# Introduction

We're just a biological speculation
Sitting here, vibrating
And we don't know what we're vibrating about . . .
Oh, and if and when the law of man
Is not just, equal and fair
Then the laws of nature will come and do her thing.
FUNKADELIC, "BIOLOGICAL SPECULATION"
FROM *AMERICA EATS ITS YOUNG* (1972)

We speak casually of improving a course of action by getting some feedback, as if that were the most natural thing in the world. But the idea of feedback itself has a history. During the Second World War, "feedback" developed as a term to refer to the dynamics of self-regulating mechanical systems, which correct their actions by "feeding" some effects "back" into the system as input to influence later actions. Due to the ability of such systems to self-correct, or "learn," they could be considered intelligent.

Conversely, systems theory, which developed to describe how such systems worked, came to define intelligence itself as the ability to self-correct in response to feedback. Redefining intelligence this way—not as a uniquely human faculty produced by consciousness, but as the property of a system governed by feedback loops—eventuated in new ways of thinking about the varieties of intelligence found in nature. This is what I mean by ecological thinking.

Variously termed "ecology" or "cybernetics," the vision of the intelligent system governed by feedback loops has been a key image in American culture since the middle

of the twentieth century. The term "cybernetics" is most often associated with the creation of artificial feedback systems using electrical circuits (that is, artificial intelligence). Foregrounding the term "ecology" instead connotes a focus on natural systems. The "new ecology" that developed in the 1960s described the complex feedback loops that define interactions among plants, animals, and their physical environments (fig. 1).[1]

The idea of feedback dynamics as the connective tissue of systems, broadly conceived, became widespread in American intellectual discourse in the postwar decades, finding expression in academic specializations as diverse as engineering, sociology, biology, and psychology. Yet it was not until the early 1970s that a distinct popular culture emerged around the concept, as feedback became the governing trope for a counterculture that reoriented and reinvigorated the postwar culture of spontaneity and the psychedelic sixties. The idea that systems-based forms of intelligence were ubiquitous in the natural environment captured the public imagination during the seventies, resulting in the creation of new and widespread cultural practices. In this sense, ecological thinking is not identical with the science of ecology. As David Oates wrote in his study *Earth Rising: Ecological Belief in an Age of Science*, "ecological thinking" refers to "the pattern of thinking called ecology [that] has proved to have potentials far beyond the science itself . . . [because] the ecological worldview is not a science: it is a belief system extrapolated from one."[2]

Ecological thinking includes environmentalism but is not limited to it. Environmentalism emphasizes the fact that we humans are nested within nature's complex systems. Therefore we must interact with those systems in ways that do not jeopardize our own survival. But ecological thinking extends to a social vision as well. Thus in 1973 philosopher Arne Næss summarized the principles of what he called "deep ecology" as opposed to a "shallow," merely environmentalist focus, writing: "There are deeper concerns which touch upon principles of diversity, complexity, autonomy, decentralization, symbiosis, egalitarianism, and classlessness."[3]

Many Americans articulated the connections between their ecological thinking and the practices they derived from them, while many more engaged in those practices without overtly parsing their logic. This is in the nature of cultural forms as the vehicles of ideas, because practices convey meanings by embodying them rather than announcing them, using them to organize and shape one's actions. Central to the construction and communication of meaning through patterns

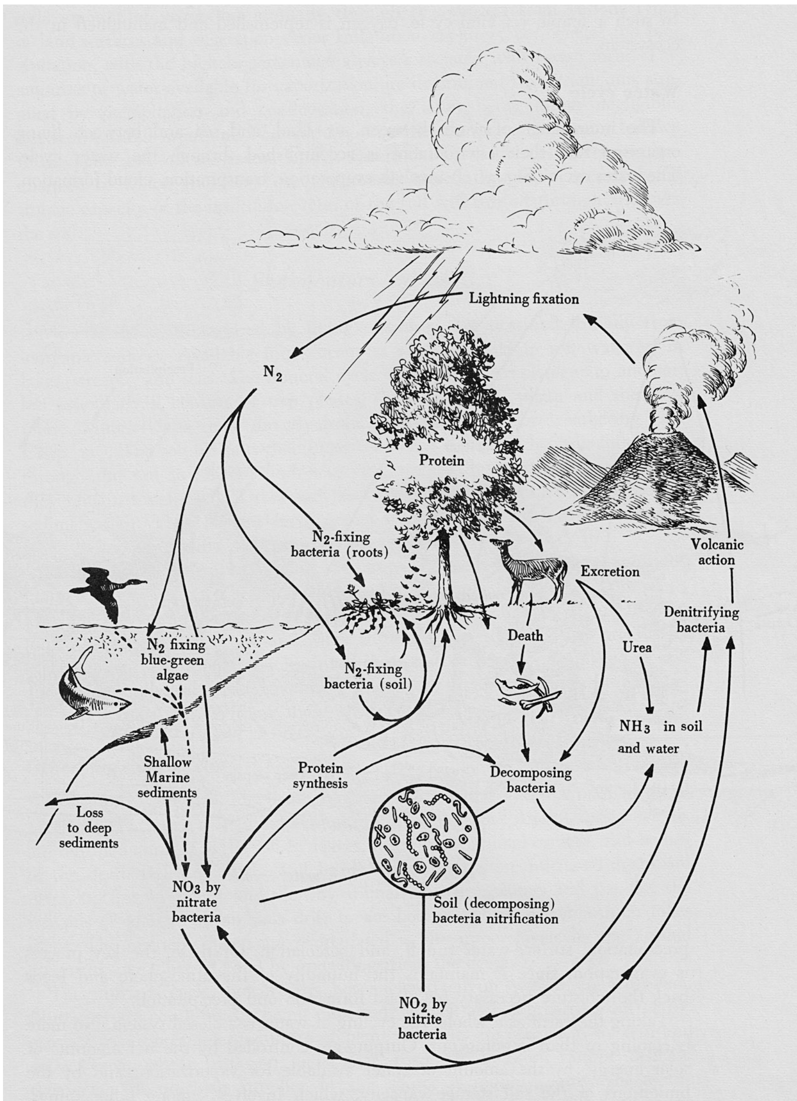


**Figure 1.** An example of an ecosystem showing feedback loops (the nitrogen cycle), originally from Robert L. Smith's *The Ecology of Man: An Ecosystem Approach* (1972). (Robert L. Smith, *Ecology and Field Biology*, 5th ed., © 1996. Reprinted by permission of Pearson Education, Inc., New York, New York.)

of practice is the evocation and articulation of affective experience through aesthetic form. By such means, thinking can be extended beyond the pale of recognizable intellectual discourse. In this way sometimes popular culture can constitute the cutting edge of thought. Conservationist Paul Shepard wrote in 1969 that the "greater and overriding wisdom [of ecology] . . . can be approached mathematically, chemically, or it can be danced or told as a myth." For epistemological reasons, he actually preferred the last two.[4]

This book traces the manifestations of ecological thinking in a culture of feedback throughout the seventies. Its scope extends to wherever feedback systems were invoked to imagine natural phenomena as forms of intelligence, or "mind." The result is not a comprehensive description of American culture in the seventies, nor is it a full account of the use of the feedback metaphor in intellectual and artistic circles since its inception. Instead, it is a delineation of how an enduring American counterculture responded to and shaped the historical imperatives of the decade.

In the seventies, ecological thinking took on widespread significance because it offered a new way of understanding how to go about changing society for the better. It provided convincing new definitions for old ideals, especially those of freedom, progress, and efficiency. The ability to evolve creatively in response to feedback was embraced by many Americans as the most meaningful way to define these most important and contested political keywords.[5]

## The Historiographical Context

My recovery of the influence of ecological thinking during the seventies reinforces a growing historiographical sense that it was a crucial decade in Americans' transition to postmodernity. More importantly, it gives us a better understanding of what that postmodern condition is.[6]

For about a quarter of a century after the seventies ended, published histories of the era focused on providing chronologically organized surveys of its political events and social trends. Peter Carroll's *It Seemed Like Nothing Happened: America in the 1970s* (1982) was probably the first of these; and Bruce Schulman's *The Seventies: The Great Shift in American Culture, Society, and Politics* (2001) is arguably the most influential. In 2006 there began to be published a second wave of histories whose authors absolved themselves of the earlier felt imperative to offer a comprehensive historical account of the decade. They

instead organized their studies around specific themes, exploring how each one's various ramifications elucidate the texture of life in those times. Andreas Killen's *1973 Nervous Breakdown: Watergate, Warhol, and the Birth of Post-Sixties America* (2006) focuses in this manner on crises of identity. Philip Jenkins's *Decade of Nightmares: The End of the Sixties and the Making of Eighties America* (2006) describes how the discourse surrounding child abuse grew to have a powerful cultural and political presence. Thomas Hine's *The Great Funk: Falling Apart and Coming Together (on a Shag Rug) in the Seventies* (2007) emphasizes material objects, combing them for insights into the behaviors and belief systems of which they are the artifacts. My book uses the impact of ecological thinking to look at the decade from yet another angle.

The aspects of postmodernity that emerge as most salient from this perspective concern an ontological and epistemological shift away from objectivity and toward intersubjectivity and mind-body holism. The culture of feedback extended the explorations of a previous generation into what it meant to be human in the context of this alternative metaphysics.[7] Like theirs, its search for a different humanism was motivated by a sense of the dominant culture's failures and shortcomings. The embrace of objectivity formed the basis for an advanced technological mastery of nature; the culture of feedback sought to interact with nature on terms of dialogue rather than mastery. A dichotomization of mind and body was necessary in order to sustain a faith in objectivity; the culture of feedback instead espoused a definition of rationality encompassing the bodily affects and emotions. In defiance of the scientific method, the culture of feedback insisted that some necessary knowledge could only be had by learning through emulation and empathy.

As the subtitles of both Killen's and Jenkins's histories suggest, the question of what the cultural upheavals of the sixties left as their legacy haunts narratives of the seventies, as does the question of where the culture of the eighties derived from. This book sheds some light on both of these issues, as a result of its particular thematic focus. Although the bulk of the events that I write about transpired between 1971 and 1979, cultural eras seldom coincide with calendar dates. In my research, I resisted assigning arbitrary cutoff dates to the phenomena I investigated, instead letting them manifest their own boundary conditions. Repeatedly, 1983 emerged as an end date, and 1963 as the year in which an idea or practice first emerged. In using ecological thinking to tell the story of the seventies and its relationship to the years before and after, I place myself most directly in dialogue with

Fred Turner's book *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (2006). Turner's work focuses on the career of Stewart Brand (the publisher of the *Whole Earth Catalog*) to tell the story of cybernetics as a prehistory of the culture of neoliberalism. In the sixties, Brand embraced the possibilities of cybernetics "as an intellectual framework and as a social practice"; the *Whole Earth Catalog*, conceived as an intellectual forum rooted in systems theory for the communalist lifestyle, sold nearly a million copies between 1968 and 1972, and won (in '72) the National Book Award for Contemporary Affairs. Turner's thesis is that the attitude toward technology manifested in the *Whole Earth Catalog* reveals the masculinist, white-privileged, technocratic-consumerist, libertarian bias of the sixties counterculture. This bias, he argued, was reinforced by the cyberculture of Silicon Valley, to reemerge in the Republican political agendas of the late 1980s and 1990s. In Turner's history, Brand plays a key role, as the facilitator of an interface between the countercultural and technological communities where many early programmers situated themselves.[8]

Because I focus on ecological thinking rather than on digital cybernetics, the scope of my research has differed considerably from Turner's. From this perspective, Stewart Brand appears as a figure of only peripheral importance, as compared to such people as Gregory Bateson, Gary Snyder, Pauline Oliveros, and John Lilly. And even Brand emerges, in the discursive context I recover for him, as a more complex figure than his career as a digital utopian might suggest.

To paraphrase the poet Gary Snyder, from an ecological standpoint the fatal flaw of cyberculture is that it offers networking without community. Community grounds group dynamics in the physical and social realities of place, forcing individuals to engage in cooperation and conflict to forge a shared habitat.[9] By contrast, networking without community implies only a virtual connectedness that easily devolves into egoism. Brand himself was disillusioned with this aspect of the *Whole Earth Catalog*, as he wrote in a *Harper's* magazine article of 1973 that paid homage to the ecological ideas of Bateson. "Cybernetics is the science of communication and control. It has little to do with machines unless you want to pursue that special case. It has mostly to do with life, with maintaining circuit," Brand wrote.

I came into cybernetics from a pre-occupation with biology, world saving, and mysticism. What I found missing was any clear conceptual bonding of cybernetic

> whole-systems thinking with religious whole-systems thinking . . . [to] evoke a shareable self-enhancing ethic of what is sacred, what is right for life.

Even “three years of scanning innumerable books for *The Whole Earth Catalog* didn’t turn it up.” But finally, after he had given up on the *Whole Earth Catalog*, he found what he was searching for in Bateson’s *Steps to an Ecology of Mind*.[10]

Brand invokes in his essay what might at first seem to be an idiosyncratic mix of influences: systems theory, biology, world saving, and religious mysticism. But I have found it to be representative of a cultural current that was, in the seventies, bigger than digital utopianism. Ten years after Brand published his *Harper’s* magazine essay, one could encounter a very similar mix of references in Peter Russell’s *The Global Brain* (1983), which was subtitled *Speculations on the Evolutionary Leap to Planetary Consciousness*. Russell’s book weaves together systems theory, coevolution, environmentalism, synchronicity, and telepathy. It calls on its readers to prepare mentally for the leap to planetary consciousness via meditation, biofeedback, psychedelic drugs, and digital communications networks. These tools, Russell wrote, would generate “positive feedback” for people on their individual journeys to higher consciousness, which must eventually coalesce to create a “social superorganism” with one mind but diverse ecological niches.[11] Clearly, there were other destinations for systems thinking in the counterculture besides Silicon Valley.

This book traces some of those other pathways. I am interested in how ecological thinking found expression through a range of cultural practices in a variety of media. Some of the forms that it took found names: environmentalism, biofeedback therapy, ambient music, contact improvisation, and horse whispering, to cite a few. Others—such as the practice of playing music to plants—never did. But all were united by the idea that animals, plants, and even entire ecosystems embody forms of mind that we will sooner or later come to recognize as similar to our own.

My book, in tracing the development of this idea, joins a wave of recent scholarship evincing a renewed interest in it. These works include Eduardo Kohn’s and Michael Marder’s philosophical meditations on plant-thinking; works of posthumanism centered on critical animal studies rather than on digital media and robotics; and applications of affect theory that place the embodied and affective subject at the center of cultural meaning-making. This contemporary intellectual trend

carries along with it the legacy of seventies ecological thinking, in ascribing intelligence to any "self-organizing emergent phenomena [that are] . . . 'morphodynamic'—that is, characterized by dynamics that generate form."[12]

## Why It Matters: Two Ideas of Efficiency

Once it is recognized as constituting a coherent worldview, the seventies culture of feedback can be seen to take part in a long political struggle in American society over the nature of democracy and the meaning of freedom. The importance of recovering the history of this counterculture lies in its relevance to that longer history. One way of grasping the terms of the debate is by exploring the conflicting meanings attached by two discursive traditions to an important twentieth-century American keyword: efficiency. In the first decades of the twentieth century, efficiency emerged as a moral value to serve as a guide for organizing American society in the new industrial era. Increased efficiency, defined as a higher productivity ratio (more output per input), promised to produce a harmony of interests among all parts of industrial society, by simultaneously raising wages, increasing profits, and improving services. This vision of efficiency ushered in the social order known as consumer capitalism or corporate liberalism, in which incipient class conflict was attenuated through an ostensibly perpetual rise in the American standard of living.[13]

In pursuit of this vision, the scientific management techniques of Taylorism (named for industrial engineer Frederick Winslow Taylor) delegated social power to efficiency experts who were charged with finding the "one best way" of accomplishing any task by scientifically eliminating all superfluous steps in the process. Taylorism in this way helped to define efficiency as the elimination of the superfluous. Uniformly implementing the one best way entailed centralizing the decision making. Autonomy was taken away from workers on the shop floor, who were required to follow a set of precise instructions issued by engineers. Those who couldn't meet the standard would have to find some other line of work.[14]

The credo of "the elimination of the superfluous" that Taylorism embraced resonated with contemporary social Darwinist beliefs equating the progress of human society with the process of natural selection. In the social Darwinist view, extinction was seen to improve the efficiency of nature by eliminating species and bloodlines that had

competed unsuccessfully for survival. Social relations were believed to mimic the natural order by awarding survival to the victors. In social Darwinist terms, for instance, the history of the American frontier was cast as the "winning of the West": a national myth confirming the superiority of European Americans to the Native Americans whom they had successfully displaced.[15]

During the crisis of consumer capitalism produced by the Great Depression and Dust Bowl of the 1930s, however, there emerged a competing vision of efficiency. This associated it with the optimal circulation of all resources available to a particular community. In contrast to the Taylorist principles of maximum productivity and the elimination of the superfluous, the ecological idea of efficiency emphasized conservation, inclusivity, and a close attention to the dynamics of community interaction.

The technique of contour plowing promoted by New Deal agronomists Paul Sears and Aldo Leopold illustrates the ecological principle (fig. 2). In the Taylorist view, the most efficient furrow was the straightest one, comprising the shortest distance between two points and the

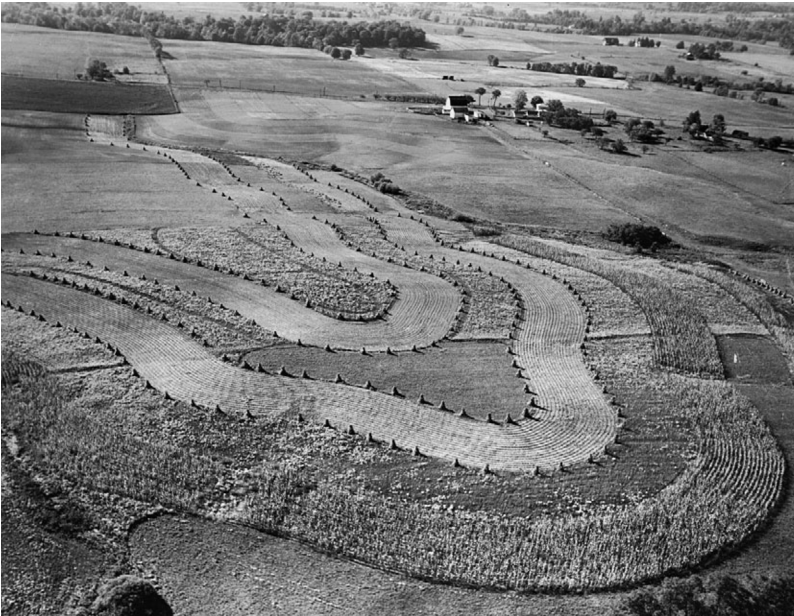

**Figure 2.** Contour plowing. Photograph by Joe Munroe. Courtesy of the Ohio History Connection.

simplest method for covering a rectangular plot of land. According to Sears and Leopold, however, the extra time and effort required by the farmer to keep the furrow constantly perpendicular to the slope of the land was an investment in community that ultimately paid off in improved soil and water conservation and an increased crop yield. On this basis, Sears counseled farmers in 1935, "Do not . . . indulge in the *vanity* of straight furrows. Plow with the contour of the land." Contour plowing takes into account how the diverse components of the ecological community—the topography, the topsoil, the plants, the rainfall, and the farmer—respond to their interactions, and it associates efficiency with this holistic viewpoint.[16]

Leopold and Sears saw this agronomic principle as just one example of the general lesson that human societies must be built on a respect for the dynamics of community interaction. Leopold observed in 1933, "Civilization is not as [the historians of progress] often assume, the enslavement of a stable and constant earth. It is a state of mutual and interdependent cooperation between human animals, other animals, plants, and soils." An ecological mind-set, Sears wrote in 1935, is intent on optimizing "*not merely what is there, but what is happening there*." It fosters mutual interdependencies. In order to check the accelerating soil erosion of the Dust Bowl, for instance, humans would have to learn to rely on "the delicate, thread-like roots of plants."[17]

The ecological idea of efficiency contradicted the conclusions of social Darwinism and Taylorism concerning the nature of progress and the value of diversity. In ecological systems, higher rates of efficiency are associated with greater complexity, not greater simplicity. Rather than standardization (the "one best way") and the elimination of the superfluous, ecological thinking values diversity and inclusivity. Diversity enables more forms of interdependency and greater resilience. Progress proceeds not by eliminating the "unfit," but by maximizing the flexibility to respond to variable conditions. Thus Sears argued in 1935 that the diversity of plant life on the arid Great Plains had provided a buffer against the region's potentially extreme climatic conditions. Plowing the plains had destroyed that buffer and "released the forces of wind and water which had been held in check . . . by a continuous carpet of plant life."[18]

These two definitions of efficiency also imply different conceptions of the individual self. Imagining life as a competition in which the "superfluous" are progressively eliminated focuses attention on the self as a discrete unit, emphasizing the boundaries that separate one person from another. It is consistent with the ideological construction of self

that Anthony Wilden in *System and Structure* called "the Lockean ego." This is a self that is "autonomous in its essence" and the prototypical and most personal form of "private property."[19] By contrast, ecology's emphasis on mutualism foregrounds the intersubjective quality of selfhood. The self is reconstituted continually through one's interactions with others. Paul Shepard wrote in 1969:

> We are hidden from ourselves by habits of perception. . . . Our language, for example, encourages us to see ourselves—or a plant or animal—as an isolated sack, a thing, a contained self. Ecological thinking, on the other hand, requires a kind of vision across boundaries. The epidermis of the skin is ecologically like a pond surface or a forest soil, not a shell so much as a delicate interpenetration.[20]

Arne Næss asserted similarly in 1973 that deep ecology implied a "*relational, total-field image*. Organisms as knots in the biospherical net or field of intrinsic relations."[21] In ecological thinking, the boundaries separating the self from the system that sustains it are permeable. To some extent their designation is arbitrary.[22]

If the New Deal is seen as a political program specific to the Great Depression, it is easy also to see it as a done deal—a set of policies and accomplishments now receding into the distant past. But it is more accurately viewed as one moment in a longer continuum of American attempts to articulate an alternative social vision to the dominant liberal order, by emphasizing interdependence and redefining how progress is measured.[23] In that sense the New Deal is still ongoing. The seventies culture of feedback continued further down that path.

The two definitions of efficiency that derive from the worldviews of Taylorism and ecological thinking imply different outlooks regarding the benefits of centralized authority structures. While the self, in ecological thinking, is understood as a "subsystem" rather than a separate entity, it is, notwithstanding, a "knot" never fully subsumed into its surroundings. As Paul Weiss wrote in *The Science of Life: The Living System—A System for Living*, published in 1973, the survival of a system hinges on its subsystems' having the necessary degree of freedom to adapt creatively to their changing environments.[24] Ecological thinking therefore places a premium on organizational dynamics that preserve relative autonomy and maximize feedback; centralized authority structures that fail to do so weaken the social order. Taylorism, by contrast, endorses the centralization of power on the basis that it strengthens the social order by achieving a more efficient coordination of disparate individual energies in pursuit of the collective good. Taylorism and

consumer capitalism embraced centralized power as the means to provide a higher standard of living for the average American. What could be more democratic than that? During the Second World War, American thinkers grappled with this very question.

## The Historical Context

The culture of feedback's engagement with the ideas of freedom, democracy, and decentralization harks back to the origins of systems theory in the context of World War II. America's mobilization for the Second World War intensified the push for economic and political centralization in service of the war effort. At the same time, however, the centralization of power in the Soviet and Nazi dictatorships—manifested in social, economic, and even cultural directives emanating from their central authorities—stood as a potent symbol of the wrongness of their politics. Anthropologists Margaret Mead and Gregory Bateson spoke out vociferously against applying such social engineering techniques in this country even in wartime, insisting that they were antithetical to democratic values. Bateson argued in 1942 that "a basic and fundamental discrepancy exists between 'social engineering,' manipulating people in order to achieve a planned blue-print society, and the ideals of democracy. . . . It is hardly an exaggeration to say that this war is ideologically about just this."[25]

Bateson and Mead insisted that democracy had to be embraced as the *means* as well as the ends of the American war effort. Bateson asserted, "If we go on defining ends as separate from means *and* apply the social sciences as crudely instrumental means, using the recipes of science to manipulate people, we shall arrive at a totalitarian rather than a democratic system of life." The paradoxical solution, he suggested, was that a democratic leadership must "discard purpose in order to achieve our purpose."[26] In countering Nazi and Soviet propaganda, instead of promulgating its own propaganda, the American government should concentrate on fostering democratic decision-making processes. The paradox of discarding purpose in order to achieve one's purpose in a manner not predetermined would become a central tenet of the culture of feedback.

On a practical level, Bateson's recommendation to the Council for Democracy's Committee on Public Morale involved focusing on second-order purposefulness, or, as he called it, "deutero-learning." Deutero-learning is the pattern of conduct that emerges due to what is

learned about how to go about learning. For instance, if a person were to lecture before an audience and pronounce that "democracy is good; fascism is bad," the message on the level of first-order learning would be pro-democratic. The message on the level of second-order learning, however, would be the opposite, because the epistemological dynamic (what the audience learns about how to learn) is that of an authority figure telling others what to think. For democracy to be operative at the level of second-order learning, the "audience" members would have to become active participants in the dialogue and engage in a process of examining the relative merits of democracy and its alternatives, arriving at their own conclusions. Then if, on the next day, another lecturer (or the same one) were to return and announce that "there has been an error: it is fascism that is good; democracy is bad," the people's habits of deutero-learning would resist that message. The patterns of deutero-learning in a culture, Bateson believed, differed according to the priorities of every social order. The cultural work of democracy could not be achieved by the propagandistic dissemination of information, but only by encouraging deutero-learning styles cultivating open habits of mind.[27]

Bateson's ideas about culture were key to his thinking on this point. He understood cultures to be systems that related lived experiences to ideas about the world via feedback loops of learning and deutero-learning. This vision linked his anthropological work to his subsequent interest in cybernetics.

It was mathematician Norbert Wiener who introduced the word "feedback" from control engineering into the general language. In 1942, the same year that Bateson articulated his theory of deutero-learning, Wiener worked out an algorithm to enable an anti-aircraft gun to predict the future location of its target based on the pilot's previous evasive maneuvers, creating an information feedback loop that made the gun self-guiding, or "intelligent." Wiener then theorized that the feedback loop was the essence of all intelligent systems, whether biological or artificial. In 1948 he gave the emerging field a lasting name when he published the best seller *Cybernetics: Or Control and Communication in the Animal and the Machine*.[28] The application of cybernetics to the life sciences and social sciences developed from a series of conferences sponsored by the Macy Foundation beginning in May 1942 and ending in 1953, on the topic of "Feedback Mechanisms and Circular Causal Systems in Biological and Social Systems." Bateson and Mead were among those who participated. For many of the thinkers involved, as Fred Turner wrote in *The Democratic Surround*, the vision of a "cyber-

netic" self that "advances by participating in feedback loops" presented itself as an alternative to "totalitarian psyches and societies."[29]

Ecological thinking merged Wiener's idea of intelligent systems with the insights of population ecologists, who in the 1930s had begun to explore the dynamics of interdependency governing the sizes of animal and plant populations in a particular geographical area, or "community." Working independently from both Bateson and Wiener but during the same time period (1942–44), Aldo Leopold penned a critique of purposeful action that mirrored Bateson's condemnation of social engineering. Titled "Thinking Like a Mountain," Leopold's essay described how, in nature, intentional human interventions often led to unintended negative consequences because of a lack of attention to the dynamics of community interaction. Specifically, he criticized the long-standing practice of eliminating wolves and other predators from the open range in order to protect deer, cattle, and sheep. Although the short-term result was to have more of those animals, the long-term result was overgrazing and mass die-offs. "The cowman who cleans his range of wolves does not realize that he is taking over the wolf's job of trimming the herd to fit the range. He has not learned to think like a mountain," Leopold observed. "Hence we have dustbowls, and rivers washing the future into the sea."[30]

In his essay, Leopold identified the feedback loop (although he did not use that term) as the fundamental means of governance in ecological systems. Feedback dynamics placed constraints on the behavior of every actor in the system. Intervening in those dynamics could destabilize the entire community. As his title suggests, he imagined this network of feedback loops as a decentralized form of intelligence: the "thinking" of the mountain. He ascribed both thoughts and feelings to this system. "I now suspect that just as a deer herd lives in mortal fear of its wolves," he wrote, "so does a mountain live in mortal fear of its deer. And perhaps with better cause, for while a buck pulled down by wolves can be replaced in two or three years, a range pulled down by too many deer may fail of replacement in as many decades."[31]

Leopold died in 1948; but Bateson lived until 1980 and devoted his remaining years to exploring the implications of defining intelligence as a phenomenon of complex natural systems produced by networks of feedback loops. Around 1967 he adopted ecology as a central metaphor. His work of three decades was collected in the book of essays *Steps to an Ecology of Mind* that so impressed Stewart Brand and that became a touchstone of ecological thinking in the seventies. By then, the dominant culture had entered another period of crisis. The New Left, the

hippie counterculture, the Black Power movement, and radical feminism all actively rejected the postwar corporate-liberal social order and the assumptions on which it was based. In this context, decentralization again emerged as an explicitly political vision. Bateson's insights into the nature of democracy merged with the sixties' radical critique, and his ecological vision of a system governed by feedback loops provided the counterculture with an alternative model with which to contest the centralization of power in corporate and military hierarchies.[32]

Bateson strove to make his ideas relevant to the new radicalism. In lectures and essays of 1967 and 1968 (later collected in *Steps to an Ecology of Mind*), he contrasted purposive, centrally directed social planning with "wisdom," which he identified with ecological thinking. In a speech delivered at the Congress on the Dialectics of Liberation held in London in July 1967, he proclaimed:

> Purposive consciousness pulls out, from the total mind, sequences which do not have the loop structure which is characteristic of the whole systemic structure. If you follow the "common-sense" dictates of consciousness you become, effectively, greedy and unwise.

In addition to Bateson, speakers at the congress included a pantheon of other cultural radicals of the 1950s and 1960s, including R. D. Laing, Paul Goodman, Stokely Carmichael, Herbert Marcuse, Allen Ginsberg, and Julian Beck. "Lack of systemic wisdom is always punished," Bateson told his younger audience. And yet, he continued—linking his ideas to causes of the late sixties that spanned from antiwar activism to environmentalism—"today the purposes of consciousness are implemented by more and more effective machinery, transportation systems, airplanes, weaponry, medicine, pesticides, and so forth." As a result, "conscious purpose is now empowered to upset the balances of the body, of society, and of the biological world around us."[33] The culture of feedback opposed that trend.

## The Culture of Feedback as Practice and Form

The culture of feedback's use of the natural feedback loop as the basis of cultural forms to give new meaning to the idea of freedom is part of the history of improvisation as a method of art-making in America. Models of improvisation from the first half of the century, following templates laid down by surrealism and Jungian psychology, empha-

sized the revolutionary possibilities of impulses that welled up "from the depths" of the unconscious. However, as Colin Campbell pointed out in *The Romantic Ethic and the Spirit of Modern Consumerism*, imagining such feelings as the site of freedom is not contrary to the consumer capitalist ethos. In consumer capitalism, individual desire, as the motivator of consumption, is the necessary complement to efficient industrial productivity.[34]

By contrast, ecological thinking moves beyond the logic of this opposition. It does not locate freedom either in the maximization of productive capacity or in the maximal fulfillment of individual desire. Instead, it aims for maximum relationality. Correspondingly, the model of improvisation associated with ecological thinking emphasized the emergence of new forms of art through processes of group interaction, or feedback. Through such interactions, the self was regenerated and transformed beginning at it surfaces; and not by impulses emanating outward from an imaginary central core. For example, as Cynthia Novack explained, the dance form from the early seventies known as contact improvisation "tried to shed the concept of . . . the body dominated by an expressive inner self" and to replace it with a focus on "the responsive body."[35] The result was a form that offered its dancers an exercise in the creation of systemic intelligence.

Successful improvisation along these lines was seen as participating in a natural process akin to evolution. Like other versions of evolution in nature, such improvisations made use of indeterminacy, diversity, and the constraints imposed by the dynamics of interaction. The last played a defining role in bringing form to emerge out of the first two. Thus experimental composer Brian Eno stated, "I want to be on the edge between improvisation and collaboration"—where collaboration refers to the constraints imposed by participation in a group dynamic. Similarly, Ian McHarg, a pioneer of ecological design, defined creativity in 1969 as innovation coupled with "responsibility"—a word connoting both responsiveness and accountability. He had, he wrote, "turned to the world at large in order to find laws and *forms of government* that might *work satisfactorily*," and had found them in ecology. "This way has no central authority," he asserted. "Tyranny is rejected because it suppresses the uniqueness of the individual and his freedom." Yet "anarchy is rejected because it replaces creation with randomness." Instead, "poised between these two extremes is the concept of creation, linked to uniqueness, freedom, and . . . responsibility."[36]

In the chapters that follow, I trace the impact of this idea through seventies culture, following a path that is roughly chronological but

organized thematically. Chapter 1 describes how systems ecology emerged in the 1950s from the integration of systems theory and ecology. I then summarize the ecological critique of game theory, as both fields claimed the mantle of postwar cybernetics but took it in very different directions. The chapter goes on to recount how the worldview of systems ecology was brought to the attention of millions of Americans in the late sixties and early seventies by the environmental movement. Environmentalists suggested that the collapse of natural systems was imminent if humans did not quickly learn to bring their behaviors within nature's constraints. This stimulated efforts to define sustainable living practices.

Chapter 2 introduces the ideas of general systems theory, which in the late sixties and early seventies clarified the theoretical underpinnings of ecological thinking. General systems theory described how nested open systems governed by feedback loops had adaptive capacities that were tantamount to the workings of a "mind." General systems theory made it reasonable to imagine animals, plants, and other natural systems as intelligent and sentient entities. Among the most significant models of such a mind was the process of coevolution. The theory of coevolution reimagined the workings of natural selection in a way that emphasized decision making rather than competition. Some envisioned the entire ecosystem as a single sentient and intelligent being named "Gaia."

For many Americans, such insights implied a validation of traditional Native American ideas, which posited a spirit immanent in material nature, unlike the scientific discourses of Western modernity. Referred to in environmentalist and New Age discourses alike as a "reverence" toward nature, the traditional Native American viewpoint was equated with an ecological wisdom that Western civilization had sacrificed in its pursuit of a scientific knowledge that promised to predict, manipulate, and otherwise transcend nature. Chapter 3 explores how this set of ideas was promulgated through popular culture, and what its implications were both for non–Native Americans who saw themselves as adopting traditional Native American beliefs, and for American Indians themselves.

Various efforts to communicate with the sentience of plants form the subject of chapter 4. According to systems theory, mental processes are not restricted to conscious thought. The physical body's kinesthetic and sensory pathways are key aspects of intelligence and comprise part of a more inclusive and holistic intelligence than consciousness alone can provide. This holistic intelligence gives rise to an intuitive grasp of

the environment that registers as "feelings." Empathy constitutes communication on this level of intelligence. In this light, even plants could be viewed as intelligent, since they respond to their environments via electrical impulses that might be compared to bodily affects in humans. While it was exciting to imagine an almost ubiquitous vegetal intelligence, it was also at the same time unsettling, since a view of plants as sentient subjects implicitly threatens to undo the mystique with which we psychologically surround our own subjectivity.

Certain styles of music appeared to offer a middle ground where two such disparate intelligences as the human and the vegetal might meet. Chapter 5, "Ambient Music," examines how experimental composers explored the possible use of music as a means of engaging in an intersubjective dialogue with sentient nature. They invented various ways of making music that interfaced with nature's systemic intelligence by imitating its processes, using feedback loops to integrate the sounds of daily living into "living" environments of sound.

Chapter 6, "Dancing with Animals," describes how ecological thinking's emphasis on empathic interactions with nature led to a particular excitement about exploring new forms of relatedness to animals. Acknowledging the emotional lives of animals demanded moving beyond behaviorist approaches. This fostered a particular interest in relationships with horses and small toothed whales (dolphins and killer whales), because these were two groups of animals that were known to resist behavioral conditioning. The intended rapport was often described as a kind of dance, due to its reliance on empathy, interaction, and physicality. A range of cultural practices including flotation therapy, "dynamology," contact improvisation, and horse whispering fostered empathic connections between humans and animals through innovative choreographies. At the same time, multiple works, from Jane Goodall's book *In the Shadow of Man* to Godfrey Reggio's film *Koyaanisqatsi*, criticized the choreographies that humans imposed on animals by confining and domesticating them, and encouraged people to see themselves as animals in captivity.

In chapter 7, I analyze how a resurgent conservatism associated with the ascendency of President Ronald Reagan triumphed politically over ecological thinking in the early 1980s. Both orthodox neo-Darwinists and free-market economists rejected ecological thinking in favor of a reinvigorated game theory. In debates surrounding the publication of E. O. Wilson's *Sociobiology*, geneticists mocked the theory of coevolution and the ecological vision of a post-Cartesian science. In a related move, free-market advocates rejected the environmentalist credo that

there were natural limits to human population and economic growth. Embracing traditional ideas of independence and an emphasis on defensible perimeters that ran counter to ecological thinking's idea of identity as emergent from the interdependence of multiple layered systems, Reaganism promised to restore to voters "control of their own lives."

In the concluding chapter, I reexamine the most well-known histories of seventies culture in light of this new information. Recovering the history of the culture of feedback compels us to reimagine the seventies as something other than the decade of malaise. Ecological thinking offered a model for different forms of relationship—both among people, and between people and the rest of nature—that continues to shape the American path into postmodernity.