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Environmental History, Vol. 6, No. 3. (Jul., 2001), pp. 374-394.

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Appropriating Technology

The *Whole Earth Catalog* and Counterculture Environmental Politics

Andrew Kirk

"We are as gods, and might as well get good at it."
—Stewart Brand, *The Whole Earth Catalog*, 1968.

When Stewart Brand issued his clarion call for technological acceptance in the opening lines of the first *Whole Earth Catalog*, the American environmental movement was in the middle of significant ideological and political reorientation. Until the mid-1960s, most environmental advocacy aimed at preserving American wilderness from industrial development and urban encroachment. Environmental activists from John Muir to Howard Zahniser focused the environmental debate on the problems of industrial technology and constructed a sharp dichotomy between nature and human civilization. In this ideological tradition, wilderness became the ultimate symbol of environmental purity and abundance with the polluted modern technological city its antithesis. This bipolar, often antimodernist, framework served conservation and preservation activists well in early fights to convince the American public of the reality of scarcity and the necessity for preservation of some forestlands and remote natural treasures.[1] This simple dichotomy was less effective when applied to increasingly complex environmental and social politics after the mid-1960s.

Following the 1964 passage of the Wilderness Act, environmental activism was enmeshed in the social struggles, political upheaval, and cultural tensions of the 1960s. A new generation of counterculture environmentalists struggled to resolve long-standing tensions between the modernist faith in Progressive reform and the antimodernist distrust of technology and desire to return to a simpler time. The success of the wilderness movement created an ideological crisis for environmentalists who found it increasingly difficult to define their movement in terms of progress vs. preservation. The spirit of cooperation that united a diverse coalition of environmental advocates behind the banner of wilderness disintegrated in the years after the passage of the Wilderness Act, and environmental politics became increasingly complicated and the boundaries of the debate harder to define.[2] Almost immediately after the successful passage of the Wilderness Act, wilderness ceased to be a defining

environmental issue. As the 1960s progressed, Americans increasingly focused less on preserving a pristine nature and more on preserving the whole environment.

The tensions between modernist desires for a technological fix and antimodernist dreams of a wilderness utopia, always simmering below the surface of wilderness politics, came bubbling to the surface again in the mid-1960s. A new generation of counterculture environmentalists, invigorated by New Left politics, attempted to move beyond the progress vs. preservation debate and redefine the parameters of the environmental movement. Counterculture environmental politics embraced the seemingly contradictory notion that the antimodernist desire to return to a simpler time when humans were more closely tied to nature could be achieved through technological progress. Counterculture environmentalism simultaneously encompassed both antimodernsim *and* modernism. Nowhere is this apparent contradiction more visible than in the pages of the *Whole Earth Catalog* (*WEC*) where primitive wood stoves and survivalist supplies for counterculture neo-Luddites share the page with personal computers, geodesic domes, and oscilloscopes.[3] Inside the covers of *WEC,* the seemingly neat bipolar world of twentieth-century environmental politics becomes a messy melange of apparently incongruous philosophies and goals.

Prior to the rise of the counterculture environmentalists, twentieth-century environmental politics only *appeared* to be neatly bipolar. In fact, the jarring juxtapositions on the pages of *WEC* only highlighted old and deep tensions in American environmental politics. Henry Thoreau was a pencil designer and entrepreneur. John Muir began his adult life as an inventor locally renown for his mechanical genius, and Aldo Leopold was a scientific forester. All of them struggled to reconcile their modernist epistemology and technological enthusiasm with their antimodern desire to restore purity to nature. Environmental historians are well aware of these struggles but tend to downplay the complex relationship between technological enthusiasm and environmental advocacy, stressing instead the ways these and other environmentalists transcended materialism and technocracy and offered alternative visions for American society.

Historical actors in the drama of twentieth-century environmental advocacy are often rated on a sliding scale according to the purity of their wilderness vision. Using this system, most environmental historians have ranked Thoreau, Muir, and Leopold high on the scale for their early, and seemingly complete, conversions to the wilderness ethic. Like fundamentalists, environmentalists and environmental historians love their prodigal sons—if you never saw that "fierce green fire," you might as well go home. Those who fail to make the full conversion are generally left out of the canon. Ambivalent conservationists who questioned the wilderness trope are ignored or ranked low on the scale of significant environmental figures.[4] The wilderness purity test tends to aim analysis of environmentalism toward the areas where environmental politics appear black and white, and the actors in the drama are easier to pigeonhole. This overenthusiasm for wilderness prodigals is counterproductive and helps foster a misleading sense of ideological purity in environmental politics that is not supported by the historical record. Historian William Cronon's "trouble with wilderness" stems from his belief that by venerating a mythically pure wilderness we cede ground in the rest of the environment where most of us live.[5] Giving precedence to purity in wilderness philosophy similarly causes problems for environmental history. It makes it too

easy to paint American perceptions of technology and the environment in black and white when shades of gray often prevail—as if you have to choose between wilderness or civilization. The bipolar division of the environment into pure wilderness and impure everything else has deeply compromised environmentalism and sometimes skews environmental history. A look at *WEC* and the counterculture political milieu from which it grew can provide a welcome corrective to the wilderness trope in environmental history.

To understand post-1960 environmentalism, environmental historians must turn away from John Muir and Aldo Leopold and look more closely at E. F. Schumacher, Amory Lovins, Murray Bookchin, Stewart Brand, and the generation of environmentalists who struggled to craft an environmental philosophy that recognized that humans "were as gods, and might as well get good at it."

Whole Earth's Counterculture Roots

Popular representations of counterculture environmentalists often include stereotypical back-to-nature communes complete with bearded wilderness advocates and naked children draped in flowers living off edible plants. It was not uncommon for younger environmentalists inspired by a renewed interest in the life and writings of Thoreau, Muir, and an emerging group of countercultural environmental prophets such as Gary Snyder to drop out and take to the woods. During the 1960s and 1970s, many counterculture environmentalists did in fact reject the modern world of large-scale technological systems in favor of a simpler, more primitive, and environmentally conscious lifestyle.[6]

At the same time, other counterculture environmentalists moved in an entirely different direction. Influenced by New Left politics, this faction critically reevaluated longstanding assumptions about the relationship between nature, technology, and society. In particular, these environmentalists replaced the wilderness focus that dominated 1960s environmentalism with a more encompassing ecological sensibility that embraced new technologies. In the late 1960s and 1970s, technologically minded counterculture environmentalists helped reshape the American environmental movement, infusing it with a youthful energy and providing it with a new sense of purpose and direction. These new counterculture environmentalists embraced *alternative technologies* as a solution to contemporary concerns about pollution, overpopulation, and the realization that America was entering a new phase in its development.

This new phase was envisioned as a "post-scarcity" economy, where advanced industrial societies theoretically possessed the means to provide abundance and freedom and reconcile nature and technology if only they choose to do so.[7] Led by New Left social theorists such as Herbert Marcuse and Murray Bookchin, post-scarcity adherents shared the belief that "the poison is . . . its own antidote."[8] In other words, technology used amorally and unecologically created the social and environmental problems of industrial capitalism. Technology used morally and ecologically could create a revolution that inspired a utopian future. The New Left critics emphasized that social and environmental problems in America stemmed not from a lack of

resources but from a misguided waste of the "technology of abundance."[9] If, these critics argued, the American people could be convinced to abandon their bourgeois quest for consumer goods, then valuable resources could be redirected toward establishing social equity and ecological harmony instead of consumerism and waste. In the late 1960s, post-scarcity assumptions fueled a brief period of technology-based utopian optimism that profoundly influenced a generation of environmentalists.

This thoughtful reevaluation of the role of technology in American society and politics is perhaps the most significant and lasting contribution of the counterculture to American culture and a critical step in the evolution in environmentalism. The move away from antimodernism manifested itself in many ways, from Buckminster Fuller designing affordable and environmentally sympathetic geodesic domes to Steve Jobs and Steve Wozniak developing "personal" computers to put the power of information in the hands of individuals.[10] Working toward similar goals, other counterculture environmentalists and sympathetic scientists and engineers focused on alternative energy, earth-friendly design, recycling, and creative waste management as the best ways to subvert the large industrial structures they viewed as most damaging to the environment and to attempt to equalize the world power structure. Whether they were building personal computers in their garage or designing composting toilets, the idea that technology could be directed toward shaping a brighter future became a driving force in environmental advocacy after 1970.

The utopian optimism and revolutionary political program of the New Left failed to become a part of the mainstream environmental movement. Consumed with the reactive fight against the Vietnam War and university bureaucracies, the predominantly campus-based New Left movement fragmented and disintegrated in the early 1970s. But renewed scarcity in the 1970s helped confirm the urgency of environmental concerns while tempering utopian ambitions that were based on post-scarcity. The politicized counterculture environmental movement survived the New Left and remained active in a multifaceted attempt to construct an alternative society.

The relationship between the counterculture, technology, and the environment is complex. It would be a mistake to assume that all of those who considered themselves counterculturalists and environmentalists thought or acted alike. Even among those who advocated the use of technology to solve environmental problems, a clear program of action or thought was rare. Often, countercultural environmentalists seemed to occupy separate but parallel universes defined by whether they considered technology to be the problem or the solution. The relationship between the counterculture and technology was always one of fundamental ambivalence. Counterculture environmentalists never constructed a unified philosophy that united like-minded individuals and organizations under one banner. They were a diverse group with a wide variety of perspectives, often pursuing opposed or mutually exclusive projects. What differentiated counterculture environmentalists from other environmental activists in the 1960s and 1970s was a shared desire to use environmental research, new technologies, ecological thinking, and environmental advocacy to shape a social revolution based on alternative lifestyles and communities, alternatives that would enable future generations to live in harmony with each other and the environment.

Counterculture environmentalists were not the first Americans to debate technology and the environment. The technology debate began in the Industrial Revolution

of the nineteenth century. While some Americans looked at advances in science and technology with a wary eye, many Americans viewed technology as beneficial and benign. This was particularly true for a generation of middle-class Progressive conservation advocates who believed that rational planning, expert management, and science were the keys to a sound environmental future. From amateur conservation advocacy groups to the utilitarian U.S. Forest Service of Gifford Pinchot, American conservation advocates looked to science for solutions to waste and wanton destruction of scarce natural resources. For most of the twentieth century, most resource conservation advocacy stemmed from the notion that through science and the march of progress humans could tame and control all elements of the natural world, stopping waste and maximizing productivity. This thinking inspired massive reclamation and irrigation projects and experiments with chemicals to rid the world of unwanted pests and predators. The steadfast faith in technology and the scientific worldview prevailed into the 1960s.[11]

In the decades following World War II, attitudes toward technology began to change. While never quite a mainstream trend, more Americans questioned the dominant view of technology and progress. A catalyst for this reevaluation was horrifying devastation caused by use of the atomic bomb in Japan. Once the patriotic fervor of the war subsided, conservationists and intellectuals started discussing what it now meant that humans had the power to destroy the world. Books like John Hersey's *Hiroshima,* published in 1946, graphically depicted the awesome destructive power of atomic weapons and inspired a growing segment to recognize the far-reaching environmental implications of modern technology. After years of turning out pro-war propaganda films, Hollywood, along with a legion of science fiction writers in the 1950s, produced a steady stream of books and films presenting horrifying visions of technology run amok. A generation of Americans born after World War II grew up watching giant nuclear ants or other such mutants of technology destroying humanity in movies such as Gordon Douglas's *Them!* (1954). By the mid-1960s, a growing segment of American society, particularly young Americans, evinced ambivalence about technology. During the 1950s, a sense of genuine terror over the evil potential of science without a social conscience grew.[12] At the same time, older members of the conservation movement also found themselves increasingly alienated from the world of modern atomic science, massive reclamation projects, and postwar consumer technology. They were distressed particularly by the consequences of technocratic thinking for American society and culture.

Within the conservation movement, a growing ambivalence toward technology turned into full-fledged technophobia for many. Fear shaped much of the conservationist alienation from the postwar world; fear that the prominence of the hard sciences, the expansion of the space race, and the explosion of consumer technology de-emphasized contact with the nonhuman world. The consequences of nuclear technology for American society led conservationists such as John Eastlick to wonder if Americans had been "blinded by the fearful brightness of the atomic bomb," and were now stumbling through life with little awareness of the environmental and social degradation that surrounded them.[13]

Despite discomfort with the modern world, most conservationists used modernist means to express and act upon their antimodernist revulsion. Even as their alienation

from postwar technocracy grew, their Progressive-style faith in government agencies, and protective federal laws continued to be staples.[14] For most of its history, the conservation movement embraced organizational principles and actions based on the idea of linear progress through Progressive enlightenment. At the same time, it viewed the history of the twentieth century as a steady decline toward chaos and environmental collapse, brought on by rampant population growth and unregulated technological expansion.[15] Although these two ideals seemed to be diametrically opposed and irreconcilable, both shared the same roots as direct responses to concerns about the relationship between nature and technology in post-industrial America. By drawing on both traditions, sometimes consciously and sometimes not, postwar conservationists and critics of technology attempted to reconcile dreams for reform with competing fears that the system was beyond repair. They were simultaneously hopeful and afraid.

Other critics of postwar society, including a contingent of more radical environmental preservationists and prominent European and American intellectuals, were less inclined to search for compromise and more willing to propose far-reaching structural changes. The most stunning of these critiques came from biologist Rachel Carson, whose explosive *Silent Spring,* published in 1962, explained in frightening detail the ecological consequences of humanity's attempt to control and regulate the environment.[16] Carson became the first of many to warn of an impending environmental "crisis." During the 1960s, a series of influential books appeared warning of an apocalyptic future if the present course was not altered. Carson's fellow biologist, Barry Commoner, produced several bestsellers, including *The Closing Circle,* warning of the dangers of sacrificing the health of the planet for temporary material gain.[17]

Three other writers also provided inspiration for a new generation of Americans who questioned the role of technology in causing social, economic, and environmental injustice. Jacques Ellul, author of *The Technological Society,* asserted that "all embracing technological systems had swallowed up the capitalistic and socialistic economies" and were the greatest threat to freedom in the modern world.[18] Ellul argued that there was "something abominable in the modern artifice itself." The system was so corrupt that only a truly revolutionary reorientation could stop social and environmental decay.[19] Herbert Marcuse, in his popular *One Dimensional Man,* described a vast and repressive world technological structure that overshadowed national borders and traditional political ideologies.[20] Marcuse popularized the insights of the Frankfurt school of Marxian philosophers and sociologists.[21] Together Marcuse and Ellul provided a critical intellectual framework for Americans looking to construct alternatives to the scientific worldview.

The most influential of the structural critics of the technological society was Lewis Mumford. Mumford began his career as a public intellectual as a strong proponent of science and technology. His 1934 classic, *Technics and Civilization,* influenced a generation and strengthened the popular belief that technology was moving human civilization toward a new golden age.[22] Like most Progressive thinkers of the industrial period, Mumford envisioned a modern world where technology helped correct the chaos of nature and brought balance to ecology. In *Technics,* Mumford extolled the virtues of the machine and painted a positive picture of how technology could reshape the world to eliminate drudgery and usher in an unprecedented period in

history where machines and nature worked together for human benefit. But this prophet of the machine age rethought his views in the 1960s. Like Marcuse and Ellul, Mumford became increasingly alarmed about the power of large technological systems. As Mumford looked around at the world of the 1960s and 1970s he worried that the ascendance of the "megamachine" boded ill for human society.[23] The "machine," once the symbol of progress toward a more balanced world, emerged as a metaphor for describing a seemingly out-of-control capitalist system.[24]

The preoccupation with technology and its consequences became one of the central features of 1960s social and environmental movements, and of the counterculture in particular. In 1968, Theodore Roszak released his influential study of the youth movement, *The Making of a Counter Culture.*[25] The counterculture was a direct reaction to "technocracy," which Roszak defined as a "society in which those who govern justify themselves by appeal to technical experts, who in turn justify themselves by appeals to scientific forms of knowledge."[26] The counterculture radicals of the 1960s, he argued, were the only group in America capable of divorcing themselves from the stranglehold of 1950s technology and its insidious centralizing tendencies. Roszak's position on technocracy mirrored Ellul and Marcuse. For Roszak the most appealing characteristic of the counterculture was its rejection of technology and the systems it spawned. Charles Reich, in his bestseller *The Greening of America* (1970), also highlighted the youth movement's rejection of technology as a fundamental component of the counterculture ideology.[27] For both Reich and Roszak, bureaucratic organization and complexity made the technocracy evil. From the perspective of Roszak, Reich, and much of the younger generation, the problem with America stemmed from that realization that there was nothing small, nothing simple, nothing remaining on a human scale.

This bigness and bureaucratization concerned British economist E. F. Schumacher, whose popular book *Small Is Beautiful* (1973) became a model for decentralized humanistic economics "as if people mattered."[28] Of all the structural critiques of technological systems, Schumacher's provided the best model for constructive action and was particularly influential in shaping counterculture environmentalism. Unlike more pessimistic critics of the modern technocracy, Schumacher assured that by striving to regain individual control of economics and environments, "our landscapes [could] become healthy and beautiful again and our people . . . regain the dignity of man, who knows himself as higher than the animal but never forgets that *noblesse oblige.*"[29] The key to Schumacher's vision was an enlightened adaptation of technology. In *Small Is Beautiful,* Schumacher highlighted what he called "intermediate technologies," those technical advances that stand "halfway between traditional and modern technology," as the solution to the dissonance between nature and technology in the modern world.[30] These could be as simple as using modern materials to construct better windmills or more efficient portable water turbines for developing nations. The key to "intermediate technologies" was to apply advances in science to specific local communities and ecosystems. Schumacher's ideas were quickly embraced and expanded upon by a wide range of individuals and organizations, often with wildly different agendas, who came together under the banner of a loosely defined ideology that became known as "appropriate technology" (AT).

Appropriate technology emerged as a popular cause at a conference on technological needs for lesser-developed nations in England in 1968.[31] For individuals and organizations concerned with the plight of developing nations, Schumacher's ideas about intermediate technologies provided a possible solution for promoting a more equitable distribution of wealth while avoiding the inherent environmental and social problems of industrialization.[32] Appropriate technology quickly became a catchall for a wide spectrum of activities involving research into older technologies that had been lost after the Industrial Revolution and the development of new high- and low-tech small-scale innovations. The most striking thing about appropriate technology, according to historian Samuel P. Hays, was "not the mechanical devices themselves as the kinds of knowledge and management they implied." Alternative technology represented a move away from the Progressive faith in expertise and professionalization and toward an environmental philosophy predicated on self-education and individual experience.[33] Alternative technology also represented a viable alternative to wilderness-based environmental advocacy.

The AT movement was also bolstered by the New Left. Particularly influential were the writings of eco-anarchist Murray Bookchin. Bookchin provided a critical political framework by situating the quest for alternative technologies within the framework of revolutionary New Left politics. In books such as *Our Synthetic Environment* (1962) and *Post-Scarcity Anarchism* (1971), he argued that highly industrialized nations possessed the potential to create a utopian "ecological society, with new ecotechnologies, and ecocommunities."[34] From this perspective, the notion of scarcity, a defining fear of the conservation movement, was a ruse perpetuated by "hierarchical society" to keep the majority from understanding the revolutionary potentialities of advanced technology. More than most New Left critics, Bookchin also clearly linked revolutionary politics with environmentalism and technology. "Whether now or in the future," he wrote, "human relationships with nature are always mediated by science, technology and knowledge."[35] By explicitly fusing radical politics and ecology, the New Left provided a model for a distinctly counterculture environmentalism. From the perspective of the New Left, pollution and environmental destruction were not only a matter of avoidable waste but a symptom of a corrupt economic system that consistently stripped both the environment and the average citizen of rights and resources.[36]

Although the utopian program of Bookchin and the New Left ultimately failed to capture the hearts of most environmentalists, it did help establish a permanent relationship for many between environmental and social politics. This linking of the social, political, and environmental in the 1970s paved the way for new trends of the 1980s such as the environmental justice movement. For inner-city African Americans and others who felt alienated from the predominantly white middle-class environmental groups such as the Sierra Club or the Wilderness Society, the New Left vision of environmental politics provided inspiration. By connecting ecological thinking with urban social issues and radical politics, the New Left introduced environmentalism to a new and more diverse group of urban Americans who had felt little connection to the wilderness and recreation-based advocacy of the conservation/preservation movement.[37]

At the same time, the New Left helped bolster the growing technological fascination of many counterculture environmentalists. The AT movement represented a different direction for radical politics in the late 1960s. By then the campus-based New Left movement was primarily a movement against the Vietnam War. New Left politics on the campus focused on striking back at the Pentagon, IBM, AT&T, and other representatives of the technocratic power structure. Escalating violence, renewed scarcity fears, and a host of pressures inside and outside the campus-based movement caused the New Left to fracture and ultimately collapse. Disillusioned by the failure of the revolution, many counterculturalists moved away from radical politics. At the same time, proponents of appropriate technology in Europe and America were taking New Left–inspired politics in some different and unconventional directions. Stewart Brand, a former member of Ken Kesey's Merry Pranksters, and organizations such as the New Alchemy Institute worked to create an alternative society from the ground up by adapting science and technology for the people.

By the early 1970s, the neo-Luddites in the American environmental movement had ceded ground to a growing number of appropriate technologists. This new group of counterculture radicals, environmentalists, scientists, and social activists recognized the liberating power of decentralized individualistic technology. The AT movement was varied and diffuse with much disagreement even among its adherents about how to define their ideology. The term meant different things to different groups, but they generally agreed that an "appropriate" technology had the following features: "low investment cost per work-place, low capital investment per unit of output, organizational simplicity, high adaptability to a particular social or cultural environment, sparing use of natural resources, low cost of final product or high potential for employment."[38] An appropriate technology was cheap, simple, and ecologically safe. The proponents of appropriate technology also agreed on the basic idea that alternative technologies could create more self-sufficient lifestyles and new social structures based on democratic control of innovation and communitarian anarchism. For supporters of appropriate technology, the most radical action against the *status quo* was not throwing bombs or staging sit-ins but fabricating wind generators to "unplug from the grid."

The move toward appropriate technology represented a significant break for the counterculture and the environmental movement. A new breed of young environmentalists built on the ideas of Schumacher, Bookchin, Marcuse, and others to craft a very different political agenda from their technophobic predecessors in the environmental movement. This new agenda found its best expression in the pages of a new publication. *The Whole Earth Catalog* was run by young radicals who wanted to fight fire with fire; they wanted to resist technocracy and frightening nuclear and military technology by placing the power of small-scale, easily understood, appropriate technology in the hands of anyone willing to listen.

A Counterculture Sears Catalog

No single institution or organization better represents the technological universe through which counterculture environmentalists defined themselves than the *Whole Earth Catalog* and its successor, *CoEvolution Quarterly*. This eclectic and iconoclastic

publication became a nexus of radical environmentalism, appropriate technology research, alternative lifestyle information, and communitarian anarchism. First published in 1968, as the AT movement burst onto the world scene, *WEC* brought a wide range of divergent counterculture trends under one roof. Commune members, computer designers and hackers, psychedelic drug engineers, and environmentalists were but a few of those who could find something of interest in the pages of *WEC*. The publication's founder, Stewart Brand, set out to create a survival manual for "citizens of planet Earth" and "hippie environmentalist spacemen."[39] According to Brand, *WEC* was a "movable education" for his counterculture friends "who were reconsidering the structure of modern life and building their own communes in the backwoods." Under his direction, *Whole Earth* and its successors extolled the virtues of steam-powered bicycles, windmills, solar collectors, and wood stoves, alongside new "personal computers," satellite telephones, and the latest telecommunications hardware. Brand and his followers were convinced that access to innovative and potentially subversive information and energy technologies was a vital part of changing the cultural perceptions that contributed to environmental decay.[40]

Brand's creation perfectly captured the post-Vietnam counterculture movement of the mid-1970s with its emphasis on lifestyle and pragmatic activism over utopian idealism and politics. *WEC* marketed real products, not just ideas, and the focus was always on theoretically feasible, if not always reasonable, solutions to real world problems. For Brand and his colleagues, *Stop the 5-Gallon Flush,* a guide to stopping water waste with simple household technological fixes, was just as revolutionary a book as *Das Kapital*.[41] Brand's practical revolution appealed to the growing numbers of disenchanted New Left radicals who tired of sitting in coffee houses endlessly debating politics but who still wanted to somehow subvert the system. The publishers of *WEC* inadvertently advanced the radical notion that by staying home from the protest demonstration and modifying your toilet, building a geodesic dome, or a solar collector you could make a more immediate and significant contribution to the effort to create an alternative future than through more conventional expressive politics.

In contrast to the downbeat rhetoric of the late 1960s campus-based New Left, Brand and his enthusiastic collaborators remained optimistic about a coming revolution brought about by appropriate technology. Drawing on the optimism of utopian post-scarcity visions of the future, Brand and other alternative technology proponents were representative of a new direction within the counterculture characterized by intellectual curiosity and a love for creative technical innovation. Inspired by the work of Buckminster Fuller, Brand expanded the "outlaw area" of counterculture innovation away from music production and psychedelic drug research toward areas such as alternative energy and information technology.[42] Brand was hardly a pragmatist; he was a dreamer. *WEC* began with the working assumption that large numbers of Americans were willing to abandon their current lives and move into self-sustaining, ecologically friendly communities. The first issues of the catalog were aimed at those who were working to use the best of small-scale technology to literally disconnect themselves from the infrastructures of mainstream society and relocate to rural or wilderness areas. At first, *WEC* promoted radically detached self-sufficiency as the key to a viable revolutionary politics.

No one better captured the optimistic spirit of appropriate technology as presented in the pages of *WEC* than the iconoclastic self-taught designer and Harvard dropout Buckminster Fuller. Born in 1895, Fuller was venerated by the 1970s, but still full of radical ideas and an inspiration to a younger generation.[43] For more than four decades he had been on a personal quest to create a completely new way of viewing design, construction, and the environment. Fuller wanted to reform the "human environment by developing tools that deal more effectively and economically with evolutionary change."[44] Although a prolific designer, Fuller is best known for the concept of "dymaxion" design. Fuller defined dymaxion as "doing the most with the least."[45] His geodesic dome epitomized the ideal of appropriate technology, using the most sophisticated design principles and the latest technologies to make more with less. He was an acute observer of the natural world. Unlike most of his contemporaries, especially in the 1930s, Fuller saw the universe in terms of interconnected triangles and spheres instead of straight lines and boxes. The ultimate example of his design ideal was the brilliant and elegantly simple geodesic dome. The domes consisted of a series of linked triangles forming a sphere that proved to be so strong that it could be built with very lightweight materials and remain structurally sound in virtually any size.

The geodesic dome was based on complex mathematics and design principles, and at the same time a structure so uncomplicated that almost anyone could build one from materials at hand. The geodesic dome became the preferred domicile for counterculture communes like Colorado's Drop City because the domes were cheap, easy to build, often portable, and environmentally friendly.[46] Fuller's artful designs epitomized the post-scarcity ideal of appropriate technologies as the basis for alternative communities and alternative societies. At *WEC,* Brand published information on Fuller, Paolo Soleri, Moshe Safdie, and other designers and architects who utilized design and technical innovation to create alternative realities.[47]

In the early years, *WEC* articulated an appealing vision for those looking for a permanent retreat from the status quo. Individuals who planned their escape through the pages of *WEC* discovered a program of action where "choices about the right technology, both useful old gadgets and ingenious new tools, are crucial," but "choices about political matters are not."[48] For appropriate technology enthusiasts, lifestyle became the primary form of political expression. In *WEC,* Brand assembled an almost mind-boggling array of information on tools, science, products, services, and publications ranging from the mundane to the downright weird, but all somehow concerned with crafting alternative lifestyles that subverted traditional networks of political, spiritual, and physical energy. For those who encountered *WEC,* the experience was often a revelation. According to Gereth Branwyn, subsequently a staff writer for *Wired Magazine*, "I got my first *Whole Earth Catalog* in 1971. It was the same day I scored my first bag of pot. I went over to a friend's house to smoke a joint . . . he pulled out this unwieldy catalog his brother had brought home from college. I was instantly enthralled. I'd never seen anything like it. We lived in a small redneck town in Virginia—people didn't think about such things as 'whole systems' and 'nomadics' and 'Zen Buddhism.' I traded my friend the pot for the catalog."[49] At a time when the New Left movement was dissipating, *WEC* and the AT movement provided hope that an alternative environmental and political future was still possible.

Not all counterculturalists, environmentalists, or appropriate technology advocates agreed with the radical self-sufficiency message of *WEC* in the early years. The first *WEC* appealed to the dropout school of hippies and back-to-the-landers who took their political cues from the likes of Ken Kesey, who encouraged them to "Just . . . turn your back and say . . . 'Fuck It' and walk away."[50] Years later, Brand realized that *WEC*'s uncritical enthusiasm for self-sufficiency and dropout politics in those early years may have caused harm. In *Soft Tech,* he wrote with some regret, "Anyone who has actually tried to live in total self-sufficiency . . . knows the mind-numbing labor and loneliness and frustration and real marginless hazard that goes with the attempt. It is a kind of hysteria."[51] Despite Brand's concerns about an overemphasis on self-sufficiency and escapism, most readers of the *WEC* never took the message literally. The vast majority of the almost two million people who purchased copies of *WEC* in its first three years never left the city, never abandoned society for a lonely exile. The message that most readers got from *WEC* was unbridled technological optimism, the idea that innovation and invention with a conscience could overcome even the worst social and environmental problems. It was this message, so profoundly different from the technophobia expressed by environmentalists and critics like Theodore Roszak that made *WEC* such a significant phenomenon. Brand and other proponents of the AT movement understood something about "technocracy's children" that Roszak did not: the youth culture of the 1960s and 1970s was, in the words of appropriate tech enthusiast and chronicler, Witold Rybczynski, "immensely attracted to technology."[52]

From the beginning, *WEC* and the AT movement as a whole directed that attraction in two distinct directions: the "outlaw edges" of alternative energy technology and information and communications technology. Over the years, readers of the catalog could find careful descriptions of the Vermont Castings "Defiant" wood stove closely followed by the latest information on Apple computers. This incongruous juxtaposition made perfect sense to Brand. "The Vermont Castings tool manipulated heat, the Apple tool manipulated information." "Both cost a few hundred dollars, both were made by and for revolutionaries who wanted to de-institutionalize society and empower the individual, both embodied clever design ideas," all characteristics of appropriate technology. According to Brand, the ability to manipulate energy and information were necessary to change the system.[53] The only way one could hope to cast off the chains of the industrial world was to steal the keys to the kingdom. Acquiring the knowledge to manipulate energy in particular was viewed by supporters of appropriate technology and a growing faction of the environmental movement as a crucial step in freeing oneself from existing structures of oppression and environmental degradation and enabling self-sufficiency.

With this broadened agenda in mind, the energy focus at *Whole Earth* and then *CoEvolution Quarterly* shifted from low-tech basic tools, the wood stove or individually crafted hand saws, to much more sophisticated alternative energy solutions such as solar, geothermal, biogas and biofuels, and high-tech wind harnessing devices such as the ever popular "Gemini Synchronous Inverter." Brand and crew drew inspiration from groups like The New Alchemists who were pushing the edges of appropriate technology and putting the latest alternative energy technologies into active use in their laboratories on Prince Edward Island and Cape Cod.[54] Other organizations explored appropriate technology from a variety of perspectives. They researched new

household technologies such as composting toilets, affordable greenhouses, and organic gardening techniques along with alternative energy technologies. While the research of individuals and organizations working in the area of AT varied greatly, all involved shared the common goal of using technical research to enable simpler more ecologically sensitive lives and economies of a human scale.

The concentration on alternative renewable energy at *WEC,* the New Alchemy Institute, and other organizations reflected a larger shift in direction in the American environmental movement as a whole. The energy crisis of the early 1970s brought a realization on the part of environmentalists that many of the ecological problems of the postwar era were either directly or indirectly linked to the acquisition and distribution of energy. Long lines at gas stations and soaring fuel prices brought home the reality of finite energy resources. This renewed realization that scarcity was once again a real and long-term problem forced counterculture environmentalists to reevaluate the aspects of their technological enthusiasm derived from 1960s New Left notions of a post-scarcity world.

By the mid-1970s, it was clear that post-scarcity was a long way off. The move away from post-scarcity politics toward an appropriate technology philosophy that recognized scarcity and reformulated utopian radicalism paved the way for AT to move into the mainstream. The energy crisis of the 1970s forced millions of Americans to reevaluate their environmental positions and helped the environmental movement dramatically expand its base. Environmental organizations working in the area of AT were poised to provide a new vision of environmental activism to this broadened audience of concerned Americans. The community of individuals and organizations working on alternative energy solutions became particularly influential during the 1970s.

All of the new and renewed energy technologies featured in the pages of *WEC* became components of what British physicist Amory Lovins referred to as the "soft path." Lovins popularized the soft path to energy solutions in a widely read and highly controversial 1976 article in the prestigious journal *Foreign Affairs.*[55] For Lovins and his supporters the soft path was the moral alternative to an American "federal policy . . . [that] relies on rapid expansion of centralized high technologies to increase supplies of energy."[56] Instead of increasing centralization, soft path proponents supported decentralized appropriate technologies and urged western nations, specifically the United States, to direct their research toward renewable alternatives and explore the possibility of shrinking the system to provide a more equitable relationship with developing nations. Appropriate soft technologies such as passive solar, the use of new technologies combined with traditional building materials to heat buildings with energy from the sun, were available immediately to all who were interested. Lovins emphasized that the benefits of soft tech were accessible for regular citizens of the western world and easily transferable to developing nations as well. Simple passive solar techniques like painting a south-facing wall black and covering it with glass, could radically decrease the dependence on large energy systems.[57] Soft path proponents pointed to several significant energy technologies with long and productive histories that fit perfectly with the ideal of easily accessible renewable energy for a modern world. Most of the soft path solutions to modern energy problems were retooled versions of preexisting technologies. None of these older technologies better captures the spirit of the soft path energy movement than the venerable windmill.

The use of wind as a source of power began when humans first harnessed the wind to power ships and soon after as an efficient means for the mechanization of food production and irrigation. For thousands of years, cultures all over the globe relied on wind power to mill their grains, drain their lowlands, draw water from aquifers, and saw their lumber.[58] In America the windmill became an emblem of self-sufficiency as farmers and ranchers moved onto the arid plains and mastered the technology of the windmill in order to survive far from established services and energy sources. Americans quickly discovered that windmills could be fabricated out of a wide variety of locally available materials and constructed cheaply from mail order plans. As early as 1885 windmills generated electrical power. Early researchers learned that windmills were an excellent source of electrical power on a small scale, and even small windmills could easily provide enough electricity for a home or small business. Preexisting windmills could be retrofitted with electrical generators and provide power to a remote farm or mill while retaining the capacity to pump water or grind wheat.[59] While many adopted the windmill as a permanent source of power, wind energy never became the standard that many thought possible. Wind power faded from view for most of the twentieth century.

The energy crisis of the 1970s renewed the interest in wind energy. One of the reasons that wind never went mainstream was because of an inability to regulate the wind. The power from wind generators ebbed and flowed, and the fickle winds never maintained a schedule. This made wind a poor substitute for hydroelectric or coal turbines, which could sustain a constant and manageable flow of energy for large systems and power grids. Soft path supporters were unconcerned about the problems of wind power for large systems. On the contrary, they sought sources of power that were better suited to small systems.

Like E. F. Schumacher, Lovins and other soft tech proponents believed that the ability to construct small-scale self-sufficient systems provided individuals and communities with a closer connection to the earth and a greater degree of control over their lives. The windmill was the type of technology that could enable one to use the latest research in electric power generators and new materials such as fiberglass to build machines that produced no pollutants and provided essentially free and limitless energy. For soft path proponents the potential of the windmill was both practical and political. Disconnecting yourself from the power grid was the first step toward a cleaner environment and a move toward reevaluating all of the large systems that dominated the economy and daily life of developed nations. The key to the politics behind soft path and AT science was the notion that real change came not from protest but from constructing viable alternatives to the status quo starting with the basic elements of human life: food, energy, and shelter. Lovins's credentials as a professionally trained scientist lent credibility to the AT movement and caused both opponents and supporters to articulate carefully their energy positions. Brand approved not only of Lovin's ideas but his terminology as well: "'Soft' signifies that something is alive, resilient, adaptive," Brand mused, "maybe even lovable."[60] By the mid-1970s, soft path energy research into solar power, wind, geothermal heat, biogas conversion, and recycled fuels moved to the forefront of the environmental and AT movements.

At the same time that a growing number of environmentalists explored different paths toward decentralization through renewable energy development, others worked

in the second area of the "outlaw edge": information technology (IT). For Brand, alternative energy was important, but IT was where the real action was. As he later expressed it, "Information technology is a self-accelerating fine-grained global industry that sprints ahead of laws and diffuses beyond them."[61] Brand was intrigued by what he called the "subversive possibilities" of technologies as diverse as recording devices, desktop publishing, individual telecommunications, and especially personal computers. He joined a growing group of counterculturalists who had a deep respect for innovators like Steve Jobs and Steve Wozniak, who were designing and then using their computers to push what Brand referred to as "the edges of the possible and permissible."[62] Like Lovins and the soft path proponents, alternative information technology was viewed, perhaps somewhat naively, by people like Steve Jobs and Stewart Brand as a means of personal empowerment. The mandate at Apple was to "build the coolest machine you could imagine," something so different that people would rethink the role of the machine in modern life.[63] The naming of the products suggested that these machines were somehow more natural than earlier computers. Old computers were identified by acronyms and numbers, new computers were named Apple and were accessed through the "mouse." This was friendly technology, designed to be unthreatening and easy to use. The specifics of how information and communications technology could become weapons in the war against the status quo were never clearly articulated by AT proponents. Optimistic counterculturalists held a general sense that the personal computer and other new technologies were intrinsically radical and could change the world simply by existing. The details could be worked out later. In the meantime their contagious enthusiasm and inventive genius inspired a technological revolution that ultimately transformed the American economy in unanticipated ways and created ideological paradoxes for the AT pioneers who helped spawn that revolution.

For many in the counterculture of the early 1960s, computers had represented the epitome of all that was wrong with technology in the service of technocracy. During that era computers were giant humming machines that were immensely expensive and required a high level of technical expertise to operate. They were the heartless mechanized brains of oppression, used by IBM and the Pentagon to design weapons of destruction and quantify the body counts in Vietnam. Neo-Luddites dismissed the computer as a malevolent machine of centralization and dehumanization. Critics argued that computers were nothing more than "low-grade mechanical counterfeits" of the human mind, devices propagated by the "most morally questionable" elements of society.[64] Many of the first purchasers of *WEC* would have agreed with these critiques. They had a hard time conceiving a role for computers in their utopian back-to-nature communes. But other counterculturalists, including Brand, quickly recognized the potential of the new wave of microcomputers and personal information technology to link individuals and organizations to transform American society. The widespread dissemination of information was essential to the project of constructing alternatives and transforming society. Long before most, Brand and others involved in the AT movement realized that computers had the potential to help build a new cyber-community. What, these pioneers wondered, could be more alternative than an electronic utopia, an alternative universe where individuals separated by huge distances could share ideas, images, and thoughts with thousands of other like-minded

people all over the world? AT enthusiasts were some of the first Americans to go online, and the *Whole Earth 'Lectronic Link* (WELL) became one of the early attempts to create a "virtual community."[65] By the mid-1970s, *WEC*'s successor, *CoEvolution Quarterly,* was dedicating more space to information technology than any other subject. They were no longer alone.

Conclusion

Before the end of the 1970s, organizations like the *Whole Earth Catalog* and The New Alchemy Institute brought together some of the most innovative members of the counterculture to attempt to reconcile nature and the machine. For Stewart Brand and other appropriate technology enthusiasts, the research they promoted, in both alternative energy and alternative information systems, succeeded in substantially altering the way Americans thought about the power of technology as a benevolent force for environmental protection, ecological living, and personal liberation. In many ways the reconciliation of ecology and technology popularized by *WEC* provided a more integrated and realistic model for environmentalism. By demonstrating that there were possibilities for a middle ground between modern technology and environmental consciousness, the AT movement contributed to the acceptance of environmentalism in mainstream American culture.

Despite this success, the AT movement was not without its ironic consequences. The liberal idealism that drove AT often failed to account for the degree to which even small-scale and individualistic ideas, such as the personal computer, could very rapidly be incorporated into and even strengthen the very systems they were designed to subvert. In 1980, Alvin Toffler published his hugely popular book *The Third Wave,* which argued that the world was on the brink of a third industrial revolution.[66] According to Toffler, this third revolution would grow out of the transformation of information technologies and would have profound consequences for industry and society. In many ways Toffler's vision was remarkably accurate. Information technologies have reshaped the American economy and society at an incredible pace. One of the most disturbing consequences of the counterculture environmental technology movement is that it helped launch this revolution and the new industrial giants it spawned. The young counterculture or counterculture inspired entrepreneurs who started their careers pushing the "outlaw edges" of the "possible and permissible" are now billionaires who run major corporations such as Apple, Intel, and Microsoft that dominate the American economy. Many of the radicals of yesterday have become the capitalist elite of today.

We live now in an age of technological systems of a level of complexity that makes the once threatening technological structures of the 1960s look antiquated and benign. One of the central notions of the AT movement was the belief that access to innovative information and energy technologies was a vital part of changing cultural perceptions and social conditions that contributed to environmental decay. Today the "outlaw edge" of technology that inspired the counterculture is more often occupied by new industrial giants such as Intel. Corporations whose factories drain millions of gallons of water a day out of ancient desert aquifers to wash the silicon chips

that power personal computers, with little concern for the effect on the environment and high-powered staff lawyers to fight off grassroots environmentalists who protest.[67] Examples like this lend credence to declensionist readings of the counterculture and environmentalism after the landmark victories of the 1960s. But the relationship between counterculture environmentalists and technology was always ambivalent. It should come as no surprise that the legacy of their technological revolution is also ambivalent.

While the AT revolution may not have played out the way New Left theorists expected, the majority of the AT initiatives have had an overwhelmingly positive impact on American culture and American environmentalism and offer a suggestion for how to move environmentalism out of the wilderness. The promotion of renewable energy resources and energy conservation through technological invention provides one example of success. Energy-efficient houses, thermal windows, solar power, and high-efficiency electrical devices have become widely accepted standard features of American culture. Curbside recycling and the proliferation of post-consumer waste recycling have also gained approval and become a part of daily life. Many of these technologies and services that seem so obvious and sensible that they go unnoticed today resulted from the radical innovation of counterculture environmentalists. Whether they went back to the land, or into the laboratory, they infused environmentalism with an optimistic hope that one day the nagging question of how to reconcile the tension between the modernist desire to exploit the progressive potential of technological innovation with the antimodernist desire to preserve the natural world might be resolved through politically enlightened technical innovation.

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Notes

1. In this essay I use the term antimodernism to group individuals and organizations who defined themselves in opposition to the prevailing twentieth-century belief in progress through technological innovation. Antimodernists in the conservation and preservation movements rarely rejected the modernist/Progressive ideal that societies are improvable, they simply rejected the notion that improvement required looking forward to new technologies to solve old problems.
2. Michael McClosky, "Wilderness Movement at the Crossroads, 1945–1970," *Pacific Historical Review* 41 (August 1972): 346–61. Samuel P. Hays, "From Conservation to Environment: Environmental Politics Since World War Two," *Environmental Review* 6 (fall 1982): 14–41. Mark W. T. Harvey, "Echo Park, Glen Canyon, and the Postwar Wilderness Movement," *Pacific Historical Review* 60 (February 1991): 43–67.
3. The *Whole Earth Catalog* has had many incarnations. Because of the editor's iconoclastic style and alternative publishing methodology, *Whole Earth* is maddeningly difficult to properly cite. The first addition was published in 1968 as, *The Whole Earth Catalog: Access To Tools,* edited by Stewart Brand and published by the Portola Institute with

distribution provided by Random House. Several revised versions followed between 1969 and 1971, all with Brand as the lead editor, when *The Last Whole Earth Catalog* (Portola & Random House, 1971) appeared. *The Last Whole Earth* won the prestigious National Book Award in 1972. All of the *Whole Earths* were reprinted many times and often there were seasonal editions. Between 1972 and 1999 there were several notable editions. See, especially, Stewart Brand, ed., *The Next Whole Earth Catalog: Access to Tools* (The Pont Foundation with distribution by Rand McNally in the U.S. and Random House in Canada, 1980). This particular edition is notable for shear size, 608 oversized pages, and breadth of coverage. There were also several *Whole Earth*–type companion volumes, such as J. Baldwin and Stewart Brand, eds., *Soft-Tech* (New York: Penguin Books, 1978), that focused on particular issues. Brand relinquished the editorship in the 1980s and several editors have since shepherded the perennially popular publication through several more editions. Most notable among these are: Howard Rheingold, ed., *The Millennnium Whole Earth Catalog* (San Francisco, Calif.: Harper San Francisco, 1994), and Peter Warshall, ed., *30th Anniversary Celebration: Whole Earth Catalog* (San Rafael, Calif.: Point Foundation, 1999). The thirtieth–anniversary edition includes a wonderful collection of Alternative Technology and Counterculture essays by leaders from the 1960s–1990s. Kevin Kelly, ed., *Signal: Communication Tools for the Information Age, A Whole Earth Catalog* (New York: Harmony Books, 1988).

4. Arthur Carhart is the example I know best. Universally considered a leading activist in the 1940s and 1950s, he has been dismissed by environmental historians primarily because his wilderness philosophy was not pure enough. For a recent corrective to these tendencies, see Charles T. Rubin, *Conservation Reconsidered: Nature, Virtue, and American Liberal Democracy* (Lanham, Md.: Rowman & Littlefield Publishers, 2000). This excellent collection of essays takes on the tendencies of historians to depict conservation, preservation, and environmentalism as oppositional movements. Particularly useful is Bob Pepperman Taylor's Afterword.
5. William Cronon, ed., *Uncommon Ground: Toward Reinventing Nature* (New York: W. W. Norton & Company, 1995), 69. For a remarkably similar argument against elevating a mythically pristine wilderness at the expense of the rest of the environment, see Arthur Carhart, *Planning for America's Wildlands* (Harrisburg, Pa.: The Telegraph Press, 1961). Carhart has often been criticized for his failure to support the Wilderness Bill at a time when his influence and access to a national audience was at a high point. Carhart argues convincingly that wilderness as defined by the Wilderness Society did not really exist in any pure state, but it was an "experience" a construct that lived "within your mind," rather than in a particular place. Carhart refused to support the Wilderness Bill in 1964 because he felt that arguing for wilderness purity would be a *de facto* concession to those who sought to develop lands not considered pristine.
6. This section on counterculture environmentalism and the WEC owes a great deal to an essay I wrote for an edited collection on the counterculture. "Machines of Loving Grace: Appropriate Technology, Environment, and the Counterculture," in *Imagine Nation: The American Counterculture of the 1960s and 1970s,* ed. Michael Doyle and Peter Braunstein (New York: Routledge, forthcoming).
7. Murray Bookchin, *Post-Scarcity Anarchism* (Berkeley, Calif.: The Ramparts Press, 1971).
8. Ibid., 12.
9. Ibid., 11.
10. Steven Levy, *Hackers: Heroes of the Computer Revolution* (New York: Penguin Books, 1994).
11. The classic study of the conservation movement is Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890–1920* (Cambridge,

Mass.: Harvard University Press, 1959). Also useful is Stephen Fox, *The American Conservation Movement: John Muir and His Legacy* (Madison: University of Wisconsin Press, 1981).

12. For an excellent overview of the effect of atomic technology on American culture, see Paul Boyer, *By the Bombs Early Light: American Thought and Culture at the Dawn of the Atomic Age* (New York: Pantheon Books, 1985).
13. John Eastlick, "Proposed Collection of Conservation of Natural Resources," FF-51, box 4, Conservation Library Collection archive.
14. Fox, *The American Conservation Movement.* Fox highlights Muir's antimodernist rhetoric as evidence that the conservation movement had, from the beginning, two distinct strains of thought: one, progressive and modern, focused on efficiency and reform; and the other, antimodernist, focused on the aesthetic and spiritual values of wilderness. A further discussion of these ideas can be found in Max Oelschlaeger, *The Idea of Wilderness: From Prehistory to the Age of Ecology* (New Haven, Conn.: Yale University Press, 1991).
15. Oelschlaeger, *The Idea of Wilderness,* 2.
16. Rachel Carson, *Silent Spring* (Greenwich, Conn.: Fawcett Publications, 1962).
17. Barry Commoner, *The Closing Circle: Nature, Man, and Technology* (New York: Alfred A. Knopf, 1971).
18. Jacques Ellul, *The Technological Society,* trans. Joachim Neugroschel (New York: Continuum, 1980); first published in French in 1954 and in English in 1964. Quote is from Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm* (New York: Penguin Books, 1989), 450.
19. Quote is from Langdon Winner, "Building a Better Mousetrap: Appropriate Technology as a Social Movement," in *Appropriate Technology and Social Values: A Critical Appraisal,* ed. Franklin A. Long and Alexandra Oleson (Cambridge, Mass.: Ballinger Publishing Company, 1980), 33.
20. Herbert Marcuse, *One Dimensional Man: Studies in the Ideology of Advanced Industrial Society* (Boston: Beacon Press, 1964).
21. Hughes, *American Genesis,* 445.
22. Lewis Mumford, *Technics and Civilization* (New York: Harcourt Brace & World, 1963).
23. Hughes, *American Genesis,* 446–50. Lewis Mumford, *The Myth of the Machine: The Pentagon of Power* (New York: Harcourt Brace Jovanovich, 1970).
24. For an in-depth look at the "machine" in American culture, see Leo Marx, *The Machine and the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964). This classic study remains the best source on the strange relationship between technology and nature in American culture. See also Richard White, *The Organic Machine* (New York: Hill & Wang, 1995).
25. Theodore Roszak, *The Making of the Counter Culture: Reflections on the Technocratic Society and Its Youthful Opposition* (New York: Doubleday & Company, 1968).
26. Ibid., 8.
27. Charles A. Reich, *The Greening of America: How the Youth Revolution is Trying to Make America Livable* (New York: Random House, 1970).
28. E. F. Schumacher, *Small Is Beautiful: Economics as if People Mattered* (New York: Harper & Row, 1973).
29. Ibid., 124.
30. A useful taxonomy of technologies can be found in Marilyn Carr, ed., *The AT Reader: Theory and Practice in Appropriate Technology* (New York: Intermediate Technology Development Group of North America, 1985), 6–11.
31. Witold Rybczynski, *Paper Heroes: A Review of Appropriate Technology* (Garden City, N.Y.: Anchor Books, 1980), 1–4.

32. David Dickson, *Alternative Technology and the Politics of Technical Change* (Glasgow: Fontana/Collins, 1974), 148–73.
33. Samuel P. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955–1985* (Cambridge: Cambridge University Press, 1987), 262.
34. Lewis Herber (Murray Bookchin), *Our Synthetic Environment* (New York: Alfred A. Knopf, 1962). Murray Bookchin, *Post-Scarcity Anarchism* (Berkeley, Calif.: The Ramparts Press, 1971). Quote is from *Post-Scarcity*, 22. See also Ulrike Heider, *Anarchism: Left, Right, and Green* (San Francisco, Calif.: City Lights Books, 1994); and, Arthur Lothstein, ed., *"All We Are Saying . . .": The Philosophy of the New Left* (New York: Capricorn Books, 1970).
35. Bookchin, *Post-Scarcity Anarchism*, 21.
36. The best overview of the New Left, the counterculture, and environmentalism can be found in Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Washington D.C.: Island Press, 1993), 81–114. See also, Martin Lewis, *Green Delusions: An Environmentalist Critique of Radical Environmentalism* (Durham, N.C.: Duke University Press, 1992. For a very different point of view from Gottlieb's and from that in this essay, see Hays, *Beauty, Health, and Permanence*, 259–65. Hays argues that there were only superficial similarities between the "negative" counterculture and the "positive" environmental alternative lifestyle movement.
37. See Robert D. Bullard, *Dumping in Dixie: Race, Class, and Environmental Quality* (Boulder, Colo.: Westview Press, 1990), and *Confronting Environmental Racism: Voices from the Grassroots* (Boston: South End Press, 1993).
38. Carr, ed., *The AT Reader*, 9. There are many fine sources on the development of appropriate technology, see David Dickson, *Alternative Technology and the Politics of Technical Change* (New York: Universe Books, 1975); Nicholas Jéquier, ed., *Appropriate Technology: Problems and Promises* (Paris: Organization for Economic Co-operation and Development, 1976); Franklin A. Long & Alexandra Oleson, eds., *Appropriate Technology and Social Values;* Witold Rybczynski, *Taming the Tiger: The Struggle to Control Technology* (New York: Penguin, 1985); Mathew J. Betz, Pat McGowan, and Rolf T. Wigand, eds., *Appropriate Technology: Choice and Development* (Durham, N.C.: Duke Press Policy Studies, 1984); Ron Westrum, *Technologies and Society: The Shaping of People and Things* (Belmont, Calif.: Wadsworth Publishing, 1991); and Theodore Roszak, *Where the Wasteland Ends: Politics and Transcendence in Postindustrial Society* (Garden City, N.Y.: Anchor Books, 1973). Two recent works shed new light on the history of alternative technology within the context of environmental politics. Martin W. Lewis, *Green Delusions: An Environmentalist Critique of Radical Environmentalism* (Durham, N.C.: Duke University Press, 1992); and Charles T. Rubin, ed., *Conservation Reconsidered: Nature, Virtue, and American Liberal Democracy* (Lanham, Md.: Rowman & Littlefield Publishers, 2000).
39. Winner, "Building a Better Mousetrap," 31.
40. Stewart Brand, *The Media Lab: Inventing the Future at MIT* (New York: Penguin Books, 1988); *How Buildings Learn: What Happens After They're Built* (New York: Penguin Books, 1994); *The Clock of the Long Now: Time and Responsibility* (New York: Basic Books, 1999).
41. Witold Rybczynski, *Stop the 5-Gallon Flush* (Montreal: Minimum Cost Housing Group, 1975).
42. Kevin Kelly, ed., *Signal: Communications Tools for the Information Age, A Whole Earth Catalog* (New York: Harmony Books, 1988), 3.
43. R. Buckminster Fuller and Robert Marks, *The Dymaxion World of Buckminster Fuller* (Garden City, N.Y.: Anchor Books, 1973); Robert Marks, ed., *Buckminster Fuller: Ideas and Integrities* (Englewood Cliffs, N.J.: Prentice-Hall, 1963); Robert Snyder, ed., *Buckminster Fuller: Autobiographical Monologue/Scenario* (New York: St. Martin's Press, 1980).

44. Snyder, *Buckminster Fuller,* 38.
45. Ibid., 54–55.
46. Clark Secrest, "'No Right to be Poor': Colorado's Drop City" *Colorado Heritage* (winter 1998): 14–21.
47. Paolo Soleri's vision of an alternative world created through revolutionary architecture was even more iconoclastic than Fuller's. Soleri's radical design ideas were popularized in *Arcology: The City in the Image of Man* (Cambridge, Mass.: MIT Press, 1969), and epitomized by his still unfinished life project, Arcosanti in the Arizona desert. Like Soleri, Moshe Safdie focused on alternative designs for communal living. See Moshe Safdie, *Beyond Habitat* (Cambridge, Mass.: MIT Press, 1970).
48. Winner, "Building a Better Mousetrap," 32.
49. Gareth Branwyn, "Whole Earth Review." Streettech website: http://www.streettech.com/bcp/BCPgraf/CyberCulture/WholeEarthReview.html (6/26/01).
50. Tom Wolfe, *The Electric Kool-Aid Acid Test* (New York: Bantam Books, 1997), 191–200.
51. Baldwin and Brand, *Soft Tech,* 5.
52. Rybczynski, *Paper Heroes,* 94.
53. Kelly, *Signal,* 3.
54. Todd, "The New Alchemists." *Soft Tech,* 149–65.
55. Amory Lovins, "Energy Strategy: The Road Not Taken." *Foreign Affairs* 55 (October 1976): 65–96; Hugh Nash, ed., *The Energy Controversy: Soft Path Questions and Answers* (San Francisco, Calif.: Friends of the Earth, 1979); Jim Harding, ed., *Tools for the Soft Path* (San Francisco, Calif.: Friends of the Earth, 1979).
56. Lovins, "Energy Strategy," 65.
57. Ibid., 82–83.
58. T. Lindsay Baker, *A Field Guide to American Windmills* (Norman: University of Oklahoma Press, 1985); Paul Gipe, *Wind Energy Comes of Age* (New York: Wiley, 1995); Robert W. Righter, *Wind Energy in America: A History* (Norman: University of Oklahoma Press, 1996); David Rittenhouse Inglis, *Wind Power and Other Energy Options* (Ann Arbor: University of Michigan Press, 1978; Michael Hackleman, *The Homebuilt, Wind-Generated Electricity Handbook* (Culver City, Calif.: Peace Press, 1975); Richard L. Hills, *Power From Wind: A History of Windmill Technology* (Cambridge: Cambridge University Press, 1994). See also, Nicholas P. Chermisnoff, *Fundamentals of Wind Energy* (Ann Arbor, Mich.: Ann Arbor Science, 1978); Douglas R. Coonley, *Wind: Making It Work For You* (Philadelphia: The Franklin Institute Press, 1979).
59. Hills, *Power From Wind,* 265–81.
60. Baldwin and Brand, *Soft Tech,* 5.
61. Kelly, *Signal,* 3.
62. Ibid. For more on Jobs, Wozniak, and Apple, see Steven Levy, *Insanely Great: The Life and Times of Macintosh, The Computer That Changed Everything* (New York: Penguin Books, 1995); Steven Levy, *Hackers: Heroes of the Computer Revolution* (New York: Penguin Books, 1994); and Jeff Goodell, "The Rise and Fall of Apple Inc." *Rolling Stone* (April 4, 1996): 51–73 and (April 18, 1996): 59–88.
63. Goodell, "The Rise and Fall of Apple Inc," 52.
64. Theodore Roszak, *The Cult of Information: A Neo-Luddite Treatise on High-Tech, Artificial Intelligence, and the True Art of Thinking* (Berkeley: University of California Press, 1994), xiii–xv.
65. See the WELL website: http://www.well.com (6/26/01).
66. Alvin Toffler, *The Third Wave* (New York: Bantam Books, 1982).
67. Bruce Selcraig, "Albuquerque Learns It Really Is A Desert Town." *High Country News* 26 (December 26, 1994): 1–6.

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