems.

In the early 1970s, the *Catalog* came to model the potential integration of New Communalist ideals and information technology for researchers at Xerox PARC and for the leaders of the region's emerging computer hobbyist culture. Founded in 1970 primarily to serve as a research laboratory for a recently acquired computer subsidiary, Xerox PARC substantially extended the trajectory of human-computer integration outlined by Bush and Licklider and pursued by Engelbart's ARC group. Within ten years, researchers there had designed a computer for individual use (the Alto), an internal network with which to link these computers together (the first Ethernet), a graphical user interface, and the laser printer, among many other innovations. For the most part, these innovations grew out of a technical tradition associated with the ARPA community and with Engelbart's ARC group. One of the very first hires at Xerox PARC was Robert Taylor, who had led ARPA's Information Processing Techniques Office since 1966. Taylor in turn recruited Bill English and a dozen other members of Engelbart's ARC group, hoping that they would bring their understanding of the NLS with them.[18] Along with members of the ARC team, Taylor recruited a number of talented young programmers and engineers whom he had met in a series of graduate student symposia sponsored by ARPA. One of the most prominent of these was Alan Kay. In 1969 Kay's PhD dissertation at the University of Utah had described an interactive desktop computer; as early as 1967, Kay had proposed a portable variation on that computer that he called the Dynabook. Kay's Dynabook would soon provide a guiding vision for Xerox PARC's pursuit of its own individualized computer, the Alto.

Within the various teams concerned with developing the Alto, two communities emerged. One group, based in PARC's Computer Science Laboratory and including designers Butler Lampson and Charles Thacker, focused on developing the architecture of the Alto and the Ethernet and on pushing the limits of computer design. The other, housed in the Systems Science Laboratory and including Alan Kay, Bill English, and software engineer Larry Tesler, concentrated on questions of how and why a computer might be used. By all accounts, Kay was among the most devoted to making computers into user-friendly tools for communication and creative expression.[19] Much of his drive in that direction came from within the world of computer research. In his first weeks in graduate school, for instance, the professor who recruited him handed him a copy of Ivan Sutherland's 1963 MIT PhD dissertation, "Sketchpad: A Man-Machine Graphical Communications System." In it Sutherland described how to use a light pen to create engineering drawings directly on the CRT screen of a computer. In 1968 Kay met with Seymour Papert and encountered Papert's LOGO programming language, a language so simple that it could be used by children. In both

cases, Kay discovered visions of interactive, creative computing that had developed within the centers of technological research, far away from the Bay area's counterculture.

But Kay had also found the *Whole Earth Catalog*. He first saw a copy in 1969, in Utah. "I remember thinking, 'Oh yeah, that's the right idea,'" he explained in 2004. "The same way it should be easier to do your own composting, you should have the ability to deal with complicated ideas by making models of them on the computer." For Kay, and for others at Xerox PARC, the *Catalog* embodied a do-it-yourself attitude, a vision of technology as a source of individual and collective transformation, and a media format—all of which could be applied to the computers on which they were working. As Kay explained, he had already begun to think of the computer as a "language machine where content was the description of things." When he saw the *Catalog*, it offered him a vision of how an information system might organize that content. He and others at PARC saw the *Catalog* as an information *tool* and, hence, as an analogue to the computer; at the same time, they saw it as a hyperlinked information *system*. In that sense, remembered Kay, "we thought of the *Whole Earth Catalog* as a print version of what the Internet was going to be." Kay and his colleagues in the Systems Science Laboratory paid particular attention to the *Catalog*'s design. In the *Last Whole Earth Catalog* of 1971, for example, they came upon *Divine Right's Trip*, a novel by Gurney Norman that Stewart Brand had decided to print one page at a time on each page of the *Catalog*. This was "one of the best user interface ideas we had ever seen," Kay recalled.[20] Most users of information systems tend to browse in areas they are already interested in, said Kay. Brand had found a way to lead users through the system and expose them to its full range of offerings.

For Kay and others at PARC, the *Catalog* was a conceptual resource book and a legitimator of their own work. As Kay put it, "a lot of good ideas were had by idling through the *Catalog* when you didn't know what you were looking for." Larry Tesler agreed. "I looked through every page," he explained. "It was a big event to get [a new copy of the *Catalog*]."[21] When Xerox PARC established its own library, the new librarian asked Kay to help stock its shelves. He took her to the Whole Earth Truck Store, and together they bought a copy of every book there. The PARC library thus became something of a three-dimensional *Catalog* for PARC engineers, a place where they could relax and browse, but also a place whose terms had been set in part by the browsing Stewart Brand had already done. For the engineers at PARC, the *Catalog* represented much of what was most exciting about the countercultural world outside their laboratory walls. It did so, however, in terms that celebrated the elite, technocentric, self-sufficient

ethos that characterized PARC itself. Although PARC researchers did not couch their work in countercultural terms, many did see themselves as explorers on the edge of a technological frontier. In Palo Alto they found themselves working in a self-sufficient group, far from the company's home base in Rochester, New York, and via their machinery inventing new tools for communication and collectivity. At a time when the Vietnam War had widely discredited the military establishment, the *Catalog* offered them a way to imagine their own research not only as an extension of the academic-military-industrial collaborations that had spawned the ARPA community, but as a variation of the New Communalist project of working in small, forward-thinking groups to develop new forms of consciousness and community with the aid of small-scale technologies.

The *Catalog* performed similar ideological work within two other groups that would play an important role in imagining the use of computers in countercultural terms: the *People's Computer Company* and Resource One. The *People's Computer Company* got its start at the Portola Foundation, alongside the *Whole Earth Catalog*. Bob Albrecht, a former engineer for the Control Data Corporation and Honeywell, had been teaching computing in public schools since the early 1960s. In 1968 he set up an office at the Portola Institute, and over the next few years, his office came to house both the computers he used in the schools and a technical-writing business called Dymax (after Buckminster Fuller's Dymaxion principle). As a result of his work in the schools, Albrecht had long imagined computers as tools that could be used by individuals to enhance their own learning. In the course of his work at Portola, however, this vision took on a countercultural cast. In 1972 he and his wife Mary Jo, several staffers from Dymax, and Lois Brand, as bookkeeper, founded a more or less bimonthly newspaper, the *People's Computer Company* and, shortly thereafter, a storefront center called the People's Computer Center that offered public access to computers. Over the next five years, the newspaper became one of the first and most important information sources for hobbyists and others hoping to personalize their experience of computing. With a circulation of eight thousand copies, the *People's Computer Company* (*PCC*) printed articles about BASIC programming language and how to use it, discussions of various hardware technologies, reviews of books, and pointers to various user groups. In 1976 it spun off another influential computer publication that continues to this day, *Dr. Dobb's Journal of Tiny BASIC Calisthenics and Orthodontia* (now known simply as *Dr. Dobb's Journal*).

One look at the *PCC* alerted the reader that this was not a mainstream computer-industry publication. Laid out in blocky, letterpress text and illustrated with neo-Victorian borders and funky line drawings, it looked more

like an underground newspaper than an organ of the high-technology industry. In large part, this look reflected the *PCC*'s debt to the *Whole Earth Catalog*. The first issues of the *PCC* were laid out using the *Whole Earth Catalog*'s equipment. In later editions, the *PCC* reprinted whole pages of the *Catalog*. And throughout its existence, the *PCC* advertised and sold books by *Catalog*-connected authors. As Bob Albrecht put it some years later, "I was heavily influenced by the *Whole Earth Catalog*. I wanted to give away ideas."[22] By borrowing the look and the feel and sometimes the contents of the *Catalog*, the *PCC* directly linked the hobbyist pursuit of BASIC code to the New Communalist search for tools of personal and collective transformation. In January of 1975, for example, the editors of the *PCC* decided to put the first widely available hobbyist computer—the Altair—on their cover. But rather than depict the machine alongside other machines, or even with technology-savvy users, the *PCC* displayed an Altair set out in a desert. Much like the backpacks and handsaws of the *Whole Earth Catalog*, the *PCC*'s high-tech Altair appeared to be a tool with which to get back to the land.

In this way, the *Catalog* provided a framework within which engineers and hobbyists could link their own desires for both certain forms of information processing and countercultural legitimacy to the shifting capacities of new computing machines.[23] The *Catalog* offered new ways to imagine the possibilities of computers and also legitimated the use of computers in nontraditional settings such as classrooms and public storefronts by linking those uses to a New Communalist ethos. This was particularly true for people seeking to use time-sharing computers for peer-to-peer public computing. Lee Felsenstein, for example, was a former computer engineer, a participant in the Free Speech Movement, and an antiwar activist. He had written for the underground newspaper the *Berkeley Barb*, and he would go on to help found the Homebrew Computer Club. Felsenstein remembers the *Whole Earth Catalog* as a sort of Bible of countercultural technology. At that time, he explains, technology was a "secular religion" in mainstream America; with the *Catalog*, in contrast, Stewart Brand "set up an alternate temple of the same religion, of the church of technology, telling people in technological society that people needed to learn to use tools." For those who, like Felsenstein, were both trained engineers and participants in the youth movements of the 1960s, this new religion offered a way forward. In Felsenstein's words, the *Whole Earth Catalog* reminded its readers that "you don't have to leave industrial society, but you don't have to accept it the way it is."[24]

In the summer of 1971, Felsenstein joined Resource One, a gathering of former staffers from a volunteer switchboard and computer programmers who had left the University of California at Berkeley in protest of the invasion

of Cambodia; Resource One was also a project partly funded by several thousand dollars Fred Moore had taken home from the *Catalog*'s Demise Party. At Resource One, Felsenstein and others sought to establish public computing terminals at several locations in the Bay area, with an eye toward creating a peer-to-peer information exchange. Ken Colstad, a member of the project, described its aims in a 1975 issue of the *People's Computer Company* thus: "Such a horizontal system would allow the public to take advantage of the huge and largely untapped reservoir of skills and resources that resides with the people. . . . [It would] counteract the tendencies toward fragmentation and isolation so visible in today's society." On the next page, in an article entitled "A Public Information Network," Efrem Lipkin made a similar point: "People must gain a sense of understanding of and control over the system as a tool. . . . [Computer] intelligence should be directed toward instructing [the user], demystifying and exposing its own nature, and ultimately giving him active control."[25]

The concept of building a peer-to-peer information system and the idea that individuals needed to gain control over information and information systems had been features of both the New Communalist movement and the New Left for some time. Yet, the notion of doing these things with computers was relatively new, at least outside the walls of SRI and Xerox PARC. For those who hoped to turn computing machines toward populist ends, the religion of technology espoused by the *Whole Earth Catalog* offered an important conceptual framework and source of legitimation. In the early 1970s, for example, Lee Felsenstein began to design the Tom Swift Terminal—a freestanding, easy-to-use terminal that would be as easy to repair as a radio. Although it was never built precisely to Felsenstein's first specifications, the Tom Swift Terminal design ultimately drove the creation of an early personal computer known as the Sol. Felsenstein envisioned the Tom Swift Terminal "as something that could be printed in the *Whole Earth Catalog*." As he saw it, the Terminal would be "a way to do things in line with the *Whole Earth Catalog* way to do things."[26] It might be built with technologies developed in the centers of American industry, but it could be used by individuals for their own purposes. With the *Catalog* and Brand himself as models, the Tom Swift Terminal offered Felsenstein the chance to see himself not simply as a trained engineer, but as a Fulleresque Comprehensive Designer.

In 1975 Felsenstein, along with several members of the *People's Computer Company* staff, would help create the Homebrew Computer Club. Many of the other early members of the club would be recruited from a list of people who had inquired about the People's Computer Center; Fred Moore compiled the list and passed it on to the club's first host, Gordon French.[27]

Within Homebrew, as within the *People's Computer Company* and Resource One, there was an ethos of information sharing, of peer-to-peer collaboration, and of information technology as something around which to build a community. That ethos would ultimately help drive the creation of Apple Computer and a number of other ventures, yet it was not the exclusive property of the Homebrew hobbyists. It belonged as well to the engineers of the ARPA community and Xerox PARC. Stewart Brand had entrepreneurially linked the two communities, and in the *Whole Earth Catalog*, he had offered key members of both a reflection of their technological ideals. He had also legitimated those ideals as elements in a larger New Communalist project.

Although the *Catalog* bridged cybernetics and the back-to-the-land movement, however, Brand himself had done little to address computers per se. That began to change in 1972, when, in the pages of *Rolling Stone* magazine, he gathered together the descendants of midcentury military research on computing and the members of the emerging countercultural hobbyist community. Not long after the *Catalog*'s Demise Party, the editor of *Rolling Stone*, Jann Wenner, commissioned Brand to investigate the Bay area computer scene. Brand produced one of the first (and still one of the most widely quoted) pieces of journalism to link corporation- and government-funded computer research to New Communalist ideals: "Spacewar: Fanatic Life and Symbolic Death among the Computer Bums."

As its title suggests, the piece focused on the legendary computer game Spacewar. In October 1972 Brand and *Rolling Stone* photographer Annie Liebowitz slipped into the Stanford Artificial Intelligence Laboratory, convened a crew of programmers and researchers, and staged their own "Intergalactic Spacewar Olympics." Long-haired graduate students clustered around a PDP-10 time-sharing computer, entered a few commands, conjured up tiny triangular spaceships on the computer's monitor, and proceeded to blast each other out of the sky. In his story, Brand recorded not only the commands, but also the frantic delight of the players. He then turned their pleasure into evidence of the countercultural force of Spacewar, of computers, and of the freewheeling collaborative culture that surrounded them. "Ready or not, computers are coming to the people," Brand explained in the article's first lines. "That's good news, maybe the best since psychedelics." Stanford's AI lab was "the most bzz-bzz-busy scene I've been around since the Merry Prankster Acid Tests." The Spacewarriors themselves were "out of their bodies" in the game, not unlike high-tech versions of the turned-on dancers of the Trips Festival.[28]

In Brand's rhetoric, the Spacewarriors of the AI Lab became countercultural pioneers. And they were not the only ones. Leaving the stuffy Stanford basement, Brand took his readers to Xerox PARC, where he introduced

them to Alan Kay and his Dynabook, and to the ARPANET as well. He then traveled to the offices of Resource One, where he presented the group's founder, Pam Hart. Both PARC and Resource One, he suggested, hoped to take computers out of their military, industrial, and academic contexts and turn them into tools for individuals to use as they saw fit. In that sense, both were making computers into tools for transformation in the *Whole Earth* tradition. They were also inventing a new, collaborative, play-oriented culture. The programmers and engineers at PARC and Resource One had long distinguished between "hackers" (those who figured things out as they went and invented for pleasure) and "planners" (those who pursued problems according to a set and less flexible strategy). Brand picked up on this distinction and mapped it onto the larger, New Communalist critique of technocracy. Hackers, he wrote, were not mere "technicians," but "a mobile new-found elite, with its own apparat[us], language and character, its own legends and humor. Those magnificent men with their flying machines, scouting a leading edge of technology which has an odd softness to it; outlaw country, where rules are not decree or routine so much as the starker demands of what's possible." For Brand, Stanford's AI Lab and the Defense Department–funded research rooms of Xerox PARC were the equivalent of what he and others, following Buckminster Fuller, had lately called "outlaw zones." The hackers were Comprehensive Designers. Like the builders of geodesic domes, they drew on the funding and technology emanating from the center of the American military-academic-industrial triangle in order to build new, playful, emotionally and intellectually satisfying forms of collaboration. In Brand's report, planners stood for bureaucrats everywhere, and hackers became not mere technicians, but cultural revolutionaries. The computer became a tool for the establishment of a better social world: "The hackers made Spacewar, not the planners. When computers become available to everybody, the hackers take over. We are all Computer Bums, all more empowered as individuals and as co-operators. That might enhance things . . . like the richness and rigor of spontaneous creation and of human interaction . . . of sentient interaction."[29]

In "Spacewar," Brand brought together two visions of personal computing and linked them in terms set by the New Communalist technological vision. The user-friendly, time-sharing vision of Xerox PARC and the politically empowering, information-community vision of Resource One were two sides of the same coin, Brand implied. Both groups, he suggested, were high-tech versions of the Merry Pranksters, and the computer itself was a new LSD. Drawing on the rhetorical tactics of cybernetics, Brand offered up Xerox PARC, Resource One, and the Merry Pranksters as prototypical elites for the techno-social future. He allowed each to claim some of

the cultural legitimacy of the others: in his feature, Resource One appeared to be not a fringe group of ex-hippies but a central player in a new computer movement. Xerox PARC, while still a child of the military-industrial complex, took on the cool of the Pranksters. And the Pranksters and Brand himself, six years after the Trips Festival, demonstrated that they had survived the Summer of Love and should still be regarded as harbingers of social change.

This coming together fed back into the organizations involved. At the People's Computer Center, where members of Resource One and the hobbyist community often dropped by, the "Spacewar" article was posted on a bulletin board. At Xerox PARC—if not at Xerox headquarters in Rochester, New York—the article was much loved.[30] Xerox executives resented the depiction of their elite research team as a bunch of long-hairs and restricted press access to them for years afterward. But the young programmers loved it: by appearing in *Rolling Stone,* they had in effect been compared to rock stars. For both groups, the article served as a mirror in which they could see themselves reflected as technologically savvy and counterculturally cool. They could imagine that to pursue the development of individualized, interactive computing technology was to pursue the New Communalist dream of social change. In the pages of *Rolling Stone,* the local work of individual programmers and engineers became part of a global struggle for the transformation of the individual and the community. Here, as in the *Whole Earth Catalog,* small-scale information technologies promised to undermine bureaucracies and to bring about both a more whole individual and a more flexible, playful social world. Even before minicomputers had become widely available, Stewart Brand had helped both their designers and their future users imagine them as "personal" technologies.

The End of Self-Sufficiency and the Rise of Coevolution

By 1972 Stewart Brand had become one of the most visible representatives of the New Communalist wing of the counterculture, and the *Catalog* was one of its most widely disseminated documents. The *Last Whole Earth Catalog* had sold more than a million copies and won the National Book Award. Brand himself was receiving invitations to speak around the world. Yet, both the New Left and the New Communalist movement had begun to dissolve. Between 1969 and 1971, antiwar protests had turned violent. The FBI had infiltrated the antiwar movement; the SDS had spawned the Weathermen. In 1970 a group of Weathermen accidentally set off a bomb they were building in a Manhattan townhouse. A few months later, members of the National Guard shot four students dead at Kent State University in Ohio. The

New Left came apart. Todd Gitlin recalls, "Anxiety and despair were most of what I knew. . . . The revolutionary mood [of the late 1960s] had been fueled by the blindingly bright illusion that human history was beginning afresh because a graced generation had willed it so. Now there wasn't enough life left to mobilize against all the death raining down."[31]

Members of the New Communalist movement were no more immune to the political winds howling around them. Although some communes—particularly those with a strong religious bent—still flourished, many had lasted only a year or two. In 1970, for example, sociologist Hugh Gardner had visited some thirty rural and urban communes; in 1973, when he returned to see how they were faring, he found most on the verge of collapse, if not gone already. This was true of the particular communes Stewart Brand had visited as well. In 1972 two New Mexico communes with strong links to San Francisco, Morning Star East and the Reality Construction Company, were thrown off their borrowed land; in 1973 Drop City was disbanded; the Lama Foundation continued, but by 1973 the Durkees and many of the original founders had left. Most communes collapsed for lack of sufficient political organization. The libertarian tribalism of Drop City was fun for a while, but the New Communalist emphasis on consciousness transformation rendered intentional communities vulnerable to charismatic leaders and, in their absence, anarchy. Moreover, few communes succeeded in generating sufficient income to keep going after gifts from family members and friends ran out. To survive, communities needed structures of governance and structured ways of making a living—the very institutional elements of social life that many New Communalists had hoped to avoid.[32]

In the coming years, many former New Communalists would turn toward the emerging New Age movement and toward a minor religious revival in the mid-1970s.[33] In the early part of the decade, though, many of those who had sought to live outside mainstream American culture found themselves forced to return to it and to confront its many failings head-on. The economy that had been so strong in the mid-1960s had turned sour: by 1970 unemployment was running at 6 percent, interest rates had reached new heights, and the economy as a whole found itself pinched between inflation and recession.[34] The resulting "stagflation," as it was called at the time, led the Nixon administration to institute wage and price controls. In early 1973 inflation picked up steam again, and in the fall of 1973 the Organization of Petroleum Exporting Countries established an oil embargo in response to America's support for Israel during the Yom Kippur War. By the time the embargo was lifted in the spring of 1974, oil prices had risen some 300 percent.

In 1973 the Nixon administration removed the last of America's combat troops from Vietnam. The war that had provoked a decade of demonstrations was ending, for Americans at least. But the end of the war did not provide an end to the sense of crisis among young Americans, or many of their elders. In addition to economic and energy concerns, Americans faced what many believed to be an imminent ecological disaster. Three best sellers—Paul Ehrlich's *The Population Bomb* (1970), Barry Commoner's *The Closing Circle* (1971), and the Club of Rome's *The Limits to Growth* (1972)—predicted that without substantial shifts in man's relationship to the earth, the earth as we know it might disappear. In 1974 a housewife from Chicago spoke for many Americans when she told a reporter from *Newsweek*, "You always used to think in this country that there would be bad times followed by good times. Now maybe it's bad times followed by hard times followed by harder times."[35]

For Stewart Brand, the early 1970s led to a brief period of wandering. After the Demise Party, Brand turned away from publishing for nearly three years. Rather than keep the profits from the *Last Whole Earth Catalog*, he used them to establish the Point Foundation, from which he and members of the *Whole Earth* circle, including Xerox's Bill English, doled out some eight hundred thousand dollars in small grants to a wide variety of cultural entrepreneurs. "There are coming to be Private Statesmen," Brand wrote in his journal in August 1971. "I seem to want to be one, and visualize an instrumentality to encourage them." Over the next few years, he helped manage Point, wrote articles for *Rolling Stone* and *Harper's*, and established an annual "New Games Tournament," in which individuals and teams dueled with foam rubber swords and tossed "earth balls" back and forth. In 1972 his marriage to Lois fell apart. Gradually, Brand began to find himself busy but with no single, overarching purpose. Like others in the New Communalist movement and, for that matter, the New Left, he had entered his early thirties without a clear picture of what adulthood might look like. "Most of my contemporaries were either blurred out or settling down to long-term work," he later wrote. "We no longer had any remnant of a Generational Story to sustain us from without."[36]

Under these pressures Brand returned to the *Whole Earth Catalog* and to cybernetics. In 1974 he published the *Whole Earth Epilog*—the first of a half dozen versions of the *Catalog* that would appear over the next twenty years—and turned its old *Supplement* into a new quarterly magazine that he edited for a decade, the *CoEvolution Quarterly* (commonly called *CQ*). Now that the New Communalist movement had faded away, the *Catalog* began to offer new, more broadly consumer-oriented items, such as guides to mountain bikes and macramé, while retaining its traditional look and feel. In *CQ*, however, Brand explicitly repudiated the *Catalog*'s New Communalist origins. In a 1975 article, he put it this way:

> "Self-sufficiency" is an idea which has done more harm than good. On close conceptual examination it is flawed at the root. More importantly, it works badly in practice.
>
> Anyone who has actually tried to live in total self-sufficiency—there must be now thousands in the recent wave that we (culpa!) helped inspire—knows the mind-numbing labor and loneliness and frustration and real marginless hazard that goes with the attempt. It is a kind of hysteria. . . .
>
> . . . self-sufficiency is not to be had on any terms, ever. It is a charming woodsy extension of the fatal American mania for privacy. . . . It is a damned lie. There is no dissectable self. Ever since there were two organisms life has been a matter of co-evolution, life growing ever more richly on life. . . .
>
> We can ask what kinds of dependency we prefer, but that's our only choice.[37]

For Brand and the readers of *CQ*, the fading of the New Communalist dream and the entry into middle age posed a dilemma: Having just repudiated the mainstream adult world, how could they join it? And if they did find a way in, how could they bring with them their entrepreneurial habits and their celebration of small-scale technology and spiritual community? In the late 1960s, the elevation of consciousness into a principle on which to found communities had helped justify a mass migration to the rural wilds. In the early 1970s, many were seeking a view of consciousness that might justify a return to civilization.

In the pages of *CQ*, as in the *Whole Earth Catalog* before it, Brand supplied that view by turning to systems-oriented ecological theory and cybernetics. He explained in the first issue that the magazine took its name from the biological theory of "coevolution," in which two species evolved symbiotically. Brand traced the origin of this idea to a 1965 study of the relationship between certain predatory caterpillars and the plants they ate, conducted by his old teacher Paul Ehrlich and Peter Raven.[38] The first issue of *CQ* prominently featured an article by Ehrlich outlining his conceptual framework, entitled "Coevolution and the Biology of Communities." Yet, Brand considered coevolution to be more than a biological theory. It was a metaphor—derived from and carrying the legitimacy of science—for a new way of life. That metaphor depended not so much on Brand's reading of contemporary biology as it did on his reading of the mystical cybernetics of a former anthropologist, psychiatrist, and biological researcher, Gregory Bateson. Much as the ideas of Buckminster Fuller and Norbert Wiener had presided

over the *Whole Earth Catalog,* Bateson's cybernetic vision permeated *CQ.* In the late 1960s, Fuller and Wiener had offered a vision of tool use that accorded well with youthful migrations back to the land; in the early and mid-1970s, Bateson offered a vision of the world itself as a system and of its inhabitants as potentially influential elements of that system, a view that neatly supported the New Communalists' return to mainstream America. In Bateson's vision, as in Brand's, former counterculturalists and the society around them would have to coevolve.

At one level, the turn toward coevolution marked a return to the systems orientation of the *Whole Earth Catalog.* At another, it represented a shift both in information theory and in its relationship to the New Communalist critique of technocracy. To the communities among which Stewart Brand moved in the 1960s—USCO, the downtown Manhattan art world, the communards of the back-to-the-land movement—cybernetics meant primarily the writings of Norbert Wiener. As Katherine Hayles has pointed out, Wiener represents the "first generation" of cyberneticians. This generation, which gathered during and immediately after World War II, understood cybernetics as the study of communication and control systems that could be observed from a position outside the systems themselves. A second wave emerged in 1960 with the publication of *Observing Systems,* Heinz von Foerster's collection of essays.[39] There von Foerster, who later became a charter subscriber to the *Whole Earth Catalog* and a friend of Stewart Brand, attempted to include observers as elements in the systems they observed. Within von Foerster's vision and later, within the work of a number of other cyberneticians, observer and system were inseparable.

Chronologically, Gregory Bateson belonged to the first wave of cybernetics. In 1942, not long after carrying out field work in the South Pacific and marrying fellow anthropologist Margaret Mead, he attended a meeting in New York City convened by the Macy Foundation with an eye to discussing hypnosis and conditioned reflexes. There he met Warren McCulloch and Arturo Rosenblueth, and he heard Rosenblueth present the concept of feedback that he had lately developed with Norbert Wiener and Julian Bigelow. As Steve Heims has pointed out, both physical and social science had up until that time focused on linear models of causality. Despite the appearance of circular models in Einstein's general theory of relativity, most scientists believed that circular patterns of causality could not be modeled or verified mathematically, and so could not be studied. Rosenblueth's version of causality, however, was both genuinely new and open to study with traditional mathematical methods. In 1946, as soon as World War II had ended, the Macy Foundation convened the first of ten meetings to explore these and other insights of cybernetics. These meetings went on until

1953 and served as the principal site where the cyberneticians of MIT and elsewhere met social scientists and psychologists like Bateson and Mead and, through them and others, exported the cybernetic vision from the laboratory into the social sphere.[40]

Bateson's encounter with cybernetics informed his work for the rest of his life. In the twenty years following World War II, he transformed cybernetic principles into communication-based theories of alcoholism, schizophrenia, and learning. By the late 1960s, he had embraced the insights of second-wave cybernetics and developed a global, communication-based theory of being and evolution. In a series of essays published in a 1972 best seller entitled *Steps to an Ecology of Mind,* Bateson outlined a vision of the natural world as a set of information systems in interaction with one another. Individuals were both elements of this larger system and systems in their own right: "The individual mind is immanent but not only in the body. It is immanent also in pathways and messages outside the body; and there is a larger Mind of which the individual mind is only a sub-system. This larger Mind is comparable to God and is perhaps what some people mean by 'God,' but it is still immanent in the total interconnected social system and planetary ecology." Through cybernetics, Bateson explained, humans could finally recognize that the individual was no more than "a servosystem coupled with its environment." The notion that the individual "mind" somehow stood apart from the body or even from the larger world was simply a relic from the industrial and even pre-industrial eras of human civilization. Thanks to the work of the cyberneticians, he believed, citizens of the late twentieth century could finally recognize mind as a property of the aggregate interactions of individuals with their surroundings.[41]

Bateson's theory of immanent mind held enormous appeal for counterculturalists in the early 1970s, in large part because it echoed the New Communalist focus on shared consciousness. Yet, whereas the New Communalists had pursued the experience of collective transcendence, Bateson rejected transcendence entirely. Bateson taught that mind existed here and now, as the property of local collaboration between individuals and the social and natural systems of which they were a part. Mind could no more be separated from the material world than communes built on transcendent consciousness could survive beyond the reach of material forms of governance. In this way, Bateson's theory allowed New Communalists to reject the doctrines of self-sufficiency they had associated with transcendence, which had clearly failed in the field. With Bateson's second-wave cybernetics, they could accept their own increasing need to collaborate with mainstream society as a variation on the truth that no one could live outside "the system." To try—as many so recently had—was simply to court disaster.

Yet, Bateson's theory of immanent mind also offered those who took it up a way to recover their sense of themselves as world-savers. In *Steps to an Ecology of Mind,* Bateson proposed that although the immediate causes of what appeared to be an impending ecological crisis might be technological and social, the ultimate cause was epistemological. He pointed out in an essay entitled "Effects of Conscious Purpose on Human Adaptation" that individual consciousness was always engaged in processes of individual learning and cultural change. These processes shaped man's relationship to the natural world and so offered the individual an opportunity to change that world. At the moment, Bateson argued in 1972, what the natural world needed most was preserving. Over the previous century, certain "self-maximizing entities," such as corporations and governments, had turned the individual human being into "a dehumanized creature."[42] By recognizing the degree of their integration into the natural and social systems around them, he suggested, individuals could simultaneously restore their individual humanity and act more humanely toward the planet as a whole.

Bateson's vision clearly echoed the New Communalist critique of technocracy. Like the former commune dwellers, Bateson offered a new consciousness as an alternative to the destructive, mechanistic forces of bureaucratic America. Yet he did not call for the establishment of alternative communities. For Bateson, mind was simply present in all social and natural relations. To recognize that immanence and to act in accord with it (and thereby possibly save the world from ecological disaster), individuals need not join an alternative community; they could simply work to influence whatever local "system" in which they found themselves involved. In this way, Bateson offered a generation that had set out for the woods fully believing that they could save the world a chance to make their way back with their faith in their own importance still intact. Although the individual could not stand outside the "system," Bateson's epistemology implied, he or she could save the system from within.

Throughout the 1970s, Bateson exerted a substantial intellectual influence on *CQ*. After profiling Bateson for *Harper's* magazine in 1972, Brand introduced him to readers of *CQ* in 1974. In a series of articles and interviews over the next seven years, Brand presented Bateson to his readers much as he had presented Buckminster Fuller some years earlier. Brand's Bateson was an intellectual seeker, an autodidact and polymath possessed of an orphic speaking style and a childlike curiosity. Just as his theories of mind gave *CQ*'s readers a way to rationalize their return to society, Bateson himself served as an emblem of a possible adulthood. Like Fuller and, for that matter, like McLuhan and Wiener, Bateson had found a way to bridge high technology and communitarian idealism and to build a flexible career around their intersection.

Moreover, he had become an emotionally whole person. In 1980 Bateson died at the San Francisco Zen Center after a brief illness. His daughter, Mary Catherine, penned a long recollection of his death for *CQ*, in which she celebrated his affection for his children and grandchildren and described their visits to his bedside. After Bateson's life force had left his body, she recalled, she and a number of monks washed and tended his corpse and prepared it for cremation. In every way, her article suggested, this had been the end of a life well lived—perhaps even the life of a saint.

For a generation that had grown up in fear of cold war technocracy and the mechanistic adulthood it seemed to portend, the figure of Bateson, like that of Fuller before him, offered a way to celebrate the high-technology world of cybernetics without forgoing the full range of emotional and spiritual experience. And like the *Whole Earth Catalog, CQ* served as a forum for the discussion and integration of science, technology, mysticism, and right living. In its pages a reader might find an article on sanctuary in Cuba set next to a piece on neighborhood preservation or perhaps a technical discussion of a potentially useful but neglected metal alloy. At its peak, *CQ* had around thirty thousand subscribers, many, though by no means all, from northern California. Sized slightly smaller than a standard glossy magazine and printed on the familiar plain paper of the *Catalog, CQ* contained a mix of lengthy feature articles followed by briefer pieces and an assortment of *Catalog*-style reviews. Apart from the front feature section, it retained the categories of the *Catalog* and many of its contributors. Heavy on text and hand-drawn illustrations, light on photographs, and completely without advertising, *CQ* brought a do-it-yourself feel to the magazine genre.

CQ carried forward the down-home style of the *Whole Earth Catalog,* but it also made visible the disintegration of the *Catalog*'s characteristic techno-social ethos. In the *Catalog,* as in the back-to-the-land movement, small-scale technologies were depicted as tools to be used by individuals to construct communities. By dint of these individuals' efforts, their communities and their own lives would be more closely integrated into the landscape itself and the natural forces that governed it. Geodesic domes, for instance, may have been born in the world of cold war high technology, but, put to use on the plains of Colorado, they offered a way for communities to come closer to one another and to nature. They represented what would later be called "appropriate technology" or, in the language of the Whole Earth publications, "soft technology."[43] Although they emerged out of high-tech research and smokestack industrial processes, they could serve the local needs of their users and, ultimately, planetary health.

In *CQ* this tool-based, back-to-nature view of technology began to confront a different view, one in which technology served not as a tool with

which to build new communities, but as the host to communities themselves. In part, this vision derived from the work of Gregory Bateson. Bateson explicitly attacked mechanistic visions of the social and natural worlds,[44] and his understanding of mind bore a mystical cast, but his vision of the world as a set of interconnected information systems strongly echoed cold war visions of the world as a mirror of the computer. In 1975 this implied computational metaphor became attached to a specific technology: the space station. That fall, Brand introduced *CQ* readers to Gerard O'Neill, a Princeton physics professor. In 1969 O'Neill and his students had begun to imagine a massive colony in space.[45] Powered by the sun, floating near the vast mineral deposits of the moon and passing asteroids, O'Neill expected this imaginary space colony to house a million people by the year 2000. It would consist of two concentric, six-mile-long metal cylinders spinning in opposite directions to generate gravity, and it would house a veritable Eden. Each inhabitant would have five acres of land, and humans would coexist with plants and animals in homeostatic harmony. In a much-circulated painting by Don Norman, an illustrator who often worked for NASA, the inside of the space colony bore a striking resemblance to the San Francisco Bay area: colorful, clean, full of trees and water. Only the dome over the sky and the slight curvature in the land itself revealed the technology on which the colony depended.

By the mid-1970s, O'Neill's ideas had received widespread attention in the press and a grant from the Point Foundation. When *CQ* wrote up O'Neill's work in the fall of 1975, though, it sparked intense debate within the Whole Earth community about the proper ways in which humans and technology should coevolve. O'Neill's vision generated so many angry letters to the editor that Stewart Brand invited both members of his extended network and the readership at large to mail in their opinions of the colony for the next issue of the magazine. Close to two hundred responded, and their letters, printed across seventy-five pages of the spring 1976 *CQ*, mark a deep split in countercultural approaches to technology. On the one hand, many regular contributors to *Whole Earth* publications remained wedded to a small-is-beautiful view of technology. Essayist Wendell Berry made their case vociferously. "The Fall 1975 issue displays a potentially ruinous split between what I at least have thought to be coevolution and what I think the energy lobby would unhesitatingly recognize as Progress," he wrote. As far as Berry was concerned, O'Neill's project was nothing more than a boondoggle for big business and big government. It was a "moral escape valve," he wrote, and "yet another 'new frontier' to be manned by an elite of experts."[46] Berry and those associated with soft technology were repelled by the notion of living inside a closed technological system. Berry was a small-scale farmer in Kentucky, and he and others like him sought to live in contact with the earth, not cut off from it.

On the other hand, many of *CQ*'s readers had lately confronted the harsh realities of rural living and the failure of their own communal experiments. For these readers, the chance to live inside a six-mile-long machine—at least in fantasy—offered a way to revivify the New Communalist dream. "I see the main issue of space colonies as religious," wrote Gurney Norman. He hoped that space colonies might become hippie cathedrals:

> I want the connection between the Indian Coyote tales and the Space colonies to be very direct and clean. I want the building of the colonies to encourage folk life and country music and old time religion, not discourage it. . . . I want there to be places for Neal Cassady and Nimrod Workman, and Merle Haggard. . . . In my head, I'm against all this space stuff. But in my heart, if they're goin' to build 'em, I want to be on one. I want to get to heaven, by hook or by crook.[47]

According to Stewart Brand, outer space could serve some readers "as a path, or at least a metaphor, for their own liberation." It was "free space"—never occupied and never inhabited. Its lack of oxygen and gravity were not so much hardships as opportunities. They opened space to settlement in ways that the materiality of the lands actually occupied by communes a decade before had always resisted. If the communes had collapsed, and with them the chance to imagine alternative ways of living, space colonies might offer the New Communalists a second chance. After all, as Brand put it, space was an "Outlaw Area too big and dilute for national control."[48]

Over the next few years, the debate about space colonies faded from view. However, its intensity in the pages of *CQ* marks an important change in the relationship of technology, and particularly information technology, to New Communalist ideals. For the readers of *CQ*, space colonies served as a rhetorical prototype. They allowed former New Communalists to transfer their longings for a communal home to the same large-scale technologies that characterized the cold war technocracy they had sought to undermine. Fantasies of a shared, transcendent consciousness gave way to dreams of technologically enabled collaboration in friction-free space. Within a decade, these fantasies would reappear in the rhetoric of cyberspace and the electronic frontier, and as they did, they would help structure public perceptions of computer networking technology. But in the late 1970s, they marked the final breakdown of the New Communalist movement. The communes of the late 1960s were almost all long gone.

And neither the soft-technology wing of *CQ*'s readership nor those who dreamed of traveling to space would see their socio-technical visions survive the decade. By 1979 space colonies remained little more than an elaborate fantasy. The soft-technology movement left a more widespread legacy. By the end of the decade, even urban Americans tried to conserve energy and to recycle their waste.[49] Even as many of the movement's conservationist ideals persisted, though, the hope that small-scale technologies might lead their users into utopian communion with one another vanished from public view.

Software, Hackers, and the Return of the Counterculture

In the early 1980s, former communards found themselves confronting both middle age and a changed political landscape. The buttoned-down, square-jawed former governor of California, Ronald Reagan, had assumed the presidency and promised to restore America to what he saw as its former military and economic greatness. A new era was coming into being, and in the pages of *CQ*, the shift was palpable. The magazine continued to run articles on ecology and reviews of books on topics such as voluntary simplicity and home remedies. But it also covered books on how to buy mutual funds, get a job, and manage grants. In 1980 Paul Hawken, cofounder of the garden tools company Smith & Hawken and a Point Foundation board member, began a series of articles on small business and the "new" economy that would be one of the most popular series in the magazine's history.[50] In the late 1960s, Stewart Brand and the first readers of the *Whole Earth Catalog* had set out to build an alternative America; little more than ten years later, most had returned to the mainstream, where, with varying degrees of success, they were trying to fit in.

In 1980 Brand tried to explain to a reporter from *Newsweek* what had changed. "It used to be back-to-basics. . . . Now it's mostly onward and upward," he said. Brand no longer described himself as serving a grand social experiment. Instead, he explained, "I'm a small-business man who is hit with the same kind of problems that face any small entrepreneur."[51] Throughout the interview, a sense of the counterculture's failures hung in the air. "We were the 'now generation' because we figured there would be no then," Brand told *Newsweek*.

> We were completely apocalyptic. The sky was falling, the population was exploding, people were starving, yet we went on. When the energy crisis finally happened in '73, we said, "Aha, it's here, the end of the world." It turned out we were wrong again. . . .

> We were all outlaws who became responsible citizens—one of us [Jerry Brown] even governs California. We were looked at as the guiders of the culture. But we were also over-rewarded children. Can you imagine anything more boring than getting stoned all the time and bumping into each other?[52]

While Brand was lamenting the failure of the counterculture, the engineers and programmers he had inspired and celebrated in the early 1970s were enjoying extraordinary success. As Paul Ceruzzi has pointed out, the 1970s witnessed two waves in the development of the personal computer. The first, running roughly from 1972 to 1977, saw the rise of miniature computer technology, along with a variety of new interfaces, in parallel with the growth of a hobbyist community and, within it, new companies such as Apple and Microsoft devoted to producing minicomputers and software for public use. The second, which Ceruzzi dates from 1977 to 1985, saw the mass distribution of minicomputers into homes and offices nationwide. These computers bore the technological stamp of Xerox PARC and, in the case of Apple and its marketing campaign, at least, the cultural stamp of the Bay area hobbyists. By January 1983 minicomputers had become so ubiquitous and their effects on daily life so pronounced that *Time* magazine named the computer its "Machine of the Year."[53]

Since 1972 Brand had had almost nothing to do with computers. Nevertheless, in the early 1980s his cultural legitimacy, his networking skills, and the fame of the *Whole Earth Catalog* itself allowed him to broker a second encounter between the computer industry and the now much-faded counterculture. Ten years earlier, Brand had granted engineers and programmers a countercultural cachet. Now the computer industry returned the favor. In 1983 Brand's literary agent and friend from his forays into the Manhattan art scene in the early 1960s, John Brockman, proposed that Brand put together a *Whole Earth Software Catalog*. It would do for computing what the original had done for the counterculture: identify and recommend the best "tools" as they emerged. To Brockman and Brand, the timing looked right. The year before, Brockman had bought his own IBM PC and had begun to represent software makers, as well as authors of conventional books. And he had begun to make a lot of money. As *Wired* magazine later reported, he claimed that his clients had sold some $20 million worth of books, most of them computer-related, in 1983 alone.[54]

For his part, Brand had recently been recruited to join the faculty of an online educational project called the School of Management and Strategic Studies, sponsored by the Western Behavioral Sciences Institute in La Jolla, California. The School of Management employed the Electronic Information Exchange System (EIES) and had given Brand a modem-equipped

Kaypro II computer with which to access it. The students at the School of Management included representatives from business, academe, and government; the faculty included futurist Herman Kahn, climatologist Walter Orr Roberts, and anthropologist Mary Douglas. Brand was hired to teach a course called "Benign Social Genres"—that is, a course in understanding the organization of groups like Alcoholics Anonymous and others that Brand perceived as having a benign social impact.

What really excited Brand was the computer conferencing system itself. In the early 1980s, most commercial conferencing systems, such as CompuServe and the Source, focused on providing information for their customers to download. EIES, in contrast, emphasized conversation. Founded in 1975 by Murray Turoff, a former government official who had experimented in the 1960s with online group decision-making processes, EIES offered a series of private conferences that included representatives from industry, government, and academe. For seventy-five dollars a month plus the cost of phone calls, users could log on, enter their favorite conferences, and discuss whatever interested them. Brand felt that EIES represented a clear technological extension of the editorial world in which he was already living. The Whole Earth publications, he explained, depended on a "keyboard-enabled universe of people; electronic tools made easier what was already going on." Brand especially appreciated the system's ability to provide immediate feedback. Whereas the correspondence surrounding the *Whole Earth Catalog* and *CQ* had taken days in transit, e-mail on EIES moved at just under the speed of light. "I'm impressed," Brand told the readers of *CQ* in 1983: "By EIES, by computer conferencing, which I am reveling in, by the conferences I'm in, and by the Kaypro. Mind, it's like learning to drive in about 1924 with a Model T Ford, a big deal, and you get a flat tire every five miles, but it's adventurous. Word processing is technology I've been waiting half a lifetime for."[55]

Soon thereafter, John Brockman persuaded Doubleday to make a preemptive bid of $1.3 million for the rights to publish a *Whole Earth Software Catalog*. From a business point of view, the catalog was a failure. Like the original *Whole Earth Catalog*, the book was due to appear at least once a year and to be supplemented by a quarterly magazine that would update the book. Yet, for all of Doubleday's cash, the catalog appeared only twice and released only three of its quarterly reviews. For one thing, it had come too late to the party. By the fall of 1984, when the first *Software Catalog* appeared, the market for publications devoted to evaluating software was becoming crowded. For another, it was expensive to produce: writers knowledgeable about computing could command higher wages than the ten dollars per hour paid to most *CQ* staffers at that time, and, unlike the original *Whole Earth Catalog*, much of the *Software Catalog* was to be printed on glossy paper. More importantly, the print-based catalog format, with its comparatively slow production process, simply could not keep up with the speed at which new software titles were being released. Of all his cultural interventions, Brand reports, "that was the time I felt most off the beat."[56]

Although it failed as a business, the *Software Catalog* succeeded in introducing new networks of technology journalists and technology developers to the Whole Earth community and in turning the Whole Earth network's collective gaze toward the digital horizon. Rather than establish new offices for his new project, Brand brought production of the *Whole Earth Software Catalog*—and the computer industry journalists he had recruited—into the offices of *CoEvolution Quarterly*. There the emerging culture of personal computing and the long-standing culture of the holistic counterculture mingled daily. The editor of the *Software Review*, for instance, was Richard Dalton, an experienced computer writer who went on to write a column for *Information Week* and to serve as an information technology consultant for a number of Fortune 500 companies. The *Review*'s managing editor was Matthew McClure, a former head typesetter for the *Whole Earth Catalog* who had recently returned to the Bay area, broke, after ten years in a commune.

In addition to the offices of *CQ*, Brand and Art Kleiner, then editor of *CQ*, created a second cultural mingling point, online. Using the EIES system, they established a private conference through which software reviewers from around the country could submit their work for the *Catalog*. One of these reviewers was Kevin Kelly, the future executive editor of *Wired* magazine. The son of an executive for *Time* magazine, Kelly had spent years backpacking in Asia. Through his father, who had employed systems analysis techniques in his work, he had developed an interest in cybernetics. While traveling in the Middle East, he had also had a conversion experience and had become a born-again Christian. By the time he began contributing freelance pieces to *CQ* in 1980, Kelly was living in Athens, Georgia, writing freelance travel articles, editing a start-up magazine of his own called *Walking Journal*, and working in an epidemiology laboratory to support his writing.

Art Kleiner invited him to join the Software Conference on EIES. Once there, Kelly heard about an upcoming software industry gathering and decided to attend in the hope of meeting Stewart Brand. At the conference, Kelly pitched Brand the notion of producing an *Essential Whole Earth Catalog*, with Kelly himself as editor. Brand was noncommittal. He had liked Kelly's work on *Walking Journal* and his contributions to the *Whole Earth Review*, but he already had his hands full with his software-related projects. Soon after the conference, though, Brand replaced Richard Dalton as editor

of the *Software Review* with Art Kleiner, and, logging on to EIES, offered Kleiner's editorship of *CoEvolution Quarterly* to Kelly—by e-mail. When Kelly flew out at Brand's invitation to meet and discuss the offer, he sported a long beard, and Brand was nervous: "I realized I'd hired a Christian fundamentalist to run my science magazine," he recalled. For his part, Kelly, a long-time reader of the *Whole Earth Catalog,* was delighted. "Here was an offer to do the only job I ever wanted," he later recalled.[57] He promptly returned to Georgia, quit his jobs, sold his business, and moved to Sausalito, where he rented a houseboat several hulls down from Brand's own.

In 1985 the *Software Catalog* folded and the *Software Review* merged with *CoEvolution Quarterly* to form the *Whole Earth Review*. By that time, Brand had taken several key steps toward integrating the ideas and people of the Whole Earth into the emerging world of networked computing. Having had a foot in both worlds himself, he had linked the two communities off-line, in person, in the shared offices of the *Whole Earth Software Catalog* and the *CoEvolution Quarterly,* and online, on EIES. With an eye for the sort of synergy that had once characterized the *Whole Earth Catalog,* he had created the conditions within which a network of conversations could move fluidly across the boundary between the online and off-line worlds. Brand had once again placed himself and the Whole Earth publications at the intersection of multiple communities—here, the residual countercultural and the flourishing technical—and offered a project within which they could collaborate. He had also engaged those communities in simultaneous conversations in several media: electronic, face-to-face, and print. Although the *Software Catalog* failed, the types of conversations it facilitated—and the multiple media forms within which those conversations took place—would become key features of the Whole Earth group's influence in the years to come.

So too would the new networks it created. In the middle of 1984, Brand and the staffs of *CQ* and the *Whole Earth Software Catalog* reached out to core members of the personal computing movement: hackers. They created a forum in which hackers could get to know one another—the first Hackers' Conference—and in the process, they put hackers and their concerns at the center of the Whole Earth community. That year, a handful of self-described computer hackers had been working with Art Kleiner, Kevin Kelly, and others to help generate ideas for the *Software Catalog*. But hackers as a group came to Brand's attention only when one of the *Catalog*'s reviewers, a Bay area freelancer named Steven Levy, finished his book *Hackers: Heroes of the Computer Revolution*. In the book, Levy traced the origin of "hacking" back to the 1940s and the campus of MIT. There, at least a decade before the school began to teach computer programming to its undergraduates, the term referred to a particular style of work. According to Steven Levy, a

"hack" was "a project undertaken or a product built not solely to fulfill some constructive goal, but with some wild pleasure taken in mere involvement."[58] The first *computer* hackers emerged at MIT in 1959. They were undergraduates who clustered around a giant TX-0 computer that had been built for defense research and then donated to MIT. Within several years, these undergraduates were joined by a variety of Cambridge-area teenagers and MIT graduate students and began working with a series of computers donated by the Digital Equipment Corporation (DEC). By 1966 most of these young programmers gathered on the ninth floor of Technology Square, in Marvin Minsky's Artificial Intelligence (AI) Laboratory (just two blocks away from Norbert Wiener's old Rad Lab).

Within the AI Lab, wrote Levy, echoing Stewart Brand's 1972 piece for *Rolling Stone,* there were two kinds of workers: planners and hackers. The planners were theoreticians, usually of the mind, who thought of computers as tools that could be used to generate or model information. The hackers focused on the computer systems themselves and on seeing what they could do. Within the lab, a culture clash emerged. Theory-oriented graduate students, equipped with well-funded and well-organized careers but not necessarily with computer programming expertise, resented the hackers' claims for computer time, as well as their freewheeling style. David Silver, for instance, was then a fourteen-year-old hanger-on at the lab who solved a seemingly impossible problem in designing a robot insect. He recalls that his work "drove [the AI theoreticians] crazy . . . because this kid would just sort of screw around for a few weeks and the computer would start doing the thing they were working on that was really hard. . . . They're theorizing all these things and I'm rolling up my sleeves and doing it . . . you find a lot of that in hacking in general. I wasn't approaching it from either a theoretical point of view or an engineering point of view, but from sort of a fun-ness point of view."[59]

According to Levy, this point of view characterized the work of two subsequent generations of innovators. The first comprised the "hardware hackers" of the 1970s. Clustered in and around the San Francisco Bay area, they included the young founders of Apple Computer, Steve Jobs and Steve Wozniak, as well as early proselytizers for personal computing such as Lee Felsenstein, Bob Albrecht, and Ted Nelson, a programmer who had authored a volume loosely based on the *Whole Earth Catalog* entitled *Computer Lib: You Can and Must Understand Computers Now*. For this generation, Levy suggested, computing was a form of political rebellion. Computers may have always been large and centralized, they may have always been guarded by institutionalized experts, and they may have been used to organize the war in Vietnam, but this generation would put them to new uses.

The second generation to follow the AI hackers of MIT knew little of this countercultural legacy. They were the "young game hackers" of the early 1980s.[60] They had grown up working with the minicomputers that the previous generation had struggled to invent, and they had turned them to a new purpose: fun. This generation worked in the shadow of Atari, maker of the game PacMan; but unlike Atari, which was infamous among computer designers for its organizational hierarchy, they also aimed to maintain an open management structure within their organizations. According to Levy, their designers would be "hackers"—semi-independent, creative individuals—not drones.

Levy argued that although they had not met, members of all three generations shared a single set of six values, a "hacker ethic":

> Access to computers—and anything which might teach you something about the way the world works—should be unlimited and total. Always yield to the Hands-On Imperative! . . .
>
> All information should be free. . . .
>
> Mistrust Authority—Promote Decentralization. . . .
>
> Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race, or position. . . .
>
> You can create art and beauty on a computer. . . .
>
> Computers can change your life for the better.[61]

As Levy suggests, this ethic emerged at a time when the sharing of information allowed everyone to profit. Throughout the 1960s, MIT hackers made whatever programs they designed available to one another. In fact, one common way to become a member of the hacker elite was to take one of these programs, improve on it, and make it available once again. Such improvements clearly benefited everyone in the AI Lab. Yet this sharing of information also characterized relationships between the hackers, MIT, and local corporations such as DEC and Bolt, Baranek, and Newman—corporations that were to play a leading role in the development of the personal-computer industry and the Internet. For example, when one hacker needed a particular subroutine to help create a local version of Spacewar, he simply drove over to DEC and took it; likewise, when DEC salesmen wanted to show off their computers to potential clients, they did so by demonstrating a borrowed copy of Spacewar. As Levy explains, MIT and DEC had "an easy arrangement," since "the Right Thing to do was make sure that any good program got the fullest exposure possible because *information was free* and the world would only be improved by its accelerated flow."[62]

This ethic also accorded well with the values espoused in the *Whole Earth Catalog*. Like the *Catalog*, the hacker ethic suggested that access to tools could change the world, first by changing the individual's "life for the better" and, second, by creating art and beauty. In keeping with the *Catalog*'s habit of systems thinking, the hacker ethic characterized the tools themselves as prototypes: the computer was a rule-bound system that could serve as a model of the world; to study computers was to learn something about the world at large. Like the *Catalog*, the hacker ethic suggested that work should be organized in a decentralized manner and that individual ability, rather than credentials obtained from institutions, should determine the nature of one's work and one's authority. Finally, it insisted that access to both machines and information should be complete. Like the mystical energy that was supposed to circulate through the communes of the back-to-the-land movement, binding its members to one another, information was to circulate openly through the community of hackers, simultaneously freeing them to act as individuals and binding them in a community of like minds.

The hacker ethic helped make hackers particularly appealing to Stewart Brand and Kevin Kelly. Soon after Levy had shown them his book, Brand and Kelly got in touch with members of the hacking community, including Lee Felsenstein; Bill Budge, a software author; Andy Hertzfeld, a key member of Apple's Macintosh development team; and Doug Carlston, founder and president of Broderbund Software Inc. Together they invited some four hundred self-described hackers to pay ninety dollars each to join them, the Whole Earth crew, and about twenty mainstream journalists for a three-day weekend in November 1984 at Fort Cronkhite, a former army base in the Marin Headlands just across the Golden Gate Bridge from San Francisco.

At one level, the event was a master stroke of networking. Having been alerted to the existence of a new and potentially influential community by a member of their own Whole Earth network (Levy), Brand and Kelly reached out to that community and entrepreneurially extended and diversified their own networks. In that sense, Brand and Kelly bridged what sociologist Ronald Burt would call a "structural hole" between their own, largely countercultural, network and the networks that governed production within key parts of the computer and software industries. Steven Levy, of course, had made the first connection, along with Whole Earth staffers such as Art Kleiner, who had been talking with hackers like Lee Felsenstein about directions for the *Software Catalog*. Now Brand, Kelly, and others were building on these connections and opening a much broader road between the two communities. This outreach turned out to be of more than a little

short-term use as they worked to start up the *Whole Earth Software Catalog* and the *Review*. At another level, organizing the conference was an act of deep cultural scouting. As Kelly later recalled, he and Brand wanted to see whether hacking was "a precursor to a larger culture." In particular, he suggested, they wanted to "witness or have the group articulate what the hacker ethic was."[63] Brand and Kelly aimed to explore via the conference whether hackers might constitute the sort of cultural vanguard for the 1980s that the back-to-the-land and ecology crowds had hoped to be for the decade before.

Something like 150 hackers actually arrived. Among others, they included luminaries such as Steve Wozniak of Apple, Ted Nelson, free software pioneer Richard Stallman, and Ted Draper—known as Captain Crunch for his discovery that a toy whistle he found in a box of the cereal gave just the right tone to grant him free access to the phone system. Some of the hackers worked alone, part-time, at home; others represented such diverse institutions as MIT, Stanford, Lotus Development, and various software makers. Most had come to meet others like themselves. Their hosts offered them food, computers, audiovisual supplies, and places to sleep—and a regular round of facilitated conversations.

By all accounts, two themes dominated those conversations: the definition of a hacker ethic and the description of emerging business forms in the computer industry. The two themes were, of course, entwined. The hacker ethic that Levy described—the single thread ostensibly running through all of the participants' careers—had emerged at a moment when sharing products and processes improved profits for all. By the mid-1980s, however, the finances of computer and software development had changed radically. As Stewart Brand pointed out, in what would soon become a famous formulation, information-based products embodied an economic paradox. "On the one hand," he said, "information wants to be expensive, because it's so valuable. The right information in the right place just changes your life. On the other hand, information wants to be free, because the cost of getting it out is getting lower and lower all the time. So you have these two fighting against each other."[64]

Throughout the conference, hackers discussed different ways they had managed this dilemma. Some, like Richard Greenblatt, an early and renowned MIT hacker, argued that source code must always be made freely available. Others, like game designer Robert Woodhead, suggested that they would happily give away the electronic tools they had used to make products such as computer games, but they would not give away the games themselves. "That's my soul in that product," explained Woodhead. "I don't want anyone fooling with that."[65] In discussion Bob Wallace said he had

marketed his text editor PC-WRITE as shareware (in shareware, users got the software for free but paid if they wanted documentation and support), whereas Andrew Fluegelman indicated that he had distributed his telecommunications program PC-TALK as freeware (users voluntarily paid a small fee to use the software). Others, including Macintosh designer Bill Atkinson, defended corporate prerogatives, arguing that no one should be forced to give away the code at the heart of their software.

The debate took on particular intensity because, according to the hacker ethic, certain business practices—like giving away your code—allowed you to claim the identity of hacker. In part for this reason, participants in a morning-long forum called "The Future of the Hacker Ethic," led by Levy, began to focus on other elements of the hacker's *personality* and to modify their stance on the free distribution of information goods. For instance, participants agreed that hackers were driven to compute and that they would regard people who impeded their computing as bureaucrats rather than legitimate authorities. By and large, they agreed that although the free dissemination of information was a worthy ideal, in some cases it was clearly only an ideal. If they could not agree on proper hacker business practice, they could agree that being a hacker—in this case, being the sort of person who was invited to the Hackers' Conference—was valuable in its own right. Lee Felsenstein explained, "That little bit of cultural identity [was] extremely important." In the popular press, hackers had been characterized as machine-obsessed, antisocial, and potentially criminal loners. Gathered in the stucco halls of Fort Cronkhite, hackers could recognize themselves as something else. Lee Felsenstein recalls feeling empowered: "Don't avoid the word Hackers. Don't let somebody else define you. No apologies: we're hackers. We define what a hacker is . . . nobody else."[66]

In the end, the group did not come to any consensus on the right approach to take toward the emerging challenges of the software industry. But they had begun to reformulate their own identities, partially in terms of Whole Earth ideals. In the Hackers' Conference, Brand and company provided computer workers with a venue in which to develop and live a group identity around the idea of hacking and to make sense of emerging economic forms in terms of that identity. This work had the effect of rehabilitating hackers in the public eye, but it also explicitly and securely linked Whole Earth people and the Whole Earth ethos to the world of computing. Virtually all of the journalistic reports that came from the Conference echoed John Markoff's comments in *Byte* magazine: "Anyone attending would instantly have realized that the stereotype of computer hackers as isolated individuals is nowhere near accurate."[67] Some of

those same reports picked up on another theme as well, however. Several either quoted or paraphrased Ted Nelson's exclamation "This is the Woodstock of the computer elite!"[68] One listed Stewart Brand among the "luminaries of the personal computer 'revolution.'" Another described Brand as a "long-time supporter of hackers."[69] Quietly, almost without noticing it, the invited reporters had begun to intertwine the countercultural play of Woodstock, and countercultural players such as Brand, with an industry and a work style that had emerged within and at the edges of such culturally central institutions as MIT, Stanford, and Hewlett-Packard. Hackers were not simply highly individualistic and innovative engineers; they were cultural rebels.

In his introduction to a transcript of the Hacker Ethic forum hosted by Levy that he published in *Whole Earth Review,* Brand celebrated the hackers as simultaneously technical, economic, and cultural pioneers:

> I think hackers . . . are the most interesting and effective body of intellectuals since the framers of the U.S. Constitution. No other group that I know of has set out to liberate a technology and succeeded. They not only did so against the active disinterest of corporate America, their success forced corporate America to adopt their style in the end. In reorganizing the Information Age around the individual, via personal computers, the hackers may well have saved the American economy. High tech is now something that mass consumers do, rather than just have done to them. . . . The quietest of the '60s sub-subcultures has emerged as the most innovative and most powerful—and most suspicious of power.[70]

Much of Brand's account, of course, is true. Some hackers, most famously perhaps Wozniak and Jobs, did confront uninterested corporations (in their case, Hewlett-Packard). At a local level, some of the early AI hackers did indeed set out to "liberate" MIT's giant mainframes from the "planners," if only during overnight programming sessions. Yet, when set against the history of the Whole Earth publications, Brand's remarks seem less like an accurate, if somewhat hyped, history of several generations of computer engineers than a recasting of that history in terms of the Whole Earth's own countercultural concerns and intellectual trajectory. After all, wasn't it the *Whole Earth Catalog* that had set out to liberate technology from its corporate and governmental contexts? And wasn't it the *Catalog* that had promoted the notion that the right tools, properly used, could help reform society? Could perhaps even save the "mass" economy by "personalizing" it?

However, Brand was not simply rewriting history to his liking here. Something much subtler was going on. Brand had gathered a normally

geographically dispersed community under a single roof and literally given it voice. That community shared something of an ethic from the start, as Levy had shown, but it had other concerns as well—concerns with new working conditions and new digital technologies. Both Brand and the invited journalists built their accounts of those concerns on older symbolic foundations. That is, they linked the particular issues facing hackers to the broad themes of countercultural work generally and of the Whole Earth group in particular. They did not "report" a consensus generated by the invited hackers themselves so much as they melded the voices heard within the events' various forums with the principles along which those forums were organized and with the experience of unity within the forums. At the Hackers' Conference, Brand and his colleagues translated the individual experiences of three generations of hackers into a shared experience, an experience organized by Whole Earth people according to Whole Earth norms in the *Catalog*'s hometown.[71] In the post-event reporting, the concerns of conference-goers and the culture of the conference itself—the Whole Earth culture—became one, and Stewart Brand, rather than any of the hackers, arose as this fused culture's spokesman.

In the process, the New Communalist critique of technocracy was transformed into a tool with which to legitimate computer technologies and collaborative work styles that in fact emerged at the intersection of military, industrial, and academic research. As early as 1972, Brand had suggested that computers might become a new LSD, a new small technology that could be used to open minds and reform society. During the Super Bowl of 1984, Apple Computer introduced its Macintosh with a like-minded suggestion. Its mouse and monitor might have first been designed in research institutes funded by the Defense Department, but in the ad, a lithe blonde woman in a track suit raced up a theater aisle through row after row of gray-suited workers and threw a hammer into the maw of Big Brother on the screen. Thanks to the Macintosh, a voice then intoned, 1984 would *not* be like *1984*. Like the Merry Pranksters in their bus, the ad implied, the executives of Apple had unleashed a new technology on Americans that would, if they only embraced it, make them free.

By 1984 the New Communalist movement had disappeared. Nevertheless, thanks in large part to the entrepreneurship of Stewart Brand and the networks he assembled, its ideals lived on. In press accounts at least, the Long Hunter of the *Whole Earth Catalog,* the cultural adventurer who sought to inhabit an outlaw area, had become the Hacker. Equipped with the digital tools of his trade, he had converted the basements and back offices in which he worked into new, collaborative communities, from which he and his fellows would transform society. The world of the

New Communalists—the small-scale tools they treasured, the intense feelings of small-group camaraderie, and, above all, the faith that they were going to change the world—seemed to have come to life again. This time, though, the new world was being built not in the woods or on the open plains, but in the office, around the computer.

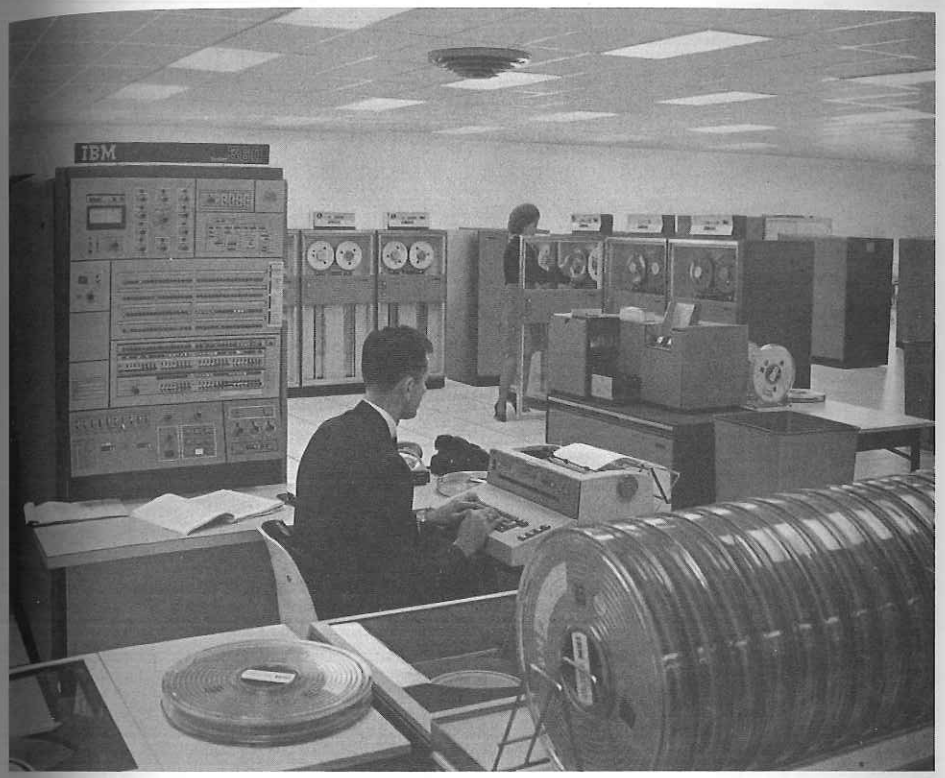


PLATE 1. Computing's state of the art in 1964, the IBM System/360. Courtesy of IBM Corporate Archives.

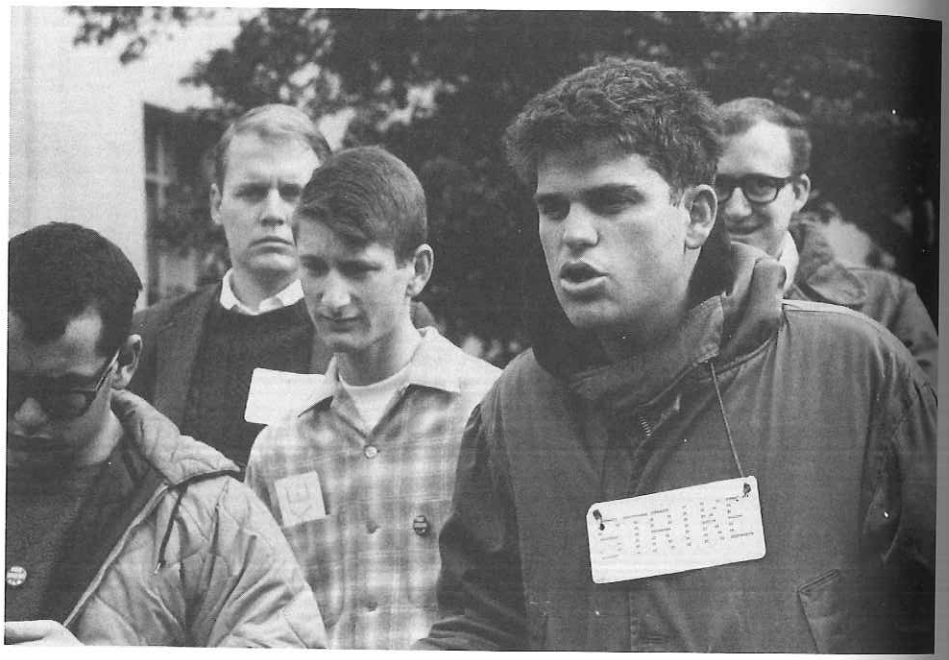


PLATE 2. Free Speech marchers at Berkeley wear computer cards as signs of protest, December 1964. Photograph by Helen Nestor. Used by permission of the photographer and by courtesy of the Helen Nestor Collection, the Oakland Museum of California.

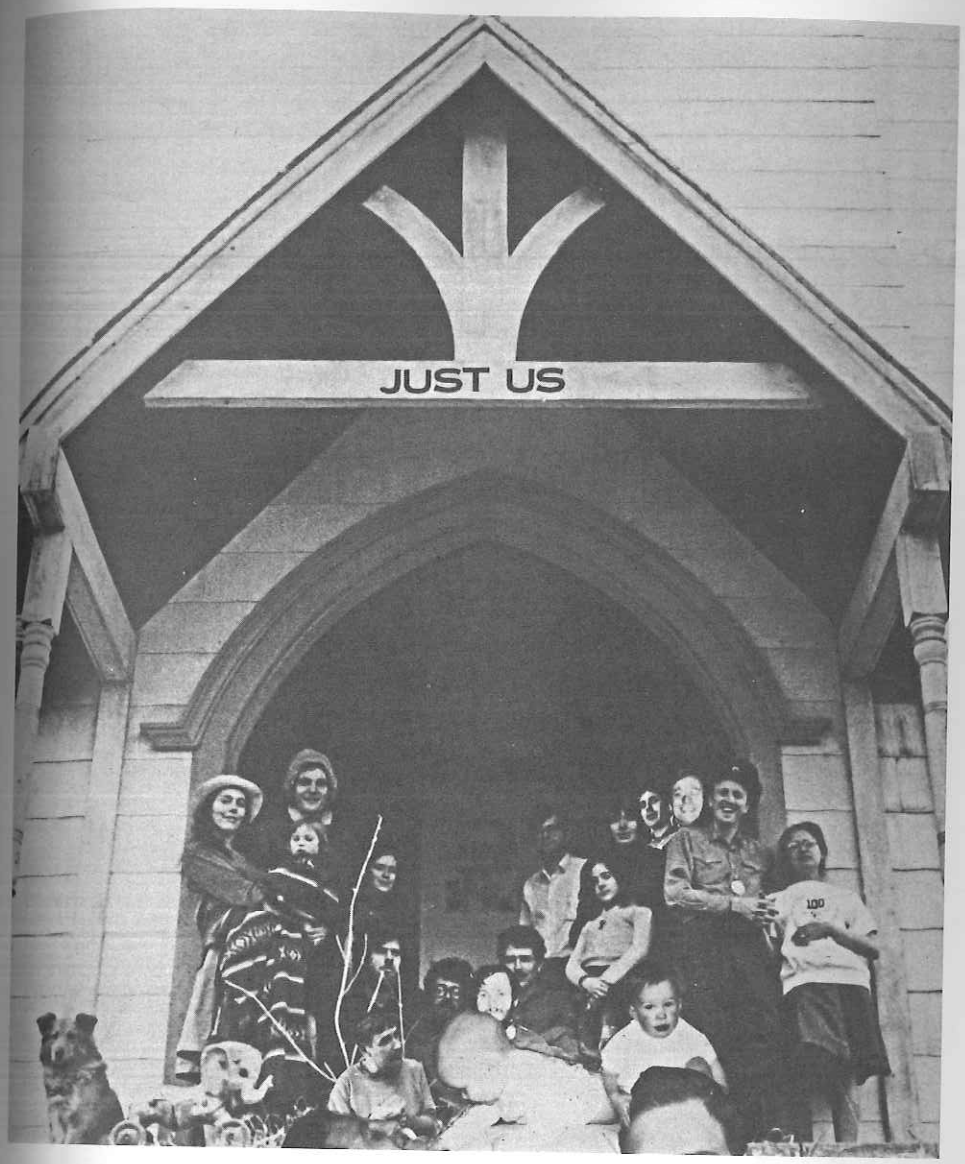


PLATE 3. A photo collage of the USCO art group in front of their Garnerville, New York, church sometime in the mid-1960s. Stewart Brand and his first wife, Lois, stand farthest to the right. Courtesy of Gerd Stern.

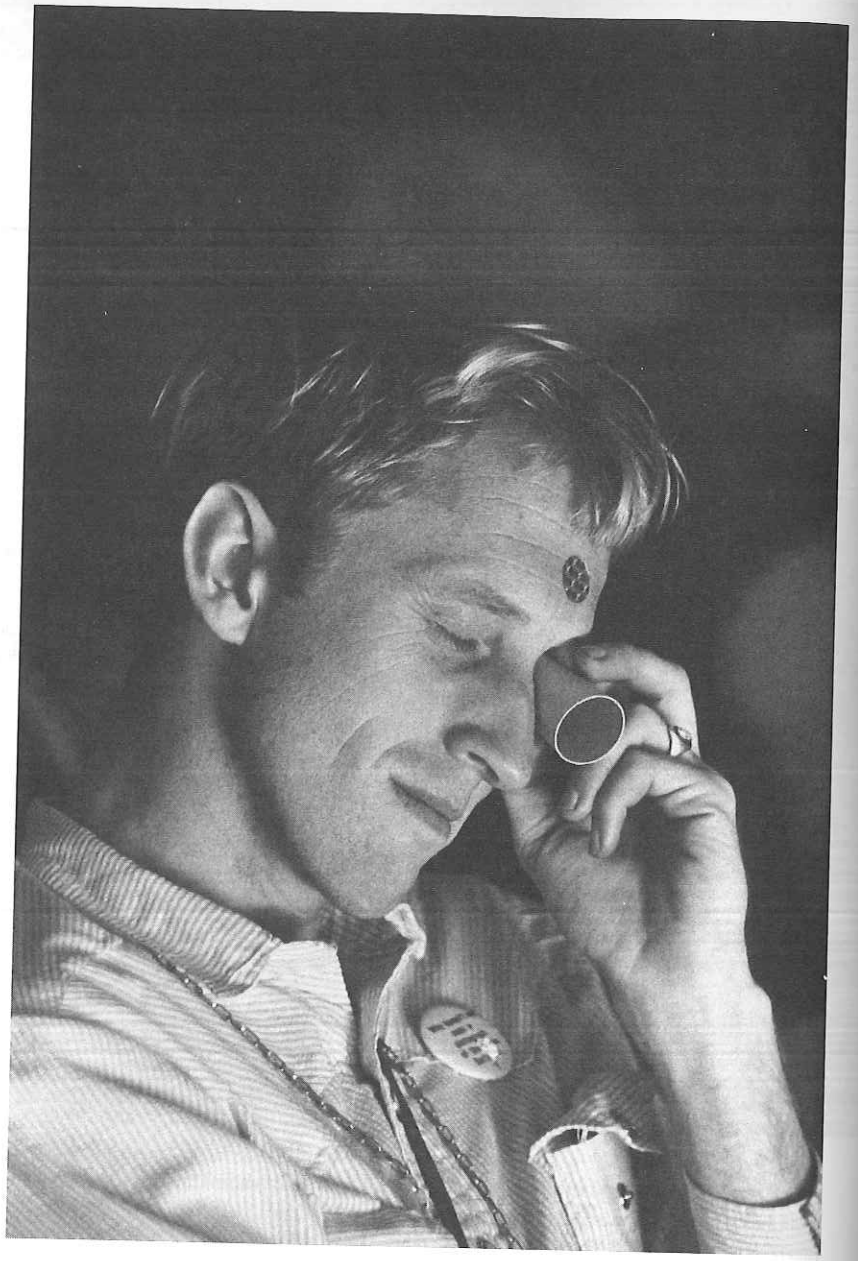


PLATE 4. Stewart Brand around the time of the Acid Test Graduation, October 1966. He is wearing a button that reads, "Why haven't we seen a photograph of the whole earth yet?" Photograph by Gene Anthony, © wolfgangsvault.com. Used by permission.

PLATE 5. A handbill for the Trips Festival. Note the oscilloscope at the center of the image. For many at the festival, both LSD and small electronic devices served as technologies for the transformation of consciousness.

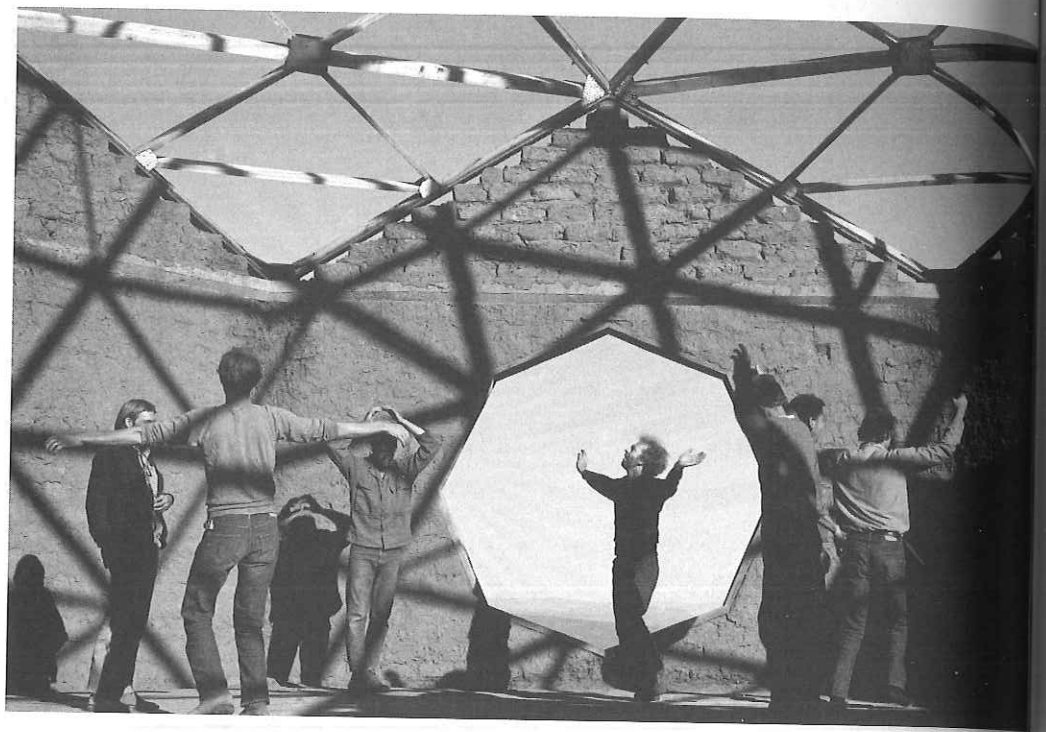


PLATE 6. Early residents of the Lama Foundation commune dance under a half-completed geodesic dome. Photograph © Dennis Stock. Used by permission of Magnum Photos.

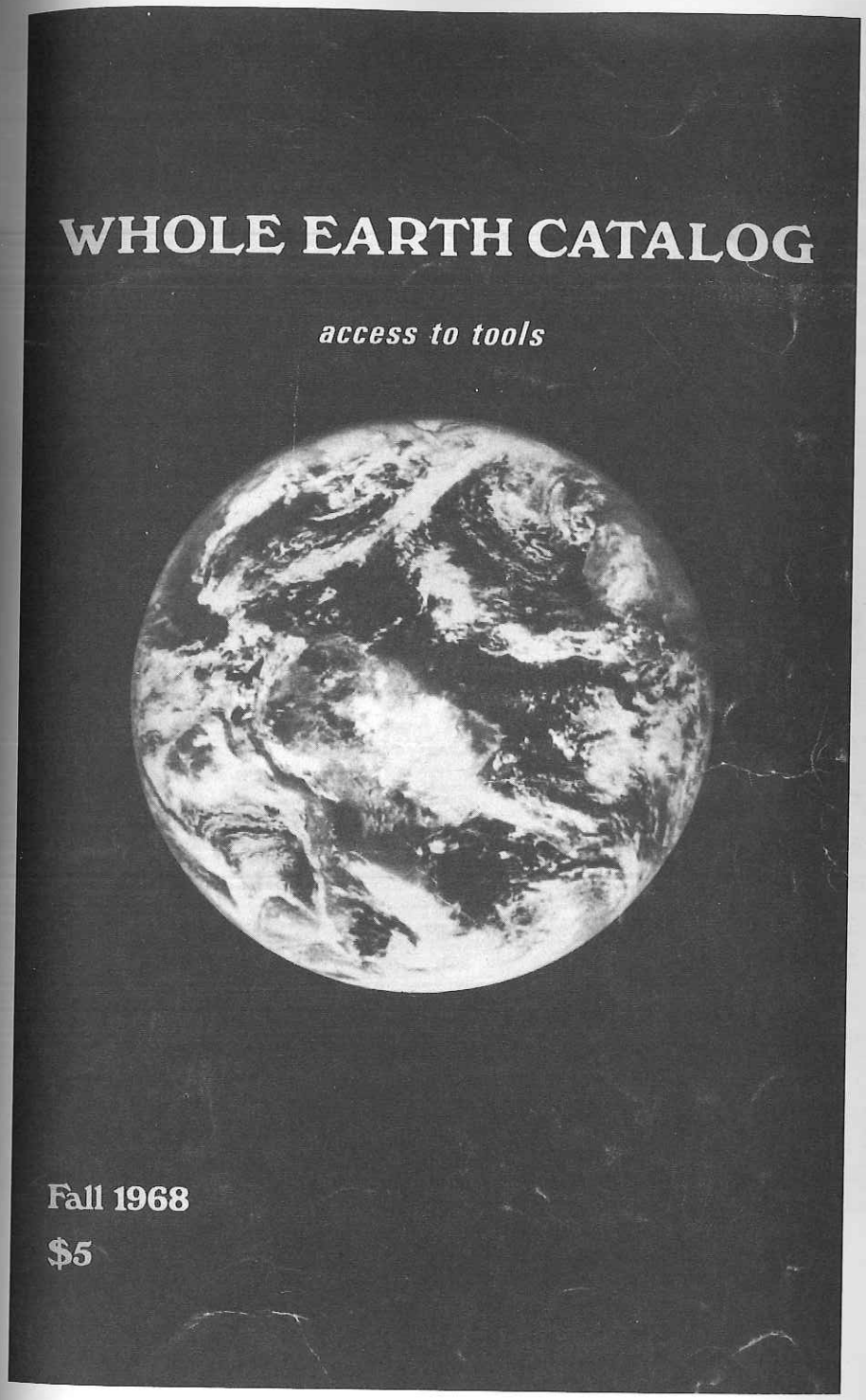


PLATE 7. The cover of the first *Whole Earth Catalog.* Courtesy of Stewart Brand and Stanford University Special Collections.

Buckskin

This is one of the best deals in the CATALOG. Buckskin in downtown San Francisco costs $1.50 a square foot; Leather Tanning offers the same material for 90¢ /sq.ft. postpaid anywhere in the U.S. The buckskin is chrome-tanned, which makes it more resistant to the effects of water than oil-tanned skin. The company also carries cowhide, elk skin, hair-on calf, etc. Orders for a dozen or more skins get 10¢/sq.ft. discount. Buckskins are generally 10-12 sq.ft. in size, calf skins smaller, elk skins larger. The shirt was made of two 12 sq.ft. buckskins.

Buckskin

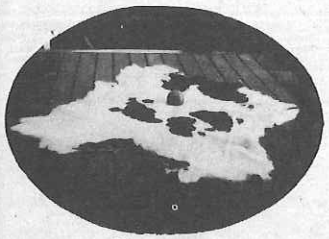
Buckskin
$.90 /sq.ft. postpaid

Hair-on-calf (clipped)
$1.80 /sq.ft. postpaid

Hair-on-calf (unclipped)
$1.60 /sq.ft. postpaid

from:
Leather Tanning Company
P.O. Box 2406a
San Francisco, California 94124

Buckskin



Hair-on calf (unclipped)

Cut Beads

In evaluating Indian beadwork, one of the first things you notice is whether the beads are cut or seed beads. Cut beads are slightly faceted so they reflect a scattered sparkling of light from the beadwork. They raise the value of the piece because (1) it is prettier, (2) the craftsman went to the extra trouble or expense to get cut beads, (3) the piece may be antique.

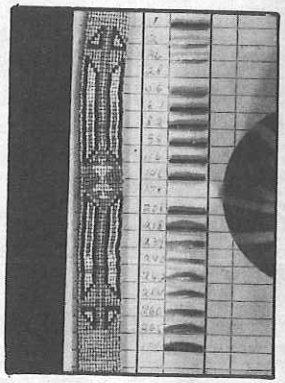
The single source of cut beads in America is Elliot Greene & Co Co. in New York. They sell a minimum of ½ kilo per color. Coax your bead pusher to stock up.

[Suggested by Michael Hoffman]

Cut Beads

$12.50 per ½ kilo

from:
Elliot Greene & Company, Inc.
37 West 37th Street
New York, N.Y. 10018



Melrose Yarns

Of the mail-order yarn catalogs that we've seen, this is the most complete, least expensive. Prices are comparable to or better than most yarn stores.

Melrose Yarns

Catalog and Sample Card
$.50

from:
Melrose Yarn Company, Inc.
1305 Utica Avenue
Brooklyn, New York 11203

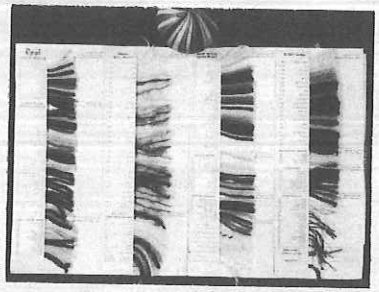


PLATE 8. Some of the items presented in the first *Whole Earth Catalog* suggested frontier handicraft. Courtesy of Stewart Brand and Stanford University Special Collections.

9100A Calculator

The best of the new table-top number crunchers is this Hewlett-Packard machine. It is programmable, versatile, and silent—more so than its competition. Portola Institute currently is using the 9100A to help kids gain early mastery over computers—it is a suberb inquiry machine.

Specs: 9100A can do addition, subtraction, multiplication, division, square root, log x, ln x, e^x, sin x, cos x, tan x, $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, sinh x, cosh x, tanh x, $\sinh^{-1}x$, $\cosh^{-1}x$, $\tanh^{-1}x$, polar to rectangular and vice versa co-ordinate transformations. Number range is 10^{-99} to 10^{99}. The magnetic core memory has 19 registers: 3 display and 16 storage. Display is decimal or floating point. Program capacity is 196 steps. Programming is done by pressing keys in proper sequence (no special language required). Programs may be stored on wallet sized magnetic cards. Typical operations take 2.2800 milliseconds. Weight of the machine is 40 lbs, dimensions 8"x16"x19"deep. Reportedly the following accesories will be available soon: printer, xy plotter, input/output interface.

[Suggested by Robert Albrecht]

HP 9100A

$4900.00 65 lbs shipping weight

from:
P.O. Box 301
Loveland, Colorado 80537

34 Communications

Cybernetics

McLuhan's assertion that computers constitute an extension of the human nervous system is an accurate historical statement. The research and speculation that led to computer design arose from investigation of healthy and pathological human response patterns embodied in the topological make-up of the nervous system. Insights here soon expanded into generalizations about communication that permitted the building of analgous electronic devices physically separate from the Central Nervous System. But they're just one artifact of these new understandings about communication. Society, from organism to community to civilization to universe, is the domain of cybernetics. Norbert Wiener has the story, and to some extent, is the story.

To predict the future of a curve is to carry out a certain operation on its past.

The central nervous system no longer appears as a self-contained organ, receiving inputs from the senses and discharging into the muscles. On the contrary, some of its most characteristic activities are explicable only as circular processes, emerging from the nervous system into the muscles, and re-entering the nervous system through the sense organs, whether they be proprioceptors or organs of the special senses. This seemed to us to mark a new step in the study of that part of neurophysiology which concerns not solely the elementary processes of nerves and synapses but the performance of the nervous system as an integrated whole.

The feedback of voluntary activity is of this nature. We do not will the motions of certain muscles, and indeed we generally do not know which muscles are to be moved to accomplish a given task; we will, say, to pick up a cigarette. Our motion is regulated by some measure of the amount by which it has not yet been accomplished.

I have spoken of the race. This is really too broad a term for the scope of most communal information. Properly speaking, the community extends only so far as there extends an effectual transmission of information. It is possible to give a sort of measure to this by comparing the number of decisions entering a group from outside with the number of decisions made in the group. We can thus measure the autonomy of the group. A measure of the effective size of a group is given by the size which it must have to have achieved a certain stated degree of autonomy.

Thus small, closely knit communities have a very considerable measure of homeostasis; and this, whether they are highly literate communities in a civilized country or villages of primitive savages. Strange and even repugnant as the customs of many barbarians may seem to us, they generally have a very definite homeostatic value, which it is part of the function of anthropologists to interpret. It is only in the large community, where the Lords of Things as They Are protect themselves from hunger by wealth, from public opinion by privacy and anonymity, from private criticism by the laws of libel and the possession of the means of communication, that ruthlessness can reach its most sublime levels. Of all of these anti-homeostatic factors in society, the control of the means of communication is the most effective and most important.

The mongoose begins with a feint, which provokes the snake to strike. The mongoose dodges and makes another such feint, so that we have a rhythmical pattern of activity on the part of the two animals. However, this dance is not static but develops progressively. As it goes on, the feints of the mongoose come earlier and earlier in phase with respect to the darts of the cobra, until finally the mongoose attacks when the cobra is extended and not in a position to move rapidly. This time the mongoose's attack is not a feint but a deadly accurate bite through the cobra's brain.

In other words, the snake's pattern of action is confined to single darts, each one for itself, while the pattern of the mongoose's action involves an appreciable, if not very long, segment of the whole past of the fight. To this extent the mongoose acts like a learning machine, and the real deadliness of its attack is dependent on a much more highly organized nervous system.

To use a biological analogy, the parallel system had a better homeostasis than the series system and therefore survived, while the series system eliminated itself by natural selection.

We thus see that a non-linear interaction causing the attraction of frequency can generate a self-organizing system.....

Cybernetics — or Control and Communication in the Animal and the Machine

Norbert Wiener
1948,1961; 212 pp.

$1.95 postpaid

from:
The M.I.T. Press
Cambridge, Mass. 02142
or
WHOLE EARTH CATALOG

PLATE 9. Other items represented the state of the art in high technology. Courtesy of Stewart Brand and Stanford University Special Collections.

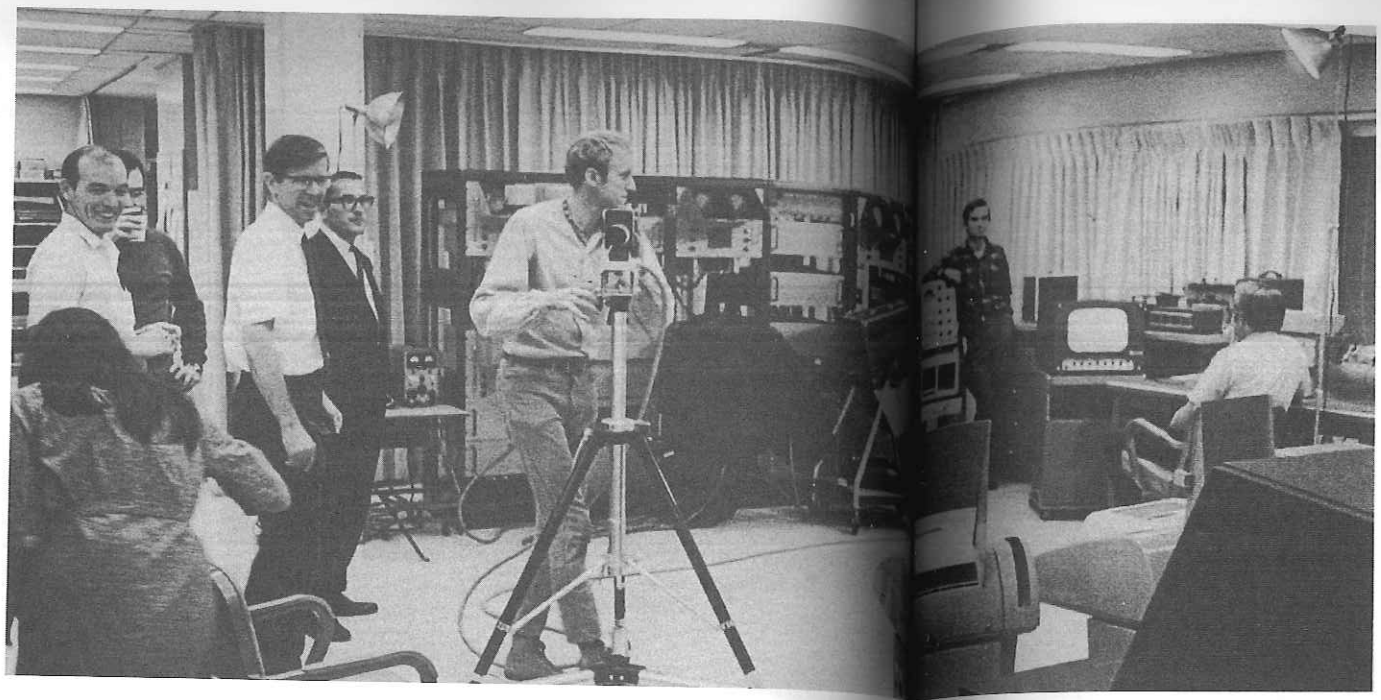


PLATE 10. In 1968 Brand manned a video camera for Douglas Engelbart's team at the Fall Joint Computer Conference held in San Francisco. The team demonstrated for the first time ever in public a computer system with the mouse-keyboard-screen combination interface that we now take for granted. Pictured here are Mary Church (*back to camera*), Marin Hardy, Dave Evans, Ed Van de Reit, Dan Lynch (?), Stewart Brand (*behind the camera*), Roger Bates, and Bill English (*sitting*). Courtesy of Douglas C. Engelbart and The Bootstrap Institute.

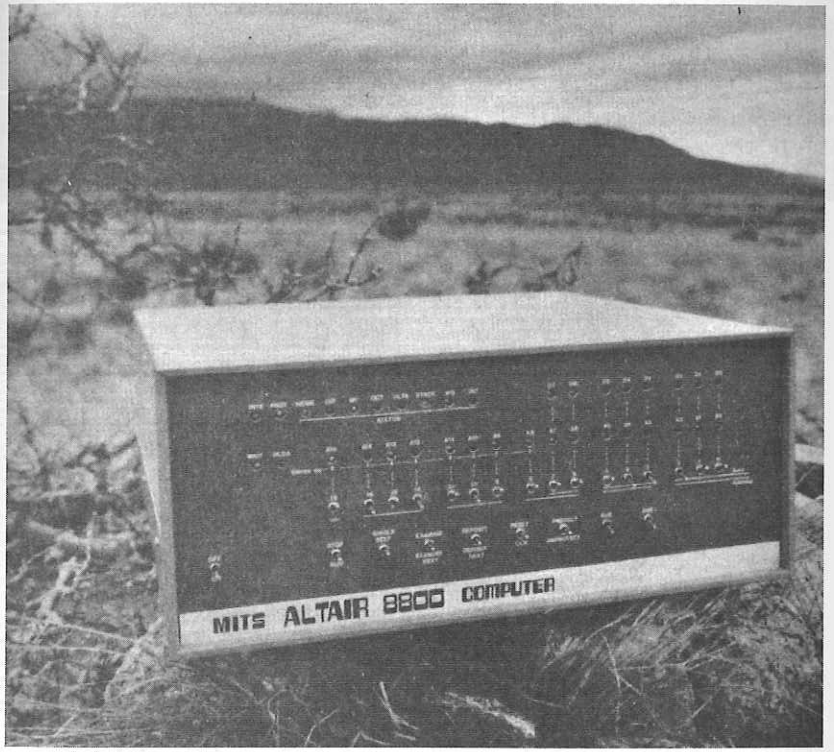


PLATE 11. The MITS Altair, one of the first minicomputers for hobbyists, depicted on the cover of the *People's Computer Company* as if it were a tool with which to return to nature. Courtesy of the *People's Computer Company*.

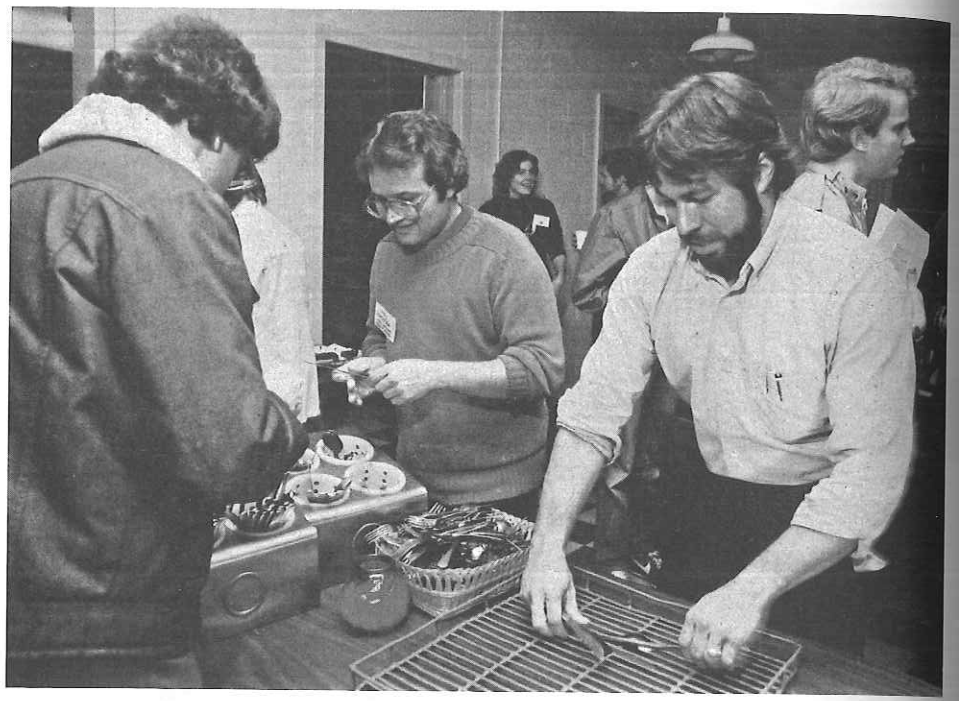


Plate 12. Apple cofounder Steve Wozniak (*right*) and Macintosh software designer Andy Hertzfeld help do the dishes at the first Hackers' Conference in 1984. © 1984 Matt Herron / Take Stock. Used by permission.

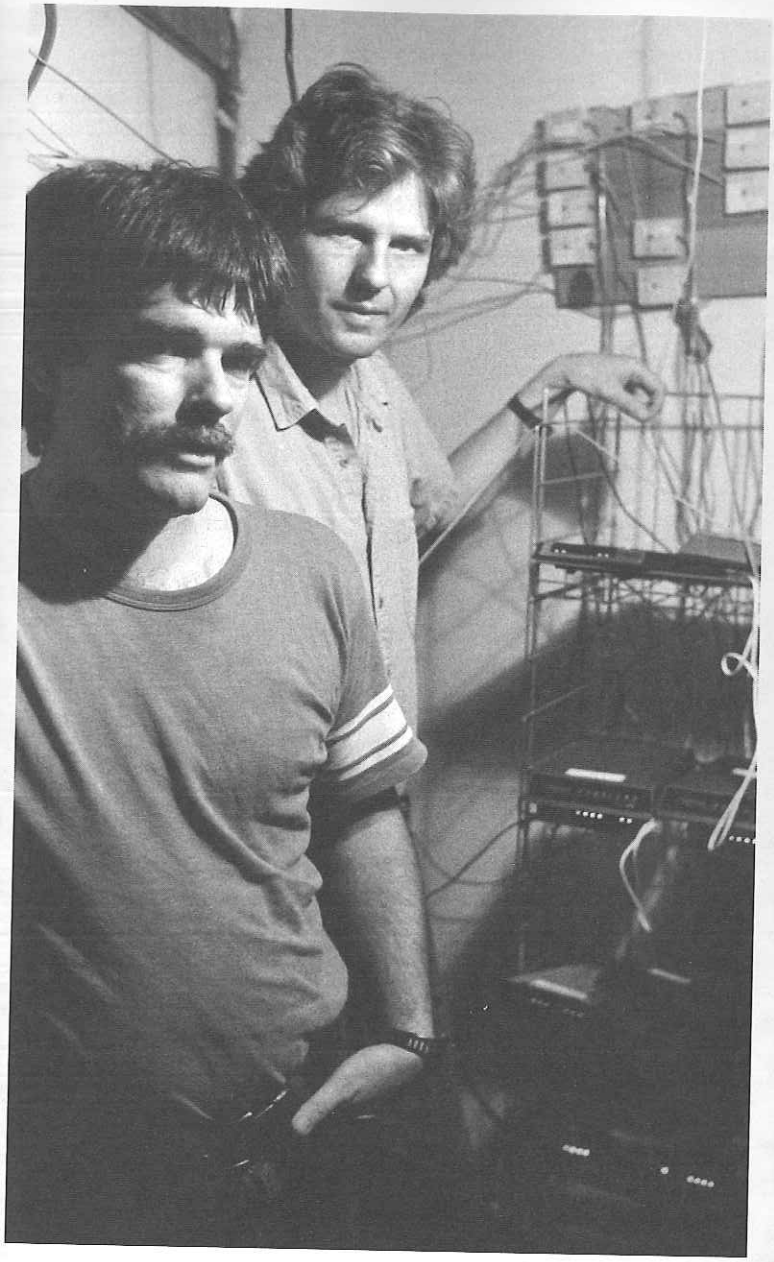


Plate 13. Cliff Figallo and John Coate, former members of the Farm commune, became early managers of the Whole Earth 'Lectronic Link, or WELL. They brought with them a deeply countercultural understanding of community. Photograph by Kevin Kelly. Used by permission.

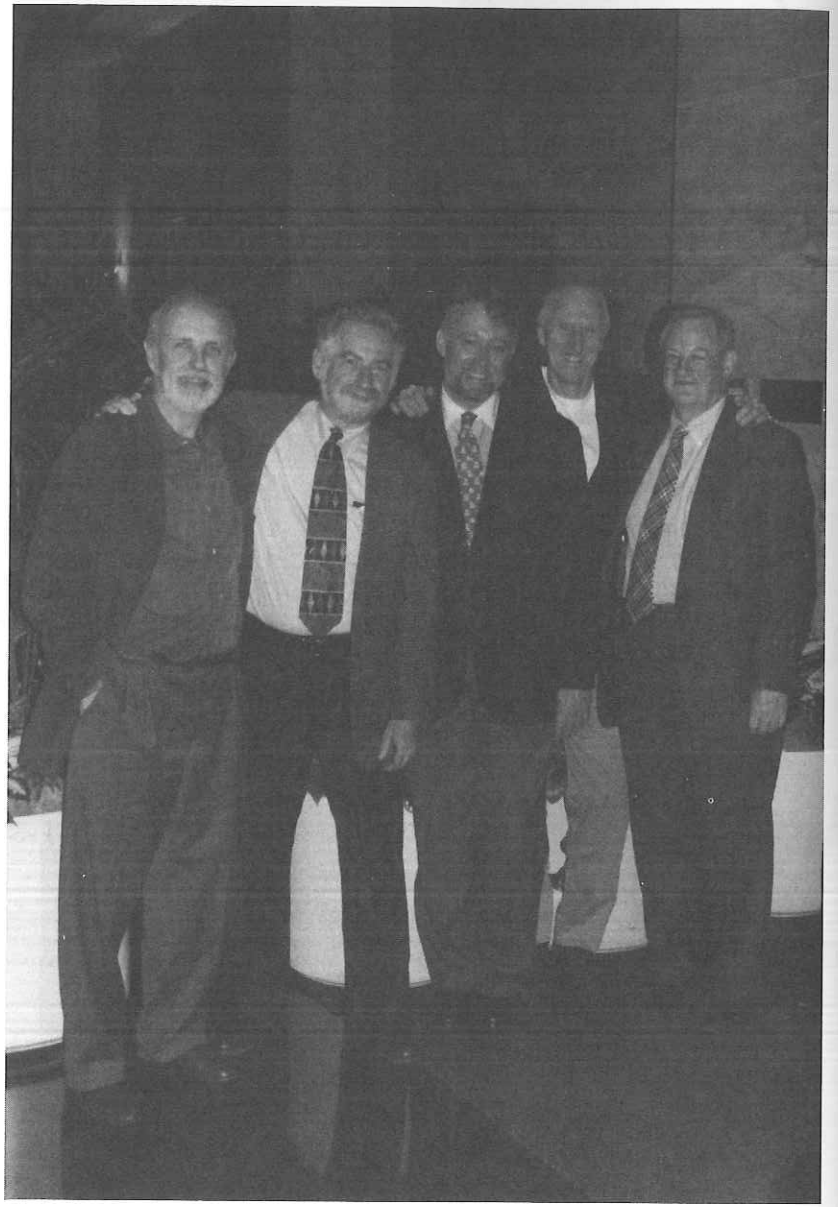


PLATE 14. In the late 1980s, Stewart Brand cofounded a corporate consulting firm, the Global Business Network. The founders are (*left to right*) Jay Ogilvy, Peter Schwartz, Lawrence Wilkinson, Brand, and Napier Collyns. Photograph by Mary Gribbin. Courtesy of the Global Business Network.

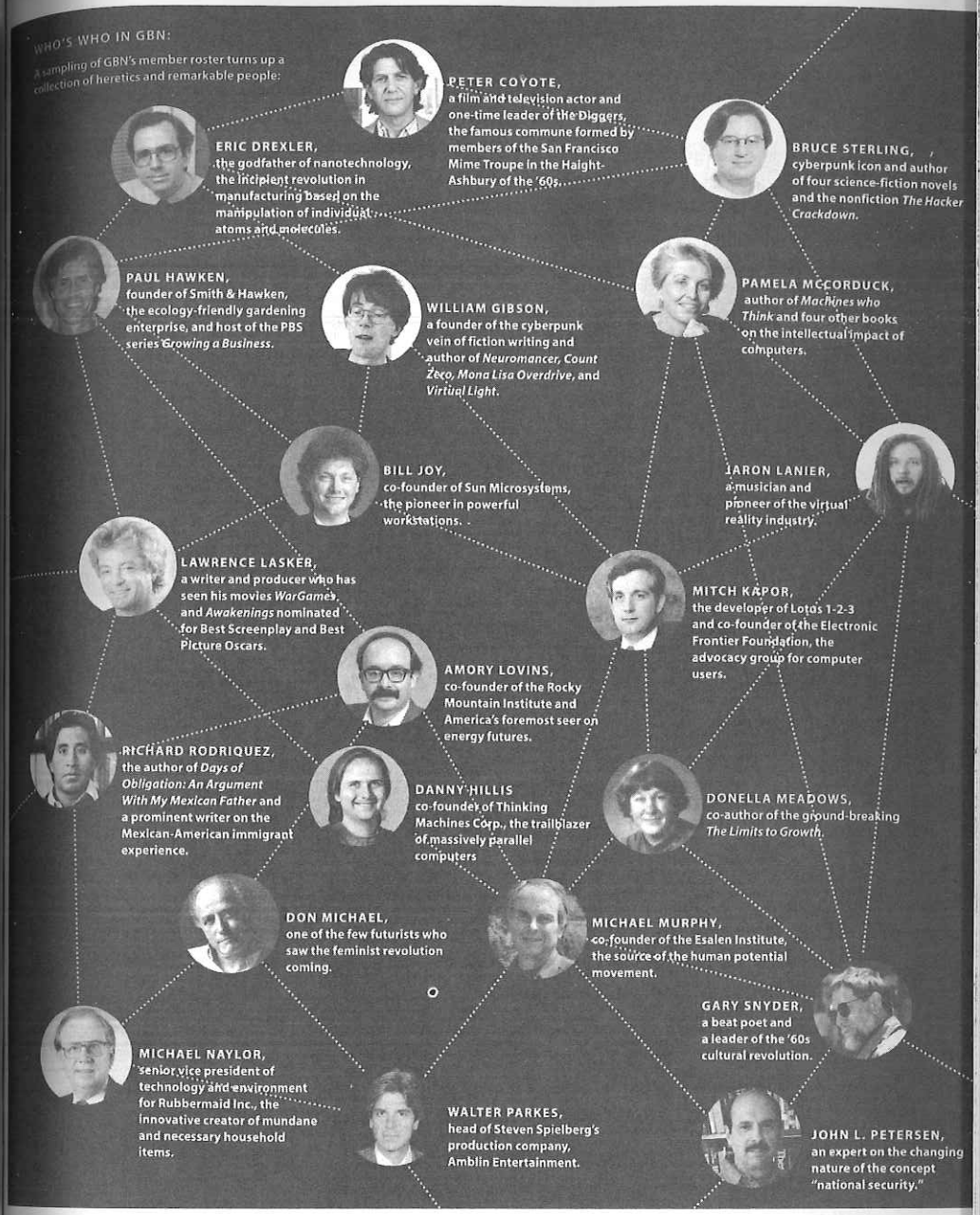


PLATE 15. Members of the Global Business Network depicted as nodes on the Internet in the pages of *Wired* magazine in November 1994. Those shown here include leading figures of the 1960s counterculture, such as poet Gary Snyder and actor Peter Coyote, cyberpunk authors William Gibson and Bruce Sterling, pioneer resource analyst and ecological advocate Amory Lovins, and leading technologists such as Jaron Lanier and Bill Joy. Courtesy of *Wired*, Condé Nast Publications Inc., and Global Business Network.

importance," he explained. In the short term, Keniston feared that antiwar activists would become frustrated at the failure to stop the conflict in Vietnam and would retreat into academe and the professions. "The field of dissent would be left to the alienated," he wrote, "whose intense quest for *personal* salvation, meaning, creativity, and revelation dulls their perception of the public world and inhibits attempts to better the lot of others."[27] In recent years, Keniston's fears seem to have come true, particularly in discussions of the social potential of the Internet and the World Wide Web. To many, these technologies still seem to promise what the strobe lights and LSD of the Trips Festival once offered the hippies of the Haight: access to a vision of the patterns underlying the world, and by means of that vision, a way to join one's life to them and to enter a global, harmonious community of mind. As both information technologies and the network mode of production have spread across the landscape, they have been celebrated as sites of personal and collective salvation. And to that extent, they have rendered their believers vulnerable to the material forces of the historical moment in which they live.

And yet, they have preserved a deeper dream as well. As they set off for the hills of New Mexico and Tennessee, the communards of the back-to-the-land movement hoped to build not only communities of consciousness, but real, embodied towns. Most failed—not for lack of good intentions, nor even for lack of tools, but for lack of attention to politics. To the extent that Stewart Brand and the Whole Earth group have succeeded in linking the ideals of those whom Kenneth Keniston called the alienated to digital technologies, they have allowed computer users everywhere to imagine their machines as tools of personal liberation. Over the past thirty years, this reimagining has helped transform the machines themselves, the institutions in which we use them, and society at large. Yet, as the short life of the New Communalist movement suggests, information and information technologies will never allow us to fully escape the demands of our bodies, our institutions, and the times in which we find ourselves. Much like the commune-bound readers of the *Whole Earth Catalog*, we remain confronted by the need to build egalitarian, ecologically sound communities. Only by helping us meet that fundamentally political challenge can information technology fulfill its countercultural promise.

Notes

Introduction

1. Negroponte, "Being Digital—A Book (P)review," 182.
2. See, e.g., Mitchell, *City of Bits;* Negroponte, *Being Digital;* Rheingold, *Virtual Community;* Stone, *War of Desire and Technology;* Turkle, *Life on the Screen.*
3. Warshaw, *Trouble in Berkeley,* 99.
4. "FSM Newsletter"; for a full history of the phrase, see Lubar, "Do Not Fold, Spindle, or Mutilate."
5. For an overview of these changes, see Ceruzzi, *History of Modern Computing* (1998).
6. Zuboff, *In the Age of the Smart Machine.*
7. Burt, "Network Entrepreneur," 281–307. See also Burt, *Structural Holes.*

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.
6. Barlow, "Declaration of the Independence of Cyberspace."
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."
9. Kelly, *New Rules for the New Economy,* 2, 160.
10. Kelly, "Computational Metaphor."
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.*
12. Edwards, *Closed World,* 94–107.

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.

19. Galison, "Trading Zone," 149.

20. Buderi, *Invention That Changed the World,* 98; Galison, "Trading Zone," 149; Guerlac, *Radar in World War II,* 233–48.

21. Buderi, *Invention That Changed the World,* 106; Galison, "Trading Zone," 152.

22. Leslie, *Cold War and American Science,* 20–43; Hughes, *Rescuing Prometheus,* 15–140.

23. Buderi, *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 Buderi, *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.

31. Heims, *John Von Neumann and Norbert Wiener,* 182–88. For a chronicle of Wiener's shifting relationship to the Rad Lab, see Conway and Siegelman, *Dark Hero of the Information Age,* 115–25.

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.

36. Heims, *John Von Neumann and Norbert Wiener,* 184.

37. Rosenblueth, Wiener, and Bigelow, "Behavior, Purpose, and Teleology"; Galison, "Ontology of the Enemy," 247; Wiener, *Cybernetics,* 15, 21. Shannon published his theory in a 1948 article, "Mathematical Theory of Communication." Shannon's theories rose to public prominence through his 1949 collaboration with Warren Weaver in *The Mathematical Theory of Communication.* There is some controversy over the question of how much Wiener's theory of messages owes to Shannon's theory of information. For detailed, if differing, accounts of this question, see Waldrop, *Dream Machine,* 75–82; and Conway and Siegelman, *Dark Hero of the Information Age,* 185–92.

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

39. Wiener, *Cybernetics,* 164–65.

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 servomechanisms 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.

45. Heims, *John Von Neumann and Norbert Wiener,* 302.

46. Bowker, "How to Be Universal," 108.

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.

62. Streeter, "That Deep Romantic Chasm," 52.

63. Albright and Perry, "Last Twelve Hours of the Whole Earth," 121, 122.

64. Beach, quoted ibid., 123.

Chapter 4

1. Brand, "We Owe It All to the Hippies," 54. Paul Freiberger and Michael Swaine, for example, describe one of the earliest home computers, the Altair, as a product of the "cultural revolution of the 1960s." *Fire in the Valley,* 111. In his foreword to Freiberger and Swaine's book, *New York Times* technology correspondent John Markoff explains that "it was a particular chemistry—not just greed and not just engineering, but also a strain of passionate political purity . . . that gave rise to the personal computer industry" (xiii). This notion guides Markoff's 2005 volume *What the Dormouse Said.* Even the most cautious historians have tended to accept this account. Thierry Bardini, in his thoroughly researched history of Douglas Engelbart's work, for example, argues that the personal computer was in part a product of the "generation of '68." *Bootstrapping,* 194.

2. Ceruzzi, *History of Modern Computing* (1998), 109–206.

3. Ibid., 143–206.

4. As late as May 1974, for instance, Hewlett-Packard identified its HP-65 calculator as a "personal computer" because it was portable, programmable, and designed for individual use. See Tung, "Personal Computer."

5. As scholars of other technologies have shown, engineers often draw on cultural resources to shape their machines and to define their meanings and potential uses. For an introduction to this literature, see Bijker, Hughes, and Pinch, *Social Construction of Technological Systems.* At the same time, this linking can be read as a species of a cultural process that Stuart Hall has analyzed under the rubric of "articulation." See Grossberg, "On Postmodernism and Articulation." See also Slack, "Articulation in Cultural Studies."

6. Bardini, *Bootstrapping,* xiii; Ceruzzi, *History of Modern Computing* (1998), 221; Pfaffenberger, "Social Meaning of the Personal Computer"; Freiberger and Swaine, *Fire in the Valley;* Levy, *Hackers.*

7. Markoff, *What the Dormouse Said.*

8. Bush, "As We May Think," quotation on 47.

9. Engelbart described how he became involved in computing, and his motivations, in an extensive interview by historian Thierry Bardini in 1996. See Bardini, *Bootstrapping,* 4–10.

10. For an exploration of Engelbart's debt to cybernetics, see ibid., 45–53. As Engelbart put it in 1988, "the workstation is the portal into a person's 'augmented knowledge workshop'—the [virtual] place in which he finds the data and tools with which he does his knowledge work, and through which he collaborates with similarly equipped workers." Quoted ibid., 219.

11. Ibid., 146; Waldrop, *Dream Machine,* 105–41, 18–23; quotations in Licklider, "Man-Computer Symbiosis," 74, 75.

12. For a complete history of Engelbart's role in the development of the ARPANET, see Bardini, *Bootstrapping,* 182–214. In 1966 Engelbart and his colleague Bill English participated in an experiment led by Willis Harman to test the impact of LSD on creativity. Like Stewart Brand, they were given the drug in a laboratory setting. For Engelbart, at least, the drug offered little of the sort of creativity enhancement he hoped computers would bring about. "The psychedelics took me so high that I was useless to the experiment," he recalled in 2004. "I ended up without the slightest inclination that it would help me be productive in what

I was trying to do." Interview, August 1, 2004. For an account of the ARC group's involvement with EST, see Bardini, *Bootstrapping,* 201–14; for a thinly veiled memoir of the period at SRI, see Vallee, *Network Revolution.* Quotation in text from Engelbart, interview, August 1, 2004.

13. Bill English, interview, July 27, 2004; Engelbart, interview, August 1, 2004.

14. Brand et al., *Whole Earth Catalog $1,* 52.

15. Andries Van Dam, quoted in Bardini, *Bootstrapping,* 138.

16. For accounts of audience responses to the NLS demo, see ibid., 138–42; and *Engelbart's Unfinished Revolution.*

17. Brand, interview, July 24, 2001.

18. Hiltzik, *Dealers of Lightning,* 67.

19. English, interview, July 27, 2004. For extensive accounts of PARC's internal politics, see Hiltzik, *Dealers of Lightning;* and Smith and Alexander, *Fumbling the Future.*

20. Alan Kay, interview, August 5, 2004. For more on the *Catalog*'s influence at PARC, see Kay, "Turning Points."

21. Kay, interview, August 5, 2004; Larry Tesler, interview, July 26, 2001.

22. Bob Albrecht, interview, July 22, 2001.

23. Another influential figure who took advantage of the *Whole Earth Catalog* in this way was Ted Nelson. In 1974 he modeled his much-cited *Computer Lib: You Must Understand Computers Now!* after the *Catalog.* See Nelson, *Computer Lib; Dream Machines,* 6.

24. Felsenstein, interview, July 18, 2001.

25. Brand, "Spacewar," 56; Colstad, "Community Memory"; Lipkin, "Public Information Network."

26. Freiberger and Swaine, *Fire in the Valley,* 115; Felsenstein, "Sol"; Felsenstein, interview, July 18, 2001.

27. Keith Britton, personal communication, July 18, 2004.

28. For a history of Spacewar, see Lowood, "Biography of Computer Games"; and Lenoir, Lowood, and Stanford Humanities Laboratory, *How They Got Game;* Brand, "Spacewar," 50.

29. Brand, "Spacewar," 51, 58.

30. Dennis Allison, interview, July 26, 2004; Hiltzik, *Dealers of Lightning,* 156–62.

31. Gitlin, *Sixties,* 408.

32. Gardner, *Children of Prosperity,* 46, 91, 116, 240–41. For an analysis of the variance in governance strategies deployed on communes, see Kanter, "Leadership and Decision-Making."

33. For more on this transition, see Heelas, *New Age Movement;* and FitzGerald, *Cities on a Hill.*

34. Carroll, *It Seemed Like Nothing Happened,* 128.

35. *Newsweek,* March 4, 1974, quotation on 132.

36. The eight-hundred-thousand-dollar figure comes from Brand's "Notebooks," September 15, 1971. Quotations ibid., August 20, 1971; and Brand, "History," 752.

37. Brand, "Local Dependency."

38. *CoEvolution Quarterly* 1 (Spring 1974), inside front cover.

39. Hayles, *How We Became Posthuman,* 16, 10, quotation on 16.

40. Heims, *Social Science for Post-War America,* 14, 16. For a full account of the Macy Conferences and their effects, see Heims, "Bateson and the Mathematicians"; Heims, *Social Science for Post-War America;* Hayles, *How We Became Post-Human.* For a critical look at the legacy of systems theory and cybernetics, see Lilienfeld, *Rise of Systems Theory.*

41. Quotations in Bateson, "Form, Substance, Difference," 468; and Bateson, "Effects of Conscious Purpose on Human Adaptation," 448. For more extensive interpretations of Bateson's intellectual career, see Berman, *Reenchantment of the World;* and Harries-Jones, *Recursive Vision.*

42. In testimony to the State Senate of Hawaii in March 1970, for example, Bateson ascribed the ecological crisis to a combination of "technological advance; . . . population increase; and . . . conventional (but wrong) ideas about the nature of man and his relation to the environment." Bateson, "Roots of Ecological Crisis," 496. Quotations in text in Bateson, "Effects of Conscious Purpose on Human Adaptation," 451–52.

43. For a study of the Whole Earth network's links to the alternative technology movement, see Kirk, "Machines of Loving Grace"; and Kleiman, "Appropriate Technology Movement," 154–216. For more broad-brush analyses of the alternative technology movement and its achievements, see Rybczynski, *Paper Heroes;* Willoughby, *Technology Choice;* Winner, "Building the Better Mousetrap," 61–84.

44. Harries-Jones, *Recursive Vision,* 6, 73–75, 103.

45. Brand, "Space Colonies," 4; Kleiman, "Appropriate Technology Movement," 190–91. For a full account, see O'Neill, *High Frontier.*

46. Wendell Berry, letter, *CoEvolution Quarterly* 9 (Spring 1976), 8–9, reprint in Brand, *Space Colonies,* 36–37.

47. Gurney Norman, letter, *CoEvolution Quarterly* 9 (Spring 1976), 48, reprint in Brand, *Space Colonies,* 69.

48. Brand, "Sky Starts at Your Feet," 6.

49. Kirk, "Machines of Loving Grace," 374.

50. Kleiner, "History of *CoEvolution Quarterly,*" 335.

51. Quoted in Langway and Abramson, "Whole Earth Revisited," 100.

52. Ibid.

53. Ceruzzi, *History of Modern Computing* (1998), 207–80; *Time,* January 3, 1983.

54. St. John, "Agent Provocateur," 106.

55. Hiltz and Turoff, *Network Nation,* 18–27, 117–21; Kelly, "Birth of a Network Nation." Quotations from Brand, interview, July 24, 2001; and Stewart Brand, [untitled], *CoEvolution Quarterly* 37 (Spring 1983), 152.

56. Brand, interview, July 24, 2001.

57. Kelly, interview, July 27, 2001.

58. Felsenstein, interview, July 18, 2001; Levy, *Hackers,* 9.

59. Quoted in Levy, *Hackers,* 104.

60. Ibid., x.

61. Ibid., 27–33.

62. Ibid., 77 (original emphasis).

63. Burt, *Structural Holes;* Kelly, interview, July 27, 2001.

64. Schrage, "Hacking Away at the Future"; Markoff, Robinson, and Shapiro, "Up to Date"; Elmer-DeWitt, "Let Us Now Praise Famous Hackers"; Brand, "Keep Designing." Quotation in Brand, "Keep Designing," 49.

65. Quoted in Brand, "Keep Designing," 48.

66. Ibid.; Felsenstein, interview, July 18, 2001.

67. Markoff, Robinson, and Shapiro, "Up to Date."

68. Schrage, "Hacking Away at the Future"; Markoff, Robinson, and Shapiro, "Up to Date."

69. Markoff, Robinson, and Shapiro, "Up to Date"; Florin and New Dimension Films, *Hackers.*

70. Brand, "Keep Designing," 44.

71. As Michelle Callon puts it, "To translate is to displace. . . . But to translate is also to express in one's own language what others say and want, why they act in the way they do and how they associate with each other; it is to establish oneself as a spokesman. At the end of the process, if it is successful, only voices speaking in unison will be heard." "Some Elements of a Sociology of Translation," 223, quoted in Star, "Power, Technologies and the Phenomenology of Conventions," 45. In that essay Star offers an excellent account of how network benefits can redound to the perceived "executive" at the heart of that network—in this case, Brand.

Chapter 5

1. The WELL still exists; it now employs the "WELL Engaged" system, which has full HTML capabilities. This chapter focuses on the WELL from its inception in 1985 to 1992. In 1992 the last of the WELL's early managers, Cliff Figallo, left; the number of members had increased drastically; and the WELL's character had begun to change substantially. The Point Foundation sold its 50 percent ownership stake in the system to Bruce Katz in 1994.

2. For the importance of informal social networks to employment in the region in this period, see Saxenian, *Regional Advantage.* To get a glimpse of how important the WELL was to its members' employment, see the archives of the WELL's "Work" conference at http://engaged.well.com/engaged.cgi?c=work.

3. Hafner, "Epic Saga of the WELL."

4. Brand, interview, July 24, 2001. Brand was also influenced in this decision by the fact that he had recently begun participating on the EIES network. He had found the conversations there exciting, and he hoped to spark a similar use of the WELL.

5. No formal accounting of early WELL membership exists today. Howard Rheingold estimates that some 600 people were using the WELL when he joined in the summer of 1985. "Slice of My Life in My Virtual Community," 430. Marc A. Smith estimates that that number had grown to approximately 6,600 by 1992. "Voices from the WELL," 8.

6. Quoted in Rheingold, *Virtual Community* (1993), 43.

7. Many of the WELL's archives from this period were lost as the system migrated across a series of different servers. For overviews of the conferences and topics in this period, see Smith, "Voices from the WELL," 8–9; and Rheingold, *Virtual Community* (2000), 32–35.

8. Glossbrenner, *Handbook of Personal Computer Communications,* 156, 160–67.

9. Hafner, *The Well,* 11.

10. Coate, *Cyberspace Innkeeping.*

11. Quoted in Hafner, *The Well,* 13.

12. Cliff Figallo, "Small Town on the Internet Highway."

13. Barayón quoted in Hafner, "Epic Saga of the WELL"; Coate and Figallo, "Farm Stories," Coate quotations on 96, 99; Figallo quotation on 92.

14. Bates, *Post-Communal Experiments at the Farm.* See also Fike, *Voices from the Farm.* At its peak in the late 1970s, the Farm had about fifteen hundred members. Most lived on the Farm. Others lived in satellite communities in Washington, D.C., Manhattan's South Bronx, Wisconsin, Florida, California, and Missouri. In 1974 the Farm established its own version of the Peace Corps, which was called Plenty. Plenty created development and public health projects in Guatemala, Lesotho, Washington, D.C., and the South Bronx. Today Plenty