

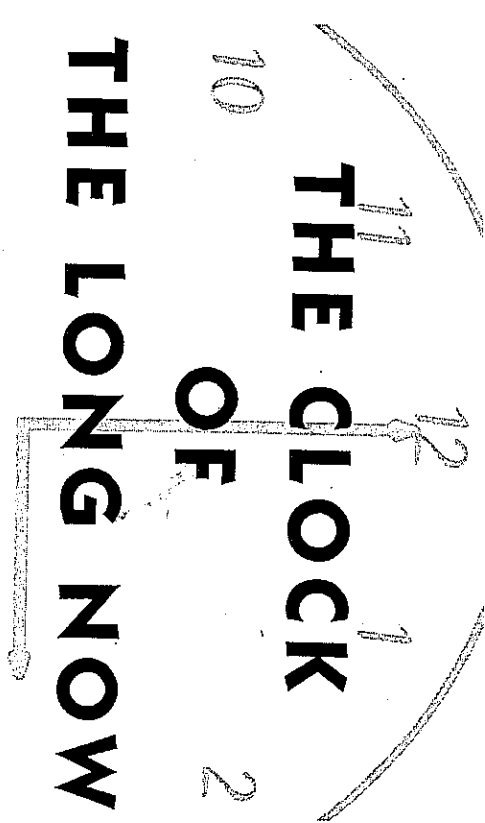
**OTHER WORKS
BY STEWART BRAND:**

Whole Earth Catalog

Two Cybernetic Frontiers

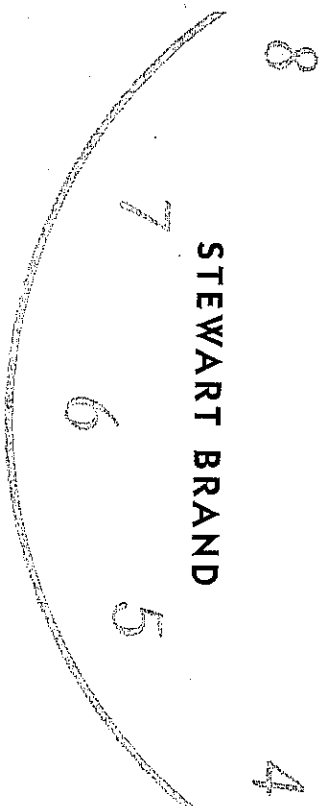
The Media Lab: Inventing the Future at MIT

How Buildings Learn: What Happens After They're Built



**THE CLOCK
OF
THE LONG NOW**

Time and Responsibility



STEWART BRAND



A Member of the Perseus Books Group



n civilizations with long noses, says Brian Eno, "you feel a very strong but flexible structure . . . built to absorb shocks and in fact incorporate them." One can imagine how such a process evolves: All civilizations suffer shocks, yet only those that absorb the shocks survive. This still does not explain the mechanism, however.

In recent years a few scientists (such as R. V. O'Neill and C. S. Holling) have been probing a similar issue in ecological systems: How do they manage change, and how do they absorb and incorporate shocks? The answer appears to lie in the relationship between components in a system that have different change rates and different scales of size. Instead of breaking under stress like some-thing brittle these systems yield as if they were malleable. Some parts respond quickly to the shock, allowing slower parts to ignore the shock and maintain their steady duties of system continuity. The combination of fast and slow components makes the system resilient, along with the way the differently paced parts affect each other. Fast learns, slow remembers. Fast proposes, slow disposes. Fast is discontinuous, slow is continuous. Fast and small instructs slow and big by accrued innovation and occasional revolution. Slow and big controls small and fast by constraint and constancy. Fast gets all our attention, slow has all the power. All durable dynamic systems have this sort of structure; it is what makes them adaptable and robust.

Consider, for example, a coniferous forest. The hierarchy in scale of pine needle, tree crown, patch, stand, whole forest, and biome is also a time hierarchy. The needle changes within a year, the tree crown over several years, the patch over many decades, the stand over a couple of centuries, the forest over a thousand years, and the biome over ten thousand years. The range of what the needle may do is constrained by the tree crown, which is constrained by the patch and stand, which are controlled by the forest, which is controlled by the biome. Nevertheless, innovation percolates throughout the system via evolutionary competition among lin-

eages of individual trees dealing with the stresses of crowding, parasites, predation, and weather. Occasionally, large shocks such as fire or disease or human predation can suddenly upset the whole system, sometimes all the way to the biome level.

The mathematician and physicist Freeman Dyson makes a related observation about human society:

The destiny of our species is shaped by the imperatives of survival on six distinct time scales. To survive means to compete successfully on all six time scales. But the unit of survival is different at each of the six time scales. On a time scale of years, the unit is the individual. On a time scale of decades, the unit is the family. On a time scale of centuries, the unit is the tribe or nation. On a time scale of millennia, the unit is the culture. On a time scale of tens of millennia, the unit is the species. On a time scale of eons, the unit is the whole web of life on our planet. Every human being is the product of adaptation to the demands of all six time scales. That is why conflicting loyalties are deep in our nature. In order to survive, we have needed to be loyal to ourselves, to our families, to our tribes, to our cultures, to our species, to our planet. If our psychological impulses are complicated, it is because they were shaped by complicated and conflicting demands.

In terms of quantity there are a great many pine needles and a great many humans, many forests and nations, only a few biomes and cultures, and but one planet. The hierarchy also underlies much of causation and explanation. On any subject, ask a four-year-old's annoying sequence of *Why?* five times and you get to deep structure. "Why are you married, Mommy?" "That's how you make a family." "Why make a family?" "It's the only way people have found to civilize children." "Why civilize children?" "If we didn't, the world would be nothing but nasty gangs." "Why?" "Because gangs can't make farms and cities and universities." "Why?" "Because they don't care about anything larger than themselves."

Considered operationally rather than in terms of loyalty, I propose six significant levels of pace and size in the working structure of a robust and adaptable civilization. From fast to slow the levels are:

- Fashion/art
- Commerce
- Infrastructure
- Governance
- Culture
- Nature

In a healthy society each level is allowed to operate at its own pace, safely sustained by the slower levels below and kept invigorated by the livelier levels above. "Every form of civilization is a wise equilibrium between firm substructure and soaring liberty," wrote the historian Eugen Rosenstock-Huussy. Each layer must respect the different pace of the others. If commerce, for example, is allowed by governance and culture to push nature at a commercial pace, all-supporting natural forests, fisheries, and aquifers will be lost. If governance is changed suddenly instead of gradually, you get the catastrophic French and Russian revolutions. In the Soviet Union government tried to ignore the constraints of culture and nature while forcing a five-Year-Plan infrastructure pace on commerce and art. Thus cutting itself off from both support and innovation, the USSR was doomed.

We can examine the array layer by layer, working down from fast and attention-getting to slow and powerful. Note that as people get older, their interests tend to migrate to the slower parts of the continuum. Culture is invisible to adolescents but a matter of great concern to elders. Adolescents are obsessed by fashion, elders bored by it.

The job of fashion and art is to be frothy: quick, irrelevant, engaging, self-preoccupied, and cruel. Try this! No, no, try *this!* Culture is cut free to experiment as creatively and irresponsibly as society can bear. From all this variety comes driving energy for commerce (e.g., the annual change in automobile models) and the occasional good idea or practice that sifts down to improve deeper levels, such as governance becoming responsive to opinion polls, or culture gradually accepting multiculturalism as structure instead of grist for entertainment.

If commerce is completely unfettered and unsupported by watchful governance and culture, it easily becomes crime, as in some nations and republics after the fall of communism. Likewise, com-

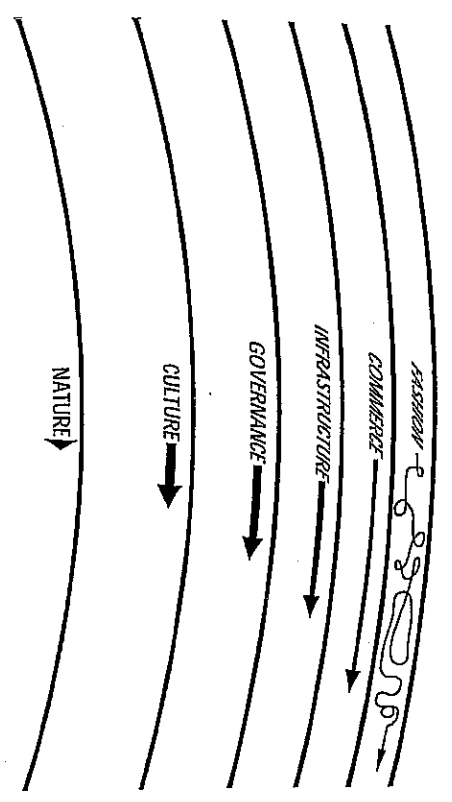


FIGURE 7.1 The order of civilization. The fast layers innovate; the slow layers stabilize. The whole combines learning with continuity.

merce may instruct but must not control the levels below it, because commerce alone is too shortsighted. One of the stresses of our time is the way commerce is being accelerated by global markets and the digital and network revolutions. The proper role of commerce is to both exploit and absorb these shocks, passing some of the velocity and wealth on to the development of new infrastructure, at the same time respecting the deeper rhythms of governance and culture.

Infrastructure, essential as it is, cannot be justified in strictly commercial terms. The payback period for such things as transportation and communication systems is too long for standard investment, so you get government-guaranteed instruments such as bonds or government-guaranteed monopolies. Governance and culture must be willing to take on the huge costs and prolonged disruptions of constructing sewer systems, roads, and communication systems, all the while bearing in mind the health of even slower "natural" infrastructure, such as water, climate, and so on.

Education is intellectual infrastructure; so is science. Very high yield, but delayed payback. Hasty societies that cannot span these delays will lose out over time to societies that can. On the other hand, cultures too hidebound to allow education to advance at infrastructural pace also lose out.

In the realm of governance the most interesting trend in current times besides the worldwide proliferation of democracy and

the rule of law is the rise of what is coming to be called the "social sector." The public sector is government, the private sector is business, and the social sector is nongovernmental, nonprofit do-good organizations. Supported by philanthropy and the toil of volunteers, they range from church charities, local land trusts, and disease support groups to global players like the International Red Cross and World Wildlife Fund. What such organizations have in common is that they serve the larger, slower good.

The social sector acts on culture-level concerns in the domain of governance. One example is the sudden mid-twentieth-century dominance of historic preservation of buildings, pushed by such organizations as the National Trust for Historic Preservation in America and English Heritage and the National Trust in Britain. Through them culture declared that it was okay to change clothing at fashion pace but not buildings; okay to change tenants at commercial pace but not buildings; okay to change transportation at infrastructure pace but not neighborhoods. "If some parts of our society are going to speed up," these organizations seemed to say, "then other parts are going to have to slow way down, just to keep balance." Even New York City, the most demolition-driven metropolis in America, began to preserve its downtown.

Culture is where the Long Now operates. Culture's vast slow-motion dance keeps century and millennium time. Slower than political and economic history, it moves at the pace of language and religion. Culture is the work of whole peoples. In Asia you surrender to culture when you leave the city and hike back into the mountains, traveling back in time into remote village culture, where change is century-paced. In Europe you can see it in terminology, where the names of months (governance) have varied radically since 1500 but the names of signs of the Zodiac (culture) remain unchanged for millennia. Europe's most intractable wars are religious wars.

As for nature, its vast power, inexorable and implacable, continues to surprise us. The world's first empire, the Akkadian, in the Tigris-Euphrates valley, lasted only a hundred years, from 2300 B.C.E. to 2200 B.C.E. It was wiped out by a drought that went on for three hundred years. Europe's first empire, the Minoan civilization, fell to earthquakes and a volcanic eruption in the fifteenth century B.C.E. When we disturb nature at its own scale—as with

our "extinction engine" and greenhouse gases of recent times—we risk triggering apocalyptic forces. Like it or not, we now have to comprehend and engage the still Longer Now of nature.

The division of powers among the layers of civilization allows us to relax about a few of our worries. We should not deplore rapidly changing technology and business while government controls, cultural mores, and so-called wisdom change slowly; that's their job. Also, we should not fear destabilizing positive-feedback loops (such as the Singularity) crashing the whole system. Such disruption usually can be isolated and absorbed. The total effect of the pace layers is that they provide many-leveled corrective, stabilizing negative feedback throughout the system. It is precisely in the apparent contradictions of pace that civilization finds its surest health.



Like a tree, civilization stands on its past. Only 5 percent of a mature tree's mass is alive—the leaves, cambium, sapwood, and root tips. All the rest is dead, yet that gradually built structure of once-living wood is what allows the leaves to reach so high and the roots to draw so deep. The medieval historian George Holmes describes thousand-year continuity in modern Europe:

Most Europeans live in towns and villages which existed in the lifetime of St. Thomas Aquinas, many of them in the shadow of churches already built in the thirteenth century. . . . The modern nation state grew out of the monarchies created by kings such as Philip Augustus of France and John of England. . . . Our methods of commerce and banking are derived from the practices of the Florentine Peruzzi and Medici. Students work for degrees already awarded in the medieval universities of Paris and Oxford. . . . Our books of history and our novels are the linear descendants of the works of Leonardi Bruni and Giovanni Boccaccio.

Some of the deepest connections we can make are with our own distant past. This is one of the great benefits of long-lasting religions, but even a secular connection with the past can be deeply moving. The thrill Brian Eno and I felt at the top of Big Ben was surpassed the next day on a tour of the back rooms of the Egyptian collection at the British Museum. At one point our host reached into one of the countless crowded shelves and drew out a decorated human forearm and hand. Eno wrote later:

The nails were beautifully manicured and hennaed, and in perfect condition. The hand, which was quite black, was gently curved as if holding a small animal or bird. I held this hand, slipped mine into it, and felt momentarily a connection with this very ancient woman. The fact that there was

only a hand and forearm, not a whole skeleton, gave the sense of a living woman—one somehow imagined the rest of her being. It was a strangely intimate experience: I was holding the hand of a person from so many years ago, a person who'd lived in this sophisticated and complicated society which loved pets and drank beer and went hunting with boomerangs and played games with bats and balls.

At Laetoli, Tanzania, the archaeologist Mary Leakey discovered an impossibly ancient trail of hominid footprints left in solidified volcanic ash by a male, female, and child. She reported:

At one point, and you need not be an expert tracker to discern this, she stops, pauses, turns to the left to glance at some possible threat or irregularity, and then continues to the north. This motion, so intensely human, transcends time. Three million six hundred thousand years ago, a remote ancestor—just as you or I—experienced a moment of doubt.

We draw profound comfort from such experiences. In the light of the long human story our own concerns seem petty and local. Something more compelling than nostalgia connects us to continuity and durable traditions. "I love everything that's old," chants Oliver Goldsmith, "old friends, old times, old manners, old books, old wines." We look back on the known and draw sustenance.

Yet comfort is not all we see looking back. At many times and places the past was considered horrible and dangerous. In 01940 the Marxist historian Walter Benjamin described his vision of the angel of history:

His face is turned toward the past. Where we perceive a chain of events, he sees one single catastrophe which keeps piling wreckage upon wreckage and hurls it in front of his feet. The angel would like to stay, awaken the dead, and make whole what has been smashed. But a storm is blowing from Paradise; it has got caught in his wings with such violence that the angel can no longer close them. This storm ir-

resistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress.

The idea of history as horror and warning itself has a distinguished history. The philosopher George Santayana voiced the sharpest version of the perennial warning in 1905: "Those who cannot remember the past are condemned to repeat it." Blinkered willfulness leading to calamity is so common in human experience that we can count on it recurring endlessly unless attention is paid and lessons harshly drawn, diligently remembered, and then applied.

It is no accident that among the finest leaders of the 20th century is a professional historian. Describing Winston Churchill, Isaiah Berlin wrote, "the single, central, organizing principle of his moral and intellectual universe is a historical imagination so strong, so comprehensive, as to encase the whole of the present and the whole of the future in a framework of a rich and multicolored past." Reading history, writing history, and creating history were all one enterprise for Churchill.

The idea of applied history, such as Churchill employed, is in low repute among historians, for the same reason that futurists with agendas are suspect among futurists. The interested eye is easily blind to what does not suit its interests. Nevertheless, policy keeps being made, and the interested eyes making these decisions require historical perspective if they want to avoid the Santayana curse.

So far as I know there is only one good text these days on how to apply history intelligently: *Thinking in Time: The Uses of History for Decision Makers* (01986) by Richard Neustadt and Ernest May, who have been teaching a course on the subject at Harvard's Kennedy School of Government since the early 1970s. Both the course and book have been popular and influential, though they have not yet generated an academic discipline of Applied History. The need is well catalogued by Neustadt and May:

General knowledge of history is less and less characteristic of American decision-makers and their aides. Our educational system turns out lawyers who may know only the his-

tory they learn through the constricting prisms of court opinions; economists who may learn neither economic history nor much if any economic thought except their own; scientists who may know next to nothing of the history of science; engineers who may be innocent of history entirely, even that of their profession; graduates of business schools with but a smattering of theirs; and generalist B.As who may, with ingenuity, have managed to escape all history of every sort. Our government and politics are peopled with such as these.

One of the most telling techniques taught by Neustadt and May is what they call "the Goldberg rule." The name comes from the head of a chain of grocery stores, Avram Goldberg, who told the authors, "When a manager comes to me, I don't ask him, 'What's the problem?' I say, 'Tell me the story.' That way I find out what the problem really is." Behind every issue is a story, the authors insist, and that story should begin with the earliest date that seems at all significant. An example given in the book concerns American debate in the 1980s about the rate of inflation. Studies that began after 1973 showed 10 to 12 percent inflation rates as "normal." Studies reaching back to 1953 showed those rates to be extraordinarily high. A two-century study would have shown that the United States had no inflation at all from the 1780s clear to the 1930s. In the light of the full story, "normal" is not 12 percent, but zero. High inflation was not the problem; any inflation was the problem.

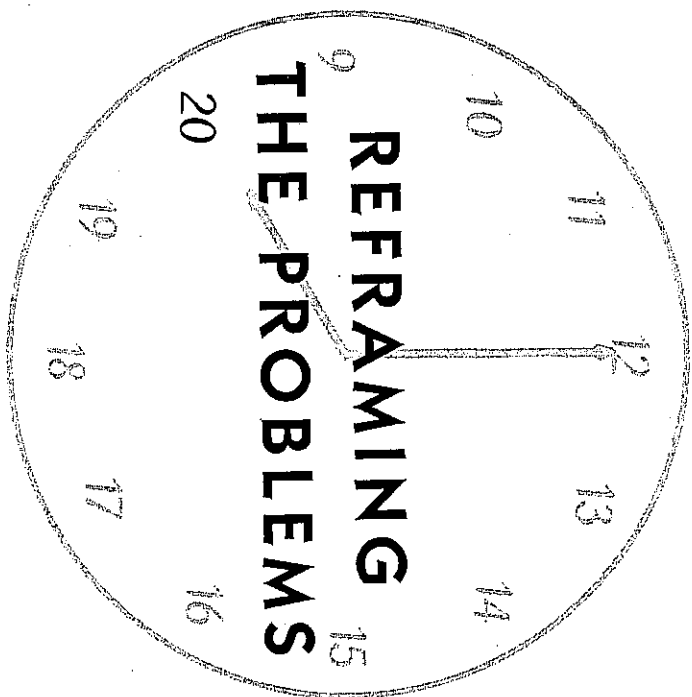
In the 1970s my generation thought that solar water heaters on roofs were a good idea, and that cocaine was a fairly harmless drug. These opinions were policy in the Carter White House. We were blithely ignorant of American experience only a half century in the past, when solar water heaters routinely crashed through the newly rotted roofs of homes in Pasadena in the 1920s. And cocaine use was so virulent an epidemic in the 1910s that the government instituted a harsh and successful prohibition of the drug. Having failed to remember, we condemned ourselves to repeat that history on an even sordid scale.

The past is both a comfort and a warning. It has to be both. If it is just a comfort, we become tranquilized and turn away from the



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future. If the past is just a warning, we may overlearn its lesson and seek a discontinuous break with the past, which then is bound to fail. Embracing the warning of the past along with its comfort is the essence of tragic optimism. With sufficiently unblinking hindsight, foresight may go well..





In 01996 a suddenly growing multibillion-dollar California foundation asked me and others to write a short paper on the question, "What are the most serious environmental problems confronting humankind at the beginning of the twenty-first century?" Figuring I would have nothing original to add to that list, I decided to write the piece from the perspective of the Clock of the Long Now. Looking from outside the present time gave a sideways rather than end-on view of the current environmental problems and invited rethinking them in terms of eventual practical solutions rather than only how great a threat they pose. I think the paper fits in at this point in the discussion, where the uses and advantages of long-view thinking are explored. The foundation (now the third-largest in America) is endowed with the wealth of David Packard, cofounder of Hewlett-Packard, the brilliantly successful electronics firm based in Palo Alto, California.

To the David and Lucile Packard Foundation:
My contribution may be to bend your question a little.

Environmental problems these days come in a pretty familiar litany of pretty familiar names. The World Population problem. Climate Change problem. Loss of Biodiversity. Ocean Fisheries. Freshwater Aquifers. North/South Economic Disparity. Rain Forests. Agricultural and Industrial Pollution. Identifying these issues and making them everyone's concern has been a major triumph of environmental science and activism in the late twentieth century.

I propose that the Packard Foundation could make a contribution beyond even the splendid effect of its funding by helping to re-think—reframe—the very structure of how environmental problems are stated. This is a common practice among inventive engineers such as the late Mr. Packard. When a design problem resists solution, reframe the problem in such a way that it invites solution.

An example of spontaneous reframing occurred in 01969, when the Apollo program began returning color photographs of the Earth from space. Everyone saw the photographs and saw that we occupied a planet that was beautiful, all one, very finite, and possibly fragile. The environmental movement took off from that moment—the first Earth Day was in 01970. That effect of the American space program was never intended or anticipated. Indeed, nearly all environmentalists in the sixties (except Jacques Cousteau) actively fought against the space program, saying that we had to solve Earth's problems before exploring space.

What might be some further helpful reframings?

(1) *Civilization's shortening attention span is mismatched with the pace of environmental problems.*

What with accelerating technology and the short-horizon perspective that goes with burgeoning market economies (next quarter) and the spread of democracy (next election), we have a situation where steady but gradual environmental degradation escapes our notice. The slow, inexorable pace of ecological and climatic cycles and lag times bear no relation to the hasty cycles and lag times of human attention, decision, and action. We can't slow down all of human behavior, and shouldn't, but we might slow down parts.

Now is the period in which people feel they live and act and have responsibility. For most of us *now* is about a week, sometimes a year. For some traditional tribes in the American northeast and Australia *now* is seven generations back and forward (175 years each direction). Just as the Earth photographs gave us a sense of *the big here*, we need things that give people a sense of *the long now*.

Candidate now-lengtheners might include: abiding charismatic artifacts; extreme longitudinal scientific studies; very large, slow, ambitious projects; human life extension (with delayable childbearing); some highly durable institutions; reward systems for slow responsible behavior; honoring patience and sometimes disdaining rush; widespread personal feeling for the span of history; planning practices that preserve options for the future.

In a sense, the task here is to make the world safe for hurry by slowing some parts way down.

(2) *Natural systems can be thought of pragmatically as "natural infrastructure."*



One area in which governments and other institutions seem comfortable thinking in the long term is the realm of infrastructure, even though there is no formal economics of infrastructure benefits and costs. (There should be and could be.) We feel good about investing huge amounts in transportation systems, utility grids, and buildings.

Infrastructure thinking is directly transferable to natural systems. Lucky for us, we don't have to build the atmosphere that sustains us, the soils, the aquifers, the wild fisheries, the forests, the rich biological complexity that keeps the whole thing resilient. All we have to do is defend these systems—from ourselves. It doesn't take much money. It doesn't even take much knowledge, though knowledge certainly helps.

A bracing way to think about this matter would be to seriously take on the project of terraforming Mars—making it comfortable for life. Then think about reterraforming Earth if we lose the natural systems that previously built themselves here. The fact is that humans are now so powerful that we are in effect terraforming Earth. Rather poorly so far. We can't undo our power; it will only increase. We can terraform more intelligently—with a light, slow hand, and with the joy and pride that goes with huge infrastructure projects. Current efforts by the Army Corps of Engineers to restore the Florida Everglades, for example, have this quality.

(3) *Technology can be good for the environment.*

My old biology teacher, Paul Ehrlich, has a formula declaring that environmental degradation is proportional to “population times affluence times technology.” It now appears that the coming of information technology is reversing that formula, so that better technology and more affluence leads to less environmental harm—if that is one of the goals of the society.

“Doing more with less”—Buckminster Fuller’s “ephemeralization”—is creating vastly more efficient industrial and agricultural processes, with proportionately less impact on natural systems. It is also moving ever more of human activity into an *infosphere* less harmfully entwined with the biosphere.

Given its roots, the Packard Foundation is particularly well suited to evaluate and foster what a Buddhist engineer might call *right technology*. It would be helpful to assemble a roster of existing environmentally benign technologies. Satellites for communica-

tion and remote sensing come to mind. So does Jim Lovelock’s gas chromatograph (which detected atmospheric chlorofluorocarbons)—invented for Hewlett-Packard, as I recall.

The foundation might support activities such as Eric Drexler’s Foresight Institute, which is aiming to shape nanotechnology (molecular engineering) toward cultural and environmental responsibility. It might support services on the Internet that distribute information and discussion about the environmental impacts of new and anticipated technologies and their interactions. Good effects should be investigated as well as ill effects.

(4) *Feedback is the primary tool for tuning systems, especially at the natural/artificial interface.*

German military officers are required to eat what their troops eat and after they eat. That single tradition assures that everyone’s meals are excellent and timely, and it enhances unit morale and respect for the officers. The feedback cycle is local and immediate, not routed through bureaucratic specialists or levels of hierarchy.

In similar fashion, factories, farms, and cities that pollute rivers and water tables could be required to release their outflows upstream of their own water intake rather than downstream.

The much-lamented “tragedy of the commons” is a classic case of pathological feedback—where each individual player is rewarded rather than punished for wasting the common resource. In fact, healthy self-governing commons systems are frequent in the world and in history, as examined in Elinor Ostrom’s *Governing the Commons*. The commons she dissects include communally held mountain meadows and forests in Switzerland, irrigation cooperatives in Japan and Spain, and jointly managed fisheries in Turkey, Sri Lanka, and Nova Scotia. The successful ones are maintained (and maintainable) neither by the state nor the market but by a local set of community feedbacks adroitly tuned to ensure the system’s long-term health and prosperity. Ostrom detects eight design principles that keep a wide variety of commons self-balancing. They are: clear boundaries; locally appropriate rules; collective agreement; monitoring; graduated sanctions; conflict-resolution mechanisms; rights to organize; nested enterprises.

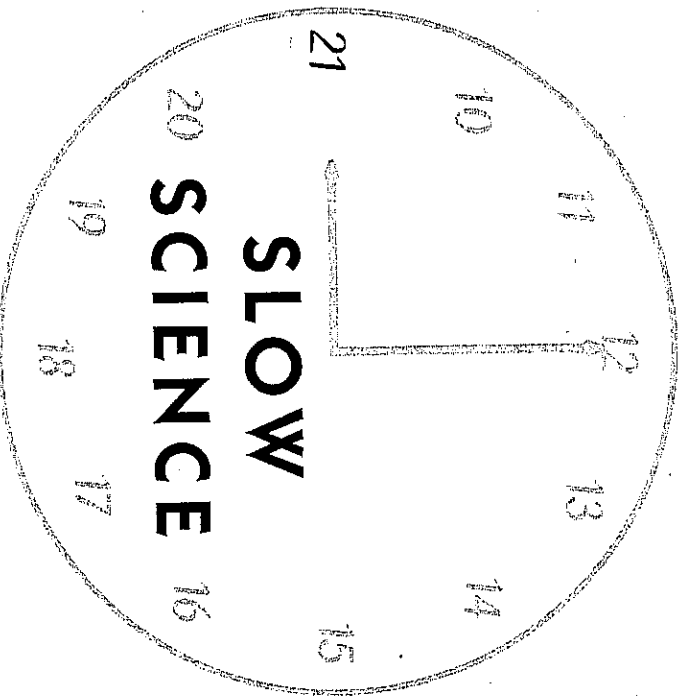
The Packard Foundation could encourage feedback analysis of environmental problems and help devise local-feedback solutions.

(5) *Environmental health requires peace, prosperity, and continuity.*

War, especially civil war, destroys the environment and displaces caring for the environment for generations. Widespread poverty destroys the environment and undermines all ability to think and act for the long term.

Environmental activists and peace activists are still catching on that they are natural partners, and both remain averse to business boosters who might aid prosperity. Peacekeeping soldiers are not in the mix at all. But for a culture and its environment to come into abiding equanimity you need all four—eco-activists, peace activists, marketers, and honest cops—each of them with a light touch, comfort with collaboration, and eagerness to replace themselves with local talent. An example of productive joining of regional business and environmental goals is the Ecotrust project at Willapa Bay, Washington.

By its funding choices and guidelines Packard Foundation could foster "jointness" in world-saving endeavors. In support of the long now, it could promote people, ideas, and organizations that are in for the long haul.





The benefits of very long-term scientific studies are so obvious it is hard to understand why they are so rare.

Global warming, the dominant environmental issue of our time, might not be an issue at all but for a study measuring atmospheric carbon dioxide begun in 01958 in a Hawaiian hut by Charles Keeling and Roger Revelle. High on the slopes of Mauna Loa volcano, downwind of thousands of miles of Pacific Ocean, the instruments have shown a steady forty-year increase in the human-exacerbated greenhouse gas, CO_2 , from 315 to 362 parts per million. Fateful numbers! Since they are largely the result of the aggregate metabolism of civilization, the trend will be an enormous task to reverse, but if it is not reversed, civilization faces a drastically different Earth over the coming century.

Maintained through four decades of budget worries and changes in scientific fashions, the Mauna Loa CO_2 records show the beginning effects of global warming (thus proof of it) as well as one of its major causes. You can see an annual cycle in the chart, with atmospheric carbon dioxide levels going down in the spring, when northern-hemisphere plants take up carbon for their growth spurt, and then rising again in the fall, when decay takes over. The amplitude of this cycle has increased some 20 percent in the forty years, indicating that Earth is "breathing deeper." The probable cause is a gradual overall increase in vegetation, fed by the higher CO_2 levels and perhaps stimulated by higher temperatures. Greenhouse indeed.

Enormous, inexorable power is in the long trends, but we cannot measure them or even notice them without doing extremely patient science. These days science is more often driven at commercial or even fashion velocity than at the deliberate pace of governance or the even slower pace of nature. As history accelerates, people become fast learners, and that's good, but it is also a problem. "Fast learners tend to track noisy signals too closely and to confuse themselves by making changes before the effects of previous actions are clear," says

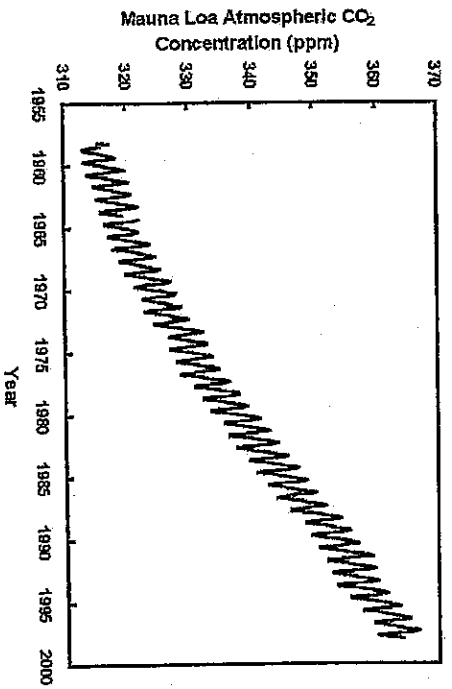


FIGURE 21.1 The recent increase in the greenhouse gas carbon dioxide is shown in this renowned graph from forty years of readings atop the Mauna Loa volcano in Hawaii. It is the prime evidence for humanity's involvement in causing global warming. The vertical dimension of the graph shows atmospheric carbon dioxide in parts per million. The rise from 01958 to 01998 is from 315 ppm to 362 ppm—an increase of 16 percent. Each year there is a seasonal oscillation, shown by the wiggles in the curve, which is driven by northern hemisphere plants taking up large quantities of CO_2 in their spring growth and releasing it in the decay of autumn.

decision analyst James March. Quiz shows and classroom teachers reward the quick answerer. This is not helpful in domains where the quick answer is the wrong answer.

A nine-year study in Africa concluded that burning new woody growth in open grassland could not prevent the woods from taking over. A forty-year study of the same subject proved the opposite, that annual burning was an ideal way to keep the grasslands open. It takes more than a decade of fires to keep woody rootstocks from resprouting, that's all.

Nearly half of ecological field research spans only one year. The two longest animal studies are George Schaller's Serengeti lion research—twenty-seven years so far—and Jane Goodall's work on chimpanzees—thirty-six years. The longest time-lapse film (such as speeded-up flower opening) covers just a week. No one has yet studied the entire life span of a termite nest, which may extend to a hundred years or more, with several queens reigning in succession.

Really extended studies are highly uncommon. The world's longest and most fruitful agricultural research (later understood as also ecological) was begun in 1843 at the Rothamsted estate, near London. John Bennett Lawes and Joseph Henry Gilbert worked together there for fifty-seven years, producing one hundred fifty scientific papers and three hundred popular articles, establishing themselves as the founders of scientific agriculture. Their original studies continue to this day at the Rothamsted Experimental Station, more than a century and a half later. What began as a series of experiments on the nutrient requirements of crop plants soon answered those questions but raised a whole new set of questions about plant diversity, soil development, community ecology, and even evolution. The longer the data set grew the more valuable it became. Particularly crucial was the preserving of one hundred fifty years of soil and plant samples, which could later be examined with tools and lines of inquiry (such as pollutant analysis) unimaginable by the founding scientists.

Rigorously collected old data keeps finding new uses. In 1790 the U.S. Constitution instituted the world's first regular population census of a nation to ensure that the population-based House of Representatives reflected accurate figures. This record later provided a precise profile of the growth, movement, and changing composition of the American people. In the 1990s the extensive marshlands of the south end of San Francisco Bay began being restored to their original teeming richness, thanks to an exquisitely detailed early map of the area by the 19th-century cartographer David Kerr. Sometimes natural systems can be mined for invaluable data sequences: polar ice cores showing the composition of the atmosphere for millennia past, tree-ring studies covering three thousand years in the American southwest and eight thousand years in Nepal, woodrat middens in Nevada preserving thirty-three thousand years of seed and pollen samples in columns of amberlike rat excrement.

One ecologist, Jim Brown, is trying to reverse the trend toward ever smaller and shorter field research projects by founding the study of *macroecology*, focusing on "phenomena at regional to global spatial scales and decadal to millennial temporal scales." In that perspective the otherwise diverging disciplines of ecology, biogeography, paleobiology, and macroevolution are forced to come

together and make sense of each other. Effective macroecology relies not on short, clever experiments but on patient observation, correlation, and statistical analysis. Brown points out that this level of study is essential now that human impact is global in scale: "Ecologists have studied the effects of starfish, largemouth bass, sea otters, beavers, and other 'keystone' species, but they are strangely reluctant to study the most key species of all, their own." (An example: there were once ninety-nine species of land birds in Hawaii. The arrival of Polynesians removed fifty of them, the arrival of Europeans another seventeen, with nineteen more now in great danger of extinction, which leaves only thirteen of the original ninety-nine bird species intact in the company of humans.)

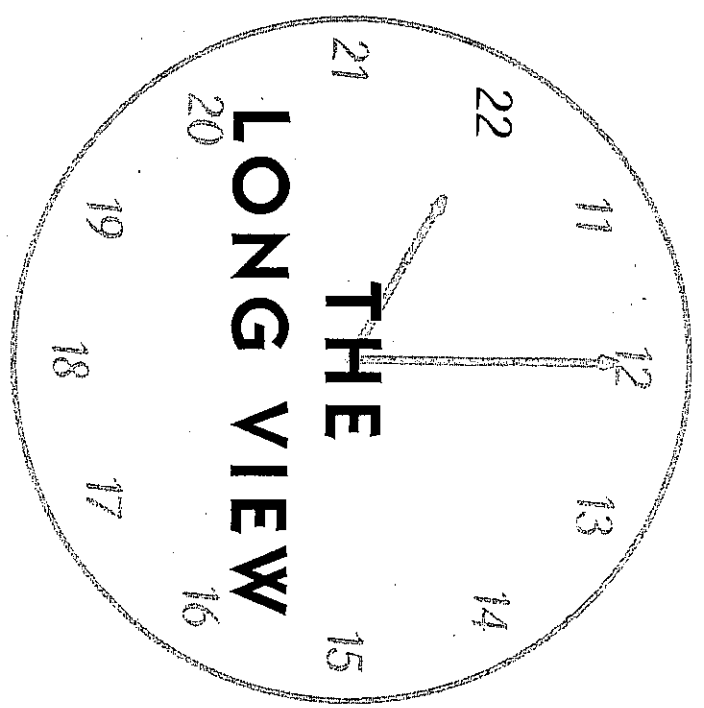
So in light of their great accumulative value, why *are* long-term scientific studies so rare? Well, (1) they're not about proving or disproving hypotheses, the coin of the scientific realm; (2) they don't generate quick papers, the coin of a scientific career; (3) they bear no relation to scientific fashion, where the excitement is; (4) they're not subject to money-making patent or copyright; (5) the few that exist usually die when their primary researcher dies; (6) they're extremely difficult to maintain funding for; and (7) ever-growing archives are an expensive hassle to service and keep accessible ("We can't stop the future to take care of the past!").

One morning at the Santa Fe Institute in New Mexico I was having breakfast with Stanford geneticist Marcus Feldman. He said that universities are dying to do long-term research, but they can't count on reliable sources of funding over time. He then described a project of his: studying the new and very troubling gender imbalance of babies in China—119 boys born for every 100 girls! Due to the customary preference for male children and the government ban on large families, mothers are getting illegal ultrasound tests and aborting female fetuses. Feldman's team had found an unusual Chinese town where the ratio of boys to girls was still even, apparently because the local custom was for newlyweds to live with the wife's parents instead of the husband's. Feldman selected an otherwise comparable town with the usual 119:100 ratio and set in motion a long-term demographic study comparing what happens over time in the two towns. "We need at least twenty years of follow-through to see what the real effects are," he fretted.

At that moment we were joined by Robert Galvin, the longtime head of Motorola Corporation. I asked Galvin how his company's major bet on China was going. He waxed enthusiastic about their grand initiative, and he was intrigued to hear about Feldman's research in China: "Those children you're studying are going to be our employees in twenty years. We plan to be in China for hundreds of years. I think you should get in touch with Motorola's foundation."

If a Long Now Library gets established, one useful role for it might be to broker ambitious longitudinal science studies with deep-pocketed—or steady-pocketed—funding sources. It might also guarantee long-term oversight and archival backup for the studies. When they are abandoned by their original researchers, it could try to find new keepers of the work, or at least preserve the accumulated material for later review or revival. Such a Library could foster cross-pollination among the long-term projects: correlating data and spreading the word on new tools, new uses for old data, and newly evolved best practices.

Science and art are always inspiring each other. Maybe some works of slow art could shame science into durational ambition. Paul Saffo likes hiding Easter eggs: "a brilliant ceramic sculpture hidden within rocklike concrete which slowly weathers away to reveal a 'Hi there!' from another era. Something wonderful buried in a flood plain where the river snakes back and forth and in time will carve a bank into the treasure. One could develop the genre to where lots of people do it for a while, making the world a very slow, very amazing Advent calendar."





Caught up as we are these years in the whirling of time, with our attention-deficit disorder and our technological obsession with the ever tinier and ever faster, how do we keep up with its pace and at the same time perceive outside it? Supposing that occasionally taking the long, contemplative view is indeed a good thing, where do you stand to get one? One authority, Dr. Gregory Cajete, a Tewa Indian from the American Southwest, has this advice:

The elders remind us of the importance of the long view when they say, “pin peyeh obe”—look to the mountain. They use this phrase to remind us that we need to look at things as if we are looking out from the top of a mountain, seeing things in the much broader perspective of the generations that are yet to come. They remind us that in dealing with the landscape, we must think in terms of a ten-thousand-, twenty-thousand-, or thirty-thousand-year relationship.

One day in the late sixties humanity found itself atop a new peak, the Moon, viewing Earth and Earth’s history from an altitude of 240,000 miles. It turned out that the astronomer Fred Hoyle was right in 1947 when he forecast, “Once a photograph of the Earth, taken from outside, is available . . . a new idea as powerful as any in history will be let loose.” In those photos from the Moon we saw fractured humanity’s home as itself unfractured and whole, and we began to see what the Tewas saw from local mountains: a relationship measured in millennia. This insight will keep being renewed as space tourism develops in the coming decades.

The environmentalist René Dubos also was right: “We are becoming planetized probably almost as fast as the planet is becoming humanized.” Our global influence and our global perspective are almost keeping pace with each other (which is fortunate—it could have been otherwise). Once we acknowledge our new responsibility for the health of the planet, the large view and the long

view become one. The Big Here and the Long Now merge as the Long Here, which is no longer just occupied but managed by what might be called the Long Us. The Chinese have a term for it: *da wo*, or “big me.”

There are other vivid points of perspective on the Long Us. Religions collect and protect many. Kevin Kelly reported on a visit to the Greek peninsula of monasteries known as Mount Athos.

It is very remote, very stable, very conservative, very much still working. There’s maybe two dozen different monasteries, all breathtaking in their architecture and settings. I’d have to say it was the most timeless place I’ve been to. You couldn’t tell what century it was at the moment. The monasteries house and feed you (men only) if you show up—that’s their rule. Those meals, with the monks in full hooded garb, by candlelight, and in complete silence, were stories in themselves. I don’t know what drew them to that place, but they were running the best time machine I know of.

Paul Saffo took his deepest time out as a youth:

I spent two summers living among a community of Maya in the highlands of Chiapas and two summers at Palenque working on the decipherment of archaeoastronomical hieroglyphs. I found all this a perfect counterpoint to what I was doing in the winters, studying history of science and technology policy. At Copan, a site with some of the most impressive inscribed stone slabs, there was one with a long count date of more than four billion years. The Maya clearly knew how to celebrate the dance of deep time.

Reader, what was the occasion of your longest view?

Communal time has been the norm over most of human history, says anthropologist Steve Barnett, and “individual time” only came in with the European Enlightenment. “I knew a guy in south India,” Barnett remarked, “who looked across a field and told me that his ancestors had been farming there, in that place, for three thousand years. He knew his ancestors back eight generations.” Long here, long us.

The slow stuff is the serious stuff, but it is invisible to us quick learners. Our senses and our thinking habits are tuned to what is sudden, and oblivious to anything gradual. Between the near-impossible win of a lottery and the certain win of earning compound interest, we choose the lottery because it is sudden. The difference between fast news and slow nonnews is what makes gambling addictive. Winning is an *event* that we notice and base our behavior on, while the relentless losing, losing, losing is a nonevent, inspiring no particular behavior, and so we miss the real event, which is that to gamble is to lose.

What happens fast is illusion, what happens slow is reality. The job of the long view is to penetrate illusion.

Edward Gibbon's *Decline and Fall of the Roman Empire* excelled in this kind of perception; it's right there in the title. For Gibbon, writes Robert D. Kaplan,

the more gradual and hidden the change, the more important it turned out to be. . . . The real changes were the insidious transformations: Rome moving from democracy to the trappings of democracy to military rule; Milan in Italy and Nicomedia in Asia Minor functioning as capital cities decades before the formal division of the empire into western and eastern halves, and almost two centuries before Rome ceased to be an imperial capital; the fact that the first fifteen "Christian" bishops of Jerusalem were circumcised Jews subscribing to a not yet formalized religion.

not gradual
accurate

Is Gibbon's view only possible from the distance he had, of fifteen centuries? How can we see the insidious transformations of our own day? Slow science is part of it, applied history is part of it, and every year there are more sophisticated tools of macroscopic vision. One video going the rounds of the conferences shows the accelerating growth of human population on a world map; the sudden overwhelm in the last seconds makes audiences gasp in shock. I know field biologists who can look at a hillside and "see" the advance of scrub growth over failing meadow; look at a wide valley and see the river lashing like a snake within its floodplain, the meander loops progressing downstream and flicking off oxbow slues to either side; look at a terminal moraine like Cape Cod and see the

glacial ice advance and then withdraw over the landscape to a one-hundred-thousand-year beat. That kind of ability is made of knowledge absorbed until it becomes perception.

Prolonged observation and deep perspective is something we assign to institutions. They aggregate human effort and are expected to handle such durational tasks as noticing slow, important change. Even some corporations, commerce-hasty as they are, do it: responsible lumber companies farming their woods on seventy-year cycles, insurance companies with their century-scale actuarial tables. But governments and universities are the main institutions we charge with caring for the long view: Governments owing to their level of responsibility, universities because their duties are to intellectual heritage and the ever-new generations passing through.

The great advisor on institutional management, Rosabeth Moss Kanter, notes that

people care about their place in history when their own past is valued. . . . People take the long view when they perceive leaders as trustworthy. . . . [They] take the long view when they believe the rules of the game are fair. They believe they will share equitably in the returns. . . . [They] take the long view when they have a deep understanding of system dynamics. They see the connections between actions in one place and consequences in another. They can therefore appreciate the need for indirect long-term investments (whether research and development, infrastructure repairs, or education).

Kanter concludes, "People take the long view when they feel a commitment to those who come after them. . . . They care about posterity—their children and other people's children—and therefore see the need for actions to benefit the distant future."

The long view looks right through death.

WV

7
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50





When you've been through enough winters you finally come to know and truly believe, in the dark of the year, that spring will come—just when you're no longer sure that you'll be around for it. Unlike the young, for whom each season is a world, the old can savor the passing of the seasons, actually feel them move through, charged with poignancy.

The great problem with the future is that we die there. This is why it is so hard to take the future personally, especially the longer future, because that world is suffused with our absence. Its very life emphasizes our helpless death. The power granted to humans by foresight is enormous, but so is the cost. We can plan only in the bitter knowledge of personal extinction. Shakespeare said it: "Thought's the slave of life, and life time's fool; And time, that takes survey of all the world, Must have a stop. O! I could prophesy, But that the earthy and cold hand of death lies on my tongue."

Time will not have a stop; it won't even slow down. That may explain why people have been speeding up, as if by cramming more and more life into each passing hour they can personally enact Zen's Paradox, always never more than halfway to death. Our technology does offer us various forms of life compression, from jet planes and cell phones to stimulants and multitasking tools. If *chronos* is the problem, day-grabbing *kaïros* looks like the solution. In some degree it may well be.

Yet each person's portion of *chronos*—our lifespan—in fact has been increasing dramatically. Global human life expectancy at birth was about ten years throughout most of human history. With safer childbirth and improvements in medicine, a newborn's life expectancy reached thirty-four in 01900, forty-six in 01954, and sixty-four in 01998. Even without a medical breakthrough it is expected to be seventy-two by 02020. In one lifetime life expectancy has increased 50 percent. The number of Americans over age sixty-five has gone from 4 percent in 01900 to 12 percent in the late 01990s to perhaps 20 percent by the 02020s.

In one century elders have gone from being rare and honored to common and powerful. The most dominant lobby in Washington, D.C., is The American Association of Retired People. Never in history have so many generations been alive at the same time. Living long enough to know your great-grandchildren has become the norm, even with delayed childbearing. Among the things that the new elders are doing with their power—and their accumulated wealth—is directing ever more sophisticated research toward life extension. I have heard biotech scientists seriously ask one another, off the record, "What if we cure death?" Whether or not effective immortality actually comes, its prospect is now in sight, and that itself begins to change things.

The best science fiction on life extension is Bruce Sterling's *Holy Fire* (01996). In its deliberately stable world dominated by the "medical-industrial complex," one character explains, "When you live a really long time, it changes everything. The whole structure of the world, politics, money, religion, culture, everything that used to be human. All those changes are your responsibility; they benefited you, they happened because of you. You have to work hard so that the polity can manage."

If long life leads to greater responsibility, because you hang around long enough to suffer the consequences of your shortsighted actions, then immortality logically leads to infinite responsibility. Esther Dyson once mused, "I personally like the certainty of death. It is amazingly relaxing to realize that one can't do everything. If I knew I were going to live forever, I would feel obliged to fix all my imperfections. I would have to learn many more languages; I would worry about my teeth not holding out; I would have to make amends for all the mistakes I have made." Kevin Kelly responded, "That's why those religions that believe in eternal virtual life are so hung up on perfecting and repenting."

Organic farmers have a bumper sticker: "Live like you'll die tomorrow. Farm like you'll live forever." When effective immortality kicks in, we all become organic farmers in one form or another, and that's not so bad. But it will do strange things to the interaction among generations, which is already pretty strange . . .

"Once an angry man dragged his father along the ground through his own orchard," wrote Gertrude Stein. ". . . 'Stop!' cried



the grinning old man at last. 'Stop! I did not drag my father beyond this tree.'

When Brian Eno approached the father of Anthea Norman-Taylor for permission to marry her, he was told, "What you have to ask yourself is, 'Would I wish this woman to be the grandmother of my grandchildren?'"

How about great-great-great-grandchildren, every one of them with orchard-dragging potential? Proliferating elders may have their own bumper sticker: "Never trust anyone under 50." The very old will have experienced enough past to believe in the reality of consequences, while the young will not have been wrong about enough future yet to doubt their own puerile notions. It's the old dialogue, but with a new balance of power when the old outnumber the young.

The bonds between immediate family generations may loosen, while the overall bond among humanity's generations becomes stronger, simply because so many generations are sharing the same world—having direct experience of the Long Us. Esther Dyson again: "As I get older, my 'age group' widens on both sides. When I was small I felt a certain kinship with five-year-olds, but six-year-olds were of another generation, and four-year-olds were little punks. When I was a teenager, my range extended a year or two in either direction. Now, in my mid-forties, my 'generation' includes people who grew up or even fought in the Second World War."

That's one scenario, inclusive and probably rather conservative. Another scenario, far more divisive, could be built around the continuing acceleration of technology: In this world only the young may be able to keep up, and thus they become the ones wielding overwhelming power. They may not be happy to have their world cluttered with out-of-it oldsters. Society could fragment into mutually hostile age cohorts, with the younger ones having no interest whatever in the old orchards, and lighting out for Mars.

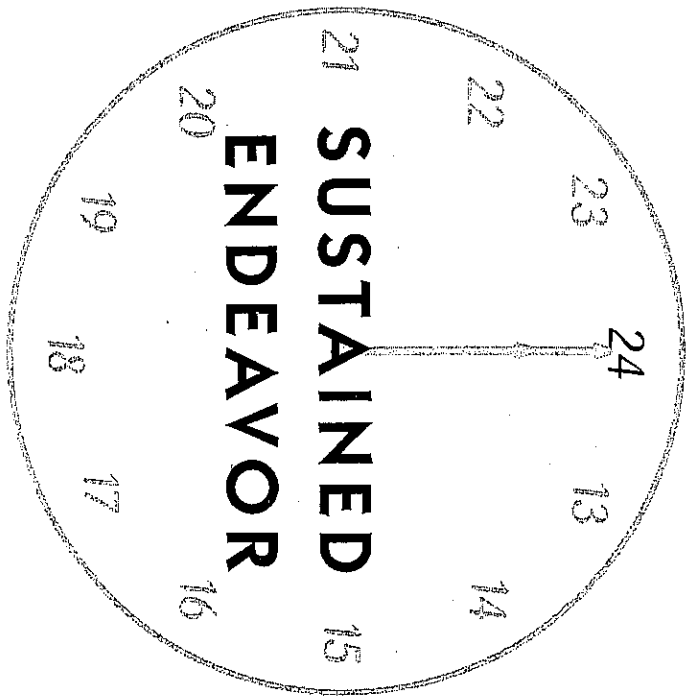
A third scenario, perhaps the ideal outcome, would be for the bonds between generations to grow stronger, with an ever-growing bias toward the young. Danny Hillis recalls, "What my grandfather did was create options. He worked hard to allow my father to have a better education than he did, and in turn my father did the same." The American revolutionary John Adams wrote to his wife in 01780:

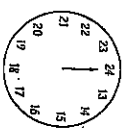
I must study politics and war that my sons may have liberty to study mathematics and philosophy. My sons ought to study mathematics and philosophy, geography, natural history, naval architecture, navigation, commerce, and agriculture, in order to give their children a right to study painting, poetry, music, architecture, statuary, tapestry, and porcelain.

Speaking of porcelain, in *The Travels of Marco Polo* is an account of a generation-spanning practice in thirteenth-century coastal China:

In a city called Tinju, they make bowls of porcelain, large and small, of incomparable beauty. They are made nowhere else except in this city, and from here are exported all over the world. . . . These dishes are made of a crumbly earth or clay which is dug as though from a mine and then stacked in huge mounds and left for thirty or forty years exposed to wind, rain, and sun. By this time the earth is so refined that dishes made of it are of an azure tint with a very brilliant sheen. You must understand that when a man makes a mound of this earth he does so for his children; the time of maturing is so long that he cannot hope to draw any profit from it himself or put it to use, but the son who succeeds him will reap the fruit.

The preserving of options for future generations can be progressive, as in Adam's case, or conservative, keeping a valuable environment, tool, or material intact and ripening. Those things were done for us. The debt we cannot repay our ancestors we pay our descendants.





Earthquakes, war, murder, the burning of libraries . . . *bad things happen fast*. Reforestation, the growth of a child, the maturing of an adult, building a library . . . *good things happen slow*.

That's not universally true, of course, but it's true enough to wonder if there is a structural explanation. I think there are several. One is simple: Construction usually requires sequential elements of assembly, whereas destruction can be done all at once. Another explanation is embodied in all the folk wisdom about the carelessness of haste, such as the fable of the giddy Hare and the steady Tortoise, "A hasty man drinks tea with a fork" (Chinese proverb), and "Haste makes waste, and waste makes want, and want makes strife between the goodman and his wife" (seventeenth-century English proverb).

Early researchers in artificial intelligence came across yet another explanation, a phenomenon they called *hill climbing*. Imagine a mountain range of opportunities, where the higher you get the greater the advantage. Hasty opportunists will never get past the foothills because they only pay attention to the slope of the ground under their feet, climb quickly to the immediate hilltop, and get stuck there. Patient opportunists take the longer view to the distant peaks, and toil through many ups and downs on the long trek to the heights.

There are two ways to make systems fault-tolerant: One is to make them small, so that correction is local and quick; the other is to make them slow, so that correction has time to permeate the system. When you proceed too rapidly with something mistakes cascade, whereas when you proceed slowly the mistakes instruct. Gradual, incremental projects engage the full power of learning and discovery, and they are able to back out of problems. Gradually emergent processes get steadily better over time, while quickly imposed processes often get worse over time.

The astonishing sophistication of ancient poems such as *The Iliad*, *The Odyssey*, and *Beowulf* long has baffled scholars. How could

Sustained Endeavor

Homer be such a genius? Recent study of illiterate bards in our own day shows that they are always partially improvising for every performance, which solves the problem. The genius of "Homer" was the accumulated ideas of generations of bardic improvisation. *The Iliad* is so effective because it is so highly evolved. Likewise, science truly took off in the seventeenth century when the Royal Society introduced the idea of the scientific "letter" (now "paper"), which encouraged a torrent of small, incremental additions to scientific knowledge.

Except for open-ended endeavors like science, the tremendously powerful lever of time has seldom been employed. The pyramids of Egypt and Central America took only fifty years to build. Some of the great cathedrals of Europe indeed were built over centuries, but that was due to funding problems rather than patience. Humanity's heroic goals generally have been sought through quick, spectacular action ("We will land a man on the Moon in this decade") instead of a sustained accumulation of smaller, distributed efforts that might have overwhelming effect over time. The kinds of goals that can be reached quickly are rather limited, and work on them displaces attention and effort that might be spent on worthier, longer-term goals.

Danny Hillis points out, "There are problems that are impossible if you think about them in two-years terms—which everyone does—but they're easy if you think in fifty-year terms." This category of problems includes nearly all the great ones of our time: The growing disparities between haves and have nots, widespread hunger, dwindling freshwater resources, ethnic conflict, global organized crime, loss of biodiversity, and so on. Such problems were slow to arrive, and they can only be solved at their own pace. It is the job of slow-but-steady governance and culture to set the goals of solving these problems and to maintain the constancy and patience required to see them through (that is not our current model of governance).

Restorative goals such as these are the most important, but they do have a negative cast. Could their accomplishment be aided by also engaging some positive goals that operate at the same pace? Colonizing Mars has this quality. Building a 10,000-Year Clock/Library might. Assembling a universal virtual-reality world on the Net feels like an achievable great work. Success in mapping the

Less Bolster -
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Plan to education



human genome should encourage the related ambition of inventing all the species on Earth and mapping their genomes. Filling in all the gaps and blanks in the total human family tree would be a vivid experience of the Long Us.

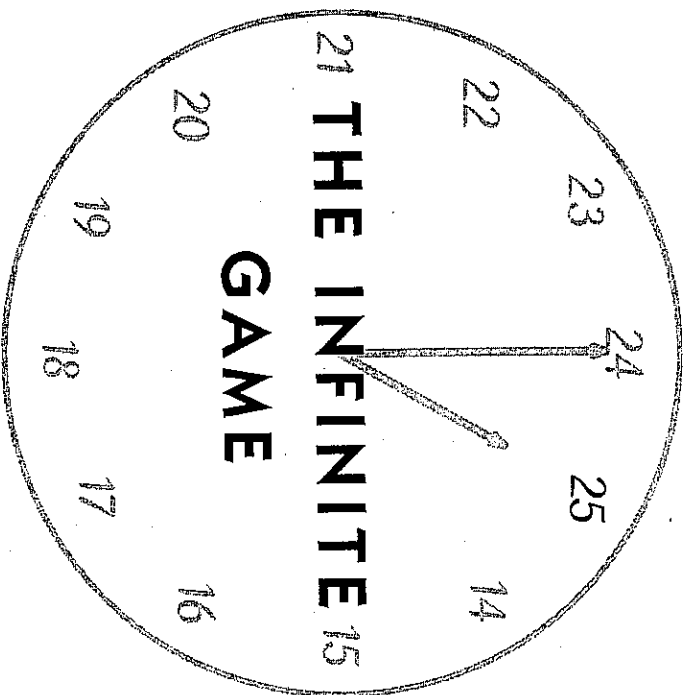
These are first-thought blurs. We have not yet seriously asked ourselves what we might do with fifty years or five hundred years of sustained endeavor. What comes to your mind, thinking in that scale?

It is not easy achieving such things. This is part of the attraction, that the task is impossible-seeming and bracingly hard. Herman Melville waited during the writing of *Moby Dick*, "Oh, Time, Strength, Cash, and Patience!" The rewards of immersion in a project, a story, reaching well beyond the span of one's own life, however, can be enormous. This is some of what keeps people working gladly in long-lived institutions such as universities and religions; it would be the main attraction of very-long-term science studies.

Environmental projects, owing to the extended lag times involved and perhaps the aesthetic rewards along the way, excel at inspiring long-term ambition. I know of two North American environmental projects with thousand-year time frames: Ecotrust, which is setting about building a nature-sustaining economy throughout the coastal temperate rain forest from mid-California to northern Alaska; and The Wildlands Project, which aims to restore enough wild land, surrounded by partially wild "buffer zones" and connected by wildlife migration corridors, for native animal and plant populations to survive indefinitely amid human dominance of the continent. Instead of saving endangered species individually and temporarily, the idea is to take the time to save them all permanently.

The learning theorist Seymour Papert tells of a group of friends eating lobsters at a Boston fish house. The question came up, "Can anyone eat lobster without making a mess?" Papert reports, "A brain surgeon at the table did it. It took him two hours—a completely eaten lobster with a perfect absence of mess. He took the time appropriate to the job, which he knew about. It wasn't his skill. It was his patience."

Two hours was the difference between impossible and easy. For what tasks would two hundred years make that kind of difference?



INFINITE GAME

- The purpose is to improve the game
- Improves through game evolving
- Winners teach losers better plays
- Winning widely shared
- Aims are diverse
- Relative complexity
- Rules changed by agreement
- Rules resemble grammar of original utterances
- Grow new markets
- Long term

The above is from a management book applying Carse's theory, *Mastering the Infinite Game*, by Charles Hampden-Turner and Fons Trompenaars, 01197.

The distinction recalls the ancient Greek differentiation between opportunity-grabbing *kairós* and all-inclusive *chronos*. Greek tragedy probed exactly such a contrast, says management consultant Charles Hampden-Turner: "Medea does not really kill her own children. She pretends to, on stage, because she is so furious with Jason, their father. And the audience surely got the message that quarreling parents kill the lives of their children by degrees. All Greek tragedies had the same structure. The finite game of feuding heroes and heroines proves itself so deadly that it kills the infinite game of parental nurture, royal succession, wise governance, etc."

Infinite games are corrupted by inappropriate finite play. Governance (infinite) is disabled when factional combat (finite) becomes the whole point instead of providing helpful debate and alternation of power. Cultures (infinite) perish when one culture seeks to eradicate another. Nature (infinite) is dangerously disrupted when commercial competition (finite) lays waste to natural cycles. Finite games flourish *within* infinite games, but they must not displace them, or all the games are over.

Finite games focus on how they end, while infinite games focus on how they continue. Freeman Dyson, a Princeton mathematician who grew up and was educated in England, once told me that the habit of long-term thinking "survives all over England. It's one reason the country has been so amazingly well cleaned up after the

It was a professor of religion, James P. Carse of New York University, who came up with the idea of "the infinite game." His jewel of a book, *Finite and Infinite Games* (01986), begins, "A finite game is played for the purpose of winning, an infinite game for the purpose of continuing the game."

Football, elections, and much of business are finite games: win/lose. Family, gardening, and spiritual practice are infinite games: Losing is meaningless. Finite games, Carse points out, require fixed rules so that the winner and loser are determined fairly, but infinite games thrive on occasional changes in the rules—agreed to by the players—so that the game constantly improves. Finite players seek to control the future; infinite players arrange things so the future keeps providing surprises. Death-defying finite players seek immortality through their famous victories; infinite players "offer their death as a way of continuing the play—they do not play for their own life, they live for their own play."

FINITE GAME

- The purpose is to win
- Improves through fittest surviving
- Winners exclude losers
- Winner takes all
- Aims are identical
- Relative simplicity
- Rules fixed in advance
- Rules resemble debating contests
- Compete for mature markets
- Short-term decisive contests



Industrial Revolution. When I was a boy, I went to London, and my clothes were filthy at the end of the day. The city was covered with soot and grime, and the rivers were very polluted; it's all been cleaned up in the past fifty years. You can always improve things as long as you're prepared to wait."

Though long based in America, Dyson is still a member of Trinity College, Cambridge, which, he notes, "has been a fantastic producer of great science for four hundred years and continues to be so." I protested that scientific revolutions turn over whole previous constructs of the universe; how could that kind of activity take place in those same buildings over four centuries? "It goes naturally together," Dyson replied. "You need the space of continuity to have the confidence not to be afraid of revolutions."

That bears repeating. You need the space of continuity to have the confidence not to be afraid of revolutions. You can always improve things as long as you're prepared to wait.

Infinite play yields strange dividends. Corfu, once the usual goat-bitten barren Greek island, was encouraged by the mercantile empire of Venice to plant olive trees for a period of four hundred years and became the most fertile and beautiful of all the Greek isles. Another island, Visingsö, in the Swedish lake Vättern, has a gorgeous mature oak forest whose origin came to light in 01980 when the Swedish Navy received a letter from the Forestry Department reporting that the requested ship lumber was now ready. It turned out that in 01829 the Swedish Parliament, recognizing that it takes one hundred fifty years for oaks to mature and anticipating that there would be a shortage of timbers for its navy in the 01990s, ordered twenty thousand trees to be planted and protected for the navy. Lone opposition came from the Bishop of Strängnäs, who said he had no doubt that there would still be war in the late twentieth century but that ships might be built of other materials by then. In finite-game terms he was right, and worthy of remembrance. For the infinite game of healthy forests it is fortunate that he was ignored by wrongheaded, long-thinking Parliament.

Infinite play converges on other infinite play. Veterans returning from the First World War were treated badly in America. In 01944 it was those aging veterans, then in politically conservative

American Legion posts, who pushed through the GI Bill for re-
turning World War II veterans, providing them with college tuition and low-cost home mortgages; it was not a Roosevelt New Deal program at all. The GI Bill's cost of \$14.5 billion was paid back eightfold in taxes in the next twenty years, it jump-started the boom years of the 01950s, it built the world's largest middle class, and it set the nation decades ahead as the world moved into a knowledge economy. America's greatest infrastructural investment ever was made as a gesture of gratitude and justice rather than of profound forethought. A move in one infinite game—generational responsibility—paid off in another infinite game—growing prosperity. Perhaps James Carse is right to end his book with the words, "There is but one infinite game."

Maturity is largely a combination of hard-earned savvy, the habit of thinking ahead, and the patience to see long-term projects through. If *kairos* is for the young, *chronos* is the domain of mature individuals and societies. Their embrace of duration yields wisdom, described by the scientist Jonas Salk as "the capability of making retrospective judgments prospectively." Wisdom decides forward as if back. Rather than make detailed, brittle plans for the future, wisdom puts its effort into expanding general, adaptive options. A fertile Corfu has more options than a barren one; veterans with a college education had more options than those without. An Earth with an intact ozone layer has more options than one without.

Preserving and increasing options is a major component of a self-saving world. Making it a habit would be part of the answer to the question, How do we make long-term thinking automatic and common instead of difficult and rare? Time-inclusive thinking began when the first farmers planted their seeds instead of eating them (it must have seemed a risky investment). The story of civilization is the story of ever-new forms of thinking ahead and the results of those forms. How the story will play out we have no way of knowing. The product of even the most imaginative and prudent forethought is not certainty but surprise. This is the reward for infinite-game generosity. Surprise plus memory equals learning. Endless surprise, diligent memory, endless learning.

While I was completing this book, the poet Gary Snyder sent me an epigram that had come to him:



*This present moment
That lives on to become
Long ago.*

I felt it was *The Clock of the Long Now* that responded to him:

*This present moment
Used to be
The unimaginable future.*

APPENDIX: ENGAGING CLOCK/LIBRARY

What the Clock/Library project offers its contributors is the possibility of being instructed and amused—maybe even inspired—for the rest of their lives. At minimum it is the work of many decades. In that time no end of ideas should be tried for their fit with each other and with the Long Now mission of expanding humanity's sense of time and responsibility.

The quality of the project—the depth of its originality and the reach of its impact—will depend entirely on how it is nourished in terms of ideas, alliances and money. If you would like to participate, you can reach The Long Now Foundation via its web site at: www.longnow.org or through its headquarters in the San Francisco Presidio:

The Long Now Foundation
P.O. Box 29462
The Presidio
San Francisco, CA 94129
Phone: (415) 561-6582
Fax: (415) 561-6297