A Boat for Thoreau

By William McDonough

One of the great leaders of the United States, Thomas Jefferson, saw himself primarily as a designer. This is evident from his tombstone, which he designed, and on which we can read three things: *"Thomas Jefferson, author of the Declaration of American Independence, author of the Statute of Virginia for Religious Freedom, and Father of the University of Virginia."* These were the three things Jefferson thought were worth mentioning on his tombstone. He did not record his various activities—that he had been president of the United States, minister to France, an architect. He recorded only what he had left behind for future generations: his creative legacy, to the world, his lasting contributions to prosperity. Consider looking at the world as a series of design assignments. How would we present the design assignment of the Declaration of Independence? Perhaps it could be framed like this: please prepare a document that provides us with the concept of "life, liberty and the pursuit of happiness free from remote tyranny." That would be the retroactive design assignment of the Declaration of Independence.

In Mr. Jefferson's case, "remote tyranny" referred to the King of England, George III: someone who ruled from a distant place, who was not sensitive to local needs and circumstance. Now, seven generations later, I believe we need to look at the concept of many Declarations of Interdependence, because we realize that some of the remote tyranny future generations will suffer—is us. Right now, we—as a culture—are imposing what I call intergenerational remote tyranny. I would like to focus on this tyrannizing effect from a design perspective and consider how we can design it out.

Thomas Jefferson clearly understood the idea of intergenerational remote tyranny. In 1789, he wrote a letter to James Madison, which I paraphrase here:

The earth belongs to the living. No man may by natural right oblige the lands he owns or occupies to debts greater than those that may be paid during his own lifetime. Because if he could, then the world would belong to the dead and not to the living.

In *Silent Spring*, Rachel Carson stated that the founding fathers who wrote the Bill of Rights—despite their intellectual gifts and foresight could not have imagined that corporations, governments, and individuals would poison children downstream. They did not protect us from this kind of tyranny in the Bill of Rights because they could not even conceive of such a problem. We have to remember that Jefferson and Madison were living in a world that was effectively solar-powered. Their homes, the original grounds of the University of Virginia, were built with local materials: local clay, local fuel sources, solar-driven fuel sources. These people inhabited a world of natural energy flows. At that time, you could look out to the West and see a vast expanse of natural resources. Petrochemicals had not yet been invented. Yet Jefferson's phrase "The earth belongs to the living" is a powerful commentary on the tyrannies we are now seeing due to poor design.

Regulations are signals of design failure. They can even be seen—in the case of regulated toxic emissions—as licenses to kill. Polluters are basically telling us, "You are going to be poisoned. The question is, how long will it take?" Regulation is a signal of design and ethical failure. So I agree with a lot of the discussion about removing regulations to liberate business, but I would like to do it for all generations, not just this one. And I would like to do it by design, on purpose, with intention.

Jefferson's design legacy still provides for us, his seventh generation, and it continues to offer profound benefits even as the world changes around us. To see the legacy he brought to the Bill of Rights more clearly, we have to consider what it promulgated over time and imagine what it might promulgate in the future.

Jefferson wrote, "No man may by natural right. . . ." "Natural rights" had become a fundamental concept for Jefferson, and he expanded on, it often. In *The Rights of Nature,* Roderick Nash pointed out that the concept of rights has been expanding since the Magna Carta gave rights to white noble English males in 1215. In 1776, the Declaration of Independence gave rights to white American land-owning males. In 1864, we had the Emancipation Proclamation. In 1922, female suffrage. In 1964, the Civil Rights Voting Act. And then, in 1973, the Endangered Species Act: the first time in our history that human beings took responsibility for giving other living species the right to exist. We acknowledged the rights of nature itself. From our perspective, "natural rights" has now expanded to include the rights of nature itself.

If we project this pattern out, it is clear that our next discourse must be about endangered ecosystems, because we are finally realizing our interdependent connection to the natural world, and it won't be enough that there's a snail here or a condor there. We now understand that we are all connected to the web of life. Our understanding of rights and responsibilities must expand to include the rights and responsibilities of all living things.

Many people question the use of the word *dominion* in the Book of Genesis, which states that human beings are given dominion over the earth. Some wish the word had been *stewardship,* because of the relationship that might imply. Yet stewardship and dominion are both still anthropocentric concepts and presume we are in charge of everything. The Native American question is really the most relevant: How do we find ourselves in kinship with nature? How do we recognize ourselves as a vital and responsible part of it? To see the world this way, and to begin creating things within that context, is an exciting prospect. We need to understand and design for a world of fecundity, growth, and abundance, not for a world of destruction, loss, and limits.

What is the natural world, and how are humans meant to inhabit it? In 1836, Emerson wrote an essay entitled "Nature" in which he reflected on these questions: If human beings are natural, are all things made by humans natural? For that matter, what is Nature? He concluded that Nature is all those things that are immutable—those "essences" unaffected by man. His examples were the mountains, the oceans, the leaves.

Following Emerson, Thoreau contemplated the mutability of nature and the search for our rightful and meaningful place within it Unlike Emerson, however, he understood that we can affect the natural world. Today, the notion that nature is immutable, that there are "essences" so powerful they are beyond our ability to *affect* them, is obsolete.

We used, to be able to throw things away. Remember that? Things went "away." Where is "away" now? "Away" is here. "Away" is someone's backyard. There is no place to go from here. We now see that we inhabit a smaller and smaller planet. "Away" has become very close indeed.

In this context, we must again ask ourselves, "What is natural?" and, "What are our intentions as evidenced by our designs?" Early in the 1830s, Ralph Waldo Emerson went to Europe on a sailboat and returned on a steamship. Let me abstract this for effect: He went over on a solar-powered recyclable craft operated by crafts persons practicing ancient arts in the open air. He returned in a steel rust bucket putting oil on the water and smoke in the sky, operated by people working in the dark shoveling fossil fuels into the mouths of boilers. We are still designing steamships. Most buildings we design are essentially steamships. On any given day, the sun is shining and we're inside with the lights on causing the production of nuclear isotopes, carbon dioxide, nitrous oxides, and sulfur dioxide. Every time you find yourself in a building illuminated by electric light when the sun is shining, you should think, "I am in a steamship. I am in the dark." We need a new design. We need a boat for Thoreau.

Peter Senge, a professor at MIT's Sloan School of Management, works with a Learning Laboratory, a program where he discusses how organizations learn to learn. One of the first questions he asks the CEOs and chairs that attend his leadership program is, "Who is the leader on a ship crossing the ocean?" The responses he gets are *captain, navigator, helmsman.* But Senge tells them no: the leader of that ship is the designer of that ship, because you can be the best captain in the world, but if your ship is not designed to be seaworthy, you're going down. From my perspective as a designer, the ship designed during the First Industrial Revolution is going down. I want to focus on the design of that ship, and I want us to imagine what the boat for Thoreau might be like—how it would work, what it would be made of, and what effects it might have. This boat is my metaphor for the design assignment of the Next Industrial Revolution.

What is the fundamental design principle of a steamship and most modern systems? The only one I can discover is, "If brute force doesn't work, you're not using enough of it." In fact, that's the design principle behind most modern architecture, behind what is known as the "International Style." You can build the same building in Reykjavik as in Rangoon, you simply heat one and cool the other. If you're too hot or too cold, just add more energy. If brute force doesn't work, you're not using enough of it. This principle kills culture. This principle kills society. This principle kills nature. And this principle kills diversity. It kills the richness of experience—the wealth of our relationship to the web of life and place.

I would like to posit the design principles for the Next Industrial Revolution, and I would also like to describe a new design assignment. But first, let me describe the retroactive design assignment of the First Industrial Revolution: Would you design a system of production and a system of commerce that

- produces billions of pounds of highly toxic hazardous material and puts them in your soil, your air, and your water every year?

- measures prosperity by how much of your natural capital you can dig up, burn, deplete, throw into holes in the ground and into the rivers and otherwise destroy?

- measures productivity by how few people are working?

- measures progress by how many smokestacks you have?

- requires thousands of complex regulations to keep you from killing each other too quickly?

- produces a few things so highly dangerous and toxic they will require future generations to maintain constant vigilance while living in terror?

That is the retroactive design assignment of the First Industrial Revolution. Is this an ethical assignment?

I am sure the framers of the Bill of Rights had no idea this could be posited as a design. In fact, I don't think it is a design, because it didn't happen by intention. The First Industrial Revolution happened incrementally, in a series of steps, as designers and engineers responded to single problems with the materials and information at hand. We have now reached the point where we can agree that this is not a design assignment we wish to accept in our time, and it is certainly not one we want to pass on to our children. It is time to look again at the horizon with delight and anticipation, with a new responsibility and a new design legacy in mind.

A magnificent example of true intergenerational responsibility is the great Peacemaker of the Six Nations of the Iroquois, who instructed all chiefs to make decisions on behalf of their seventh generation to come. Those of us here today are Thomas Jefferson's seventh generation: he designed the Declaration of Independence for us. So it's our turn now to make decisions on, behalf of our seventh generation. Let's design a system for what I call the Next Industrial Revolution that

• introduces no hazardous material into the soil, the air, and the water every year

• measures prosperity by how much natural capital and how much solar income we can accrue in productive and fecund ways

• measures productivity by how many people are being gainfully and meaningfully employed

• measures progress by how many buildings have no smokestacks, no dangerous effluents, and no pipes

• does not require regulations to stop us from killing one another too quickly

• produces nothing that will require future generations to maintain vigilance and live in terror

I believe we can accomplish great and profitable things within that conceptual framework. But first, we must step out of the framework of guilt. Guilt does not help us. People who feel guilty often tell themselves, "I am guilty, I am guilty," and then they keep doing what they were doing. This is the way they compensate, by saying, "I am bad. I am bad. I am sorry." What we need is a much more productive concept: Negligence starts tomorrow.

If you recognize the tragic consequences of bad design and mindlessly continue to do what you are doing, then you are negligent. But what we want is change, not guilt. Because if you project the tragedy, as Jaime Lerner, the brilliant civic visionary and governor of Parana, Brazil, has pointed out, you have the tragedy. Unless you change immediately, you are unintentionally invested in watching the tragedy occur. As designers with intention, you have then adopted what Governor Lerner would call a "Strategy of Tragedy." As he would say, when you recognize the tragedy you have the tragedy.

The New York City Regional Plan Association just published a report entitled *A Region at Risk***,** which indicated that a generation ago the impervious surfaces of the New York metropolitan region—the roads, the buildings, the parking lots—made up 19 percent of the city's surfaces. In 1996, they made up 30 percent. The projection for 2020? 45 percent impervious surfaces. Imagine this pattern continuing until the amount of impervious surfaces rises to 70 or 80 percent. Where are the songbirds? What is the temperature? Where do the children play? What does the water look like? This is a tragedy. How do we deal with this tragedy? The only way to counter a Strategy of Tragedy is to adopt a Strategy of Change.

This Strategy of Change must go beyond what business and government have responded with, which we call "eco-efficiency." A primary response to the Earth Summit by the Business Council for Sustainable Development and the environmental organizations was eco-efficiency—do more with less. Although eco-efficiency is a noble and valuable concept, it is not going to save us for several reasons. First of all, its motivation is guilt. When we adopt eco-efficiency, we are basically telling ourselves, "I am bad. I am bad. I am using too much fuel and too much wood. I'm destroying cultures. I'm creating pollution. I've got to cut my energy consumption. I've got to go through all this tedious stuff because I'm bad."

When I gave the opening address at a conference celebrating the conclusion of the Environmental Protection Agency's 33/50 Voluntary Toxics Reduction Program last year, we found that people there were very excited—and rightly so—because they had achieved toxic reductions of 90 percent. But we have to wonder what we were doing before these reductions. Even more importantly, we have to realize that the 10 percent we have now becomes a new, negative 100 percent, because current scientific studies are telling us that even the smallest trace amounts of certain contaminants can have devastating effects—on our endocrine systems, for example. So this smaller amount of dangerous effluent becomes a new 100 percent to eliminate entirely. This isn't revolutionary; it's still a linear process headed for zero and never getting there, like Zeno's Paradox. What do we tell our children? "You're really bad. Try to feel better by being less bad. And your goal is zero." This is our legacy? I don't know any business person who thinks a goal of zero is very exciting.

From the "Third World's" perspective, eco-efficiency is simply the "First World" figuring out how to use the "Third World's" resources longer. Since our 20 percent of the world is using up 80 percent of the world's resources, they see eco-efficiency as a way for us to steal from the rest of the world for a longer period of time.

That's the problem with eco-efficiency from a designer's perspective: it tells us to leave the way we do things in the world the same—to just get better and more "efficient" at it. It's the same system that got us into trouble in the first place,, slowed down. Paradoxically, this may make eco-efficiency even more insidious, because people are lulled into thinking the problem is being solved, when we're really just going in the same direction.

Let me borrow an analogy from Dave Crockett, a city councilor in Chattanooga: if you're driving out of Charlottesville, Virginia, you can go north to Washington, D.C., or you can go south to Lynchburg. If you find yourself going one hundred miles an hour toward Washington when you're supposed to be going to Lynchburg, it isn't going to help you to slow down to twenty miles an hour. We've got to turn around. We've got to be going somewhere else. But where? What principles do we use to get there?

A real Strategy of Change requires a new and inspiring vision of taking, making, using, and consuming in the world. We need massive creative imagination, with the design goal of imagining what perfect looks like. Then we can have a new, positive, 100 percent to work on. That's what I'm really interested in: redesign toward that 100 percent, so we can wake up in the morning and say, "I am only 20 percent sustainable. Tomorrow I want to be 21 percent. I'm trying to reach 100 percent sustainability. That's my chart." We've got to chart a new course and begin heading in a different direction. That means we have to start imagining what the new course looks like, and start framing the conditions required to achieve it.

I have developed some principles that we use in our work:

I) Waste Equals Food. In nature, there is no such thing as waste, so the first thing we must do is eliminate the concept of waste. I am not saying we need to minimize waste; I am saying we need to eliminate the entire concept of waste.

2) Use Current Solar Income. Nature does not mine the past; it does not borrow from the future. It operates on current income. Most of us can't pursue our professional lives working out of capital reserves. We have to work with current income, and so should our designs.

3) Respect Diversity. One size does not fit all. We are all different. Every place in the world is completely different; material flows, spiritual flows, character flows, cultural flows, energy flows—all of these vary in different places. We should celebrate our differences instead of trying to make us all the same.

These are the fundamental principles. But we also need new design criteria. The traditional design criteria used by designers until now are three: *cost, performance,* and *aesthetics.* Can I afford it? Does it work? Do I like it? Now we have to add three more characteristics: Is it ecologically intelligent? Is it just? Is it fun? How do I apply these principles to find out what is ecologically intelligent? How do I apply these principles to find out what is just? (The fun part I'm going to leave to you.)

If *Waste Equals Food,* we eliminate the concept of waste. If we eliminate the concept of waste, there is no such thing as waste, and everything becomes a product. So we need some guidelines to help us design these products. I have been inspired by a chemist named Michael Braungart from Germany, and he and I have developed a series of protocols that we use when designing products. We've identified a whole typology of products.

If *Waste Equals Food* and "food" implies nutrients, then we need to understand that nutrients work within a metabolism. What are the metabolisms we find in the world? What are the artifacts of human artifice, and what is their relationship to these metabolisms? Remember that question of Emerson's: If human beings are

natural, are all things made by humans natural? We now know that many things made by humans are not "natural." So there are two fundamental metabolisms in the world: one is biological, the world of biological systems, of which we are physically a part; the other is the metabolism of human industry that exists apart from natural systems. We need to design products to go into each of these metabolisms so that they nourish one metabolism without contaminating the other.

The things we design to go into the biological metabolism should not contain mutagens, carcinogens, heavy metals, persistent toxins, bioaccumulative substances, or endocrine disrupters. The things we design to go into the technical metabolism should circulate in a closed loop forever; they should not unintentionally contaminate the organic metabolism, because many materials we marshal into the technical metabolism can damage or kill the organic metabolism.

We need to design into these two metabolisms, and this will mean products are differentiated into three fundamental types: a *Product of Consumption,* a *Product of Service,* and an *Unmarketable Product.* A *Product of Consumption is* designed to return safely to the organic cycle. It is literally a consumable and goes back to the soil. A *Product of Service* is designed to go back into the technical cycle, into the industrial metabolism from which it came. An *Unmarketable Product is* a product that should not be made because it can't feed either of these two metabolisms; this category includes substances such as radioactive materials and currently indissoluble contaminated materials, like the chromium contained in shoes.

I spent most of my childhood in the Far East, in Hong Kong, and when I moved to America, I was amazed by the fact that we no longer seem to be people with lives; we've become "consumers" with lifestyles. When did we stop being people with lives? We are not "consumers." We are people. The media will tell us how many "consumers" bought television sets, but how do you consume a television set?

Imagine I had a television hidden behind my desk and I said, "I have this amazing thing. It's a *Product of Service* because you want the function, not the thing. You want the service the item provides, but you do not necessarily want the ownership of its complex and potentially hazardous materials. Again, you want the function, not the thing. Before I tell you what the thing does, which will interest you, let me tell you what it is: It is thousands of chemicals, it has toxic heavy metals, it has a potentially implosive glass tube, and we want you to put it at eye level with your children and encourage them to play with it." Do you want this in your house? Why are we selling people hazardous waste? What do you want with this thing? You want to watch television you don't want to own hazardous waste. When you pay for a television set today you have the right (the "right") to take this combination of valuable heavy metals and miscellaneous toxins and dump it in a trashcan. Future generations are going to look back and say, "What were you thinking? What did you do with the mercury? What did you do with the chromium? You lost its quality! You put it in little holes all over the planet where we can never get it back! And it is persistently toxic! What were you thinking?"

Think about the redesign of this product as a *Product of Service,* because what happens is remarkable. When you have finished with the use of the machine, you ask yourself, "Whose food is this?" A television set is obviously food for the electronics and other industries.

My partner and I work with major corporations to redesign these products to be, in effect, leased by the manufacturer to the customer not *consumer,* customer. Customers purchase the use of a machine, and when they are finished with it they can return it to the manufacturer and say, "Thank you very much for the use of this television. I would like a new one." The system is designed so that the old product goes back into what we call the "technical cycle" and becomes a *Product of Service* again—forever. This design for return we call our Eco-leasing concept.

We talk about recycling, but most of us don't recycle in the full sense of the word; we often do what Michael Braungart and I call "downcycling"—we reduce the quality of a material until its value is practically nonexistent. In other words, we slow its journey to the landfill. For example, when a high quality plastic like

PET is "recycled" it may be mixed with other plastics to produce a hybrid of much lower quality, which is then used to make park benches. The original elevated quality can never be retrieved. So what we call recycling is still working with a *Cradle-to-Grave* life cycle.

Michael Braungart points out that the *Cradle-to-Grave* mentality is definitely Northern European. In Sweden, if you throw a banana peel on the ground it is going to be there a long time, because nothing rots quickly. Northern Europeans tended to bury everything. Western culture, then, tends to bury unwanted things. Consequently, our culture developed products in terms of a *Cradle-to-Grave* life cycle concept; once you finish with something you bury it because you don't want to look at it. In the abstract, one might say it's too bad the First Industrial Revolution didn't begin in a place like Mali. As Dr. Braungart notes, if you go to "primitive" places today, you might see a lot of aluminum cans lying on the ground outside a fence and think the people there are inconsiderate and slovenly. But those people once drank out of clay cups or gourds, and when they finished, they would simply toss the vessel over the fence and the goats, ants, or beetles would take it away. Its organic materials would nourish other organisms and go back to the soil. So these people are still doing what they've been doing forever; modern production just hasn't provided them with an intelligent design for a container that turns back into dirt—a design in what I call a *Cradle-to-Cradle* life cycle.

Plastic bottles could easily be redesigned so that they don't contain questionable substances and could safely replenish the soil. Right now they may contain antimony, catalytic residues, UV stabilizers, plasticizers, and antioxidants. What happens when the people in Mali throw that over the fence? Why not design a bottle so that when you finish with it you toss it into the compost or it biodegrades by the roadside, or it can be used as fuel for needy people to cook with? It should be safe fuel. If a clothing manufacturer wants to make clothing out of it, it should not contain potentially toxic substances. Plastic bottles were not originally designed to become clothing; they were designed to hold liquids. We have a fundamental design problem. We need to design things so they go into the biological or the technical cycle, safely, *Cradle-to-Cradle.*

Use Current Solar Income. I think we're going to resolve the energy problem, because we have current solar income. Energy from the sun is the only income the planet has (except for meteorites); all our other materials are already here. If you're in business, you understand that you must work from current income, not savings. Because we have that income from the sun, I think it won't be long before we find elegant solutions to the energy situation.

The University of Virginia's School of Architecture is about to build a building addition project designed to be a net energy exporter, a structure that produces more energy than it consumes. Why would we want to make a building that produces more energy than it needs? The reason is that *sustainability* may just be a shibboleth—the magic word that lets us into the temple of hope. A lot of people use the term *sustainability* as if it's going to save us. But sustainability as it's presently defined may be only the edge between destruction and restoration. Why would we want to simply sustain where we are now? We're in a depletive mode. We need to actually design things that are restorative. Think about the high-tech designs you see around you: airplanes, computers, space age stores. Imagine how much farther we can go, how wonderfully ambitious we can really be.

What is one of the best designs we know of for inspiration? How about a tree? How about a design that can accrue solar income, is fecund, produces habitat for all sorts of living things including people, provides fuel, food, and micro-climate, distills and transpires water, sequesters carbon, and makes oxygen? How many things do you know that do that? How many things have humans designed that make oxygen?

Why not make a building that produces oxygen? Why not make a building that produces energy? We're not very bright or ambitious designers if we can't even emulate a tree, which nature has put right there in front of us as an obvious model. Just compare a tree to most rooms. Right now, I'm in a room that sucks electrical energy from a grid, I'm responsible for the production of nuclear isotopes simply by turning on a light switch, and I'm

probably breathing all sorts of chemical experiments I don't even realize I am undertaking. Compared to a tree, this is obviously primitive design. If I'm going to be a sophisticated designer, I had better start thinking more about trees—about buildings that produce more energy than they need and purify their water, and I had better start thinking about designing buildings and sites that absorb water quickly and release it slowly in a pure form like healthy soil. A building could be a restorative thing, a thing that is more fecund than destructive.

Do modern buildings absorb water quickly and release it slowly? Absolutely not. Water coming to human environments has been treated as if it is chemistry, H_2O suffering from physics, and falling, and we have got to get it away as quickly as possible. But water is the flux of life. Human beings are biology; we are where chemistry and physics conjoin. So our designs need to celebrate this flux and celebrate water, not just flush it, contaminated, away as fast as we can. We are now conceptualizing designs "without pipes." We are designing building materials and sites that absorb, filter, and transpire water, that keep buildings cool and provide habitat on site. just like nature, they will release water slowly and cleanly.

One particular project we are designing right now is a new corporate campus for a large corporation in San Bruno, California, near San Francisco. The roof is a giant, undulating, grass-covered savannah. In the middle of the site there is an open-air courtyard around an established grove of oaks. So from the air a bird looking down might think, "Oh. That looks nice." Where are the songbirds in modern building? This roof is for songbirds. When you're inside the building the ceiling looks like a cloud. The interior is fully daylit, so the sun illumines the workspace during the day. Workers spending their day indoors feel as if they've been outdoors. We've put in raised floors, which everyone wants for planning flexibility but no one can afford, and we've put them in because they allow us to run cool evening air from the San Francisco area against the concrete slabs all night long to refresh the air and cool the building down. This design means we don't have to pump foreign energy into the building during the day to cool it, and it also means there's fresh air individually directed into each person's breathing zone. Because of these strategies, we're able to cut energy equipment and energy consumption and pay for the raised floors. The building works just like an old hacienda, but goes even further with new techniques. From the air the roof is the earth. From the interior the roof is the sky. A building that's like a tree. A building that's like a meadow. Why not do this all the time?

We can do this all the time, but we need integrative thinking. We need new design principles, new aesthetics, and new engineering. Imagine what might happen if we applied our design principles to various things starting with the molecule and working up the scale to buildings, cities, and regions.

We were asked to design a fabric for a unit of the Steelcase Corporation, the largest office furniture maker in the country, and we told them we were honored to be among the famous designers they'd selected Richard Meier, Aldo Rossi, Robert Venturi, Denise Scott Brown—these were all impressive architects. But we said we had one stipulation: unlike the others, we would not just design what the fabric looks like; we would design what it is. The company told us they expected we might say that, so they presented us with an option: what about a blend of cotton, which is natural, and PET soda bottles, which are recycled? If you put the two together, they said, you have natural, you have recycled—all the current eco-product buzzwords. You're all set. It's also durable and cheap.

But let's think about this for a minute: Is this blend an organic nutrient? Is this a Product of *Consumption?* Can it go back to soil safely? Not with the PET. Is it a product of service? Can it go back to technical cycles? Not with the cotton. Look again at our criteria: Is it ecologically intelligent? Is it just? Cotton currently occasions over 20 percent of the world's pesticide use, causes hydrological disasters, and has never been associated with social fairness. As I mentioned earlier, recycled fabrics from plastic bottles may contain antioxidants, UV stabilizers, and antimony residues from catalytic reactions. Does this belong next to human skin? Why would we want to help a company make this kind of product?

In this case, we decided to create a fabric that would be an organic nutrient, a Product of Consumption. Our client, Susan Lyons, the design director at DesignTex, arranged for us to work at Rohner Textil, a respected

textile mill in Switzerland, with Albin Kalin, a director who had already made many advances at his mill. But when we arrived, Kalin told us that our project was fortuitous, because the trimmings of his bolts of cloth had just been declared hazardous waste by the Swiss government. He could no longer bury or burn it in Switzerland but had to pay to export the trimmings. Haven't you hit the wall of the First Industrial Revolution when the edges of your product are declared hazardous waste but you can still sell what's in the middle? With eco-efficiency, people contend, "My cadmium releases have been reduced and reduced," but if you look carefully, you realize that their new worst emission may be the product itself.

"Wouldn't it be nice," we told Min, "if the trimmings of your cloth became mulch for the local garden club?" So we got to work, and the first thing we reviewed was what it means to sit in a cloth-covered chair for extended periods of time. The fabric makers had interviewed people in wheelchairs, since they represent the worst case of extensive sitting, and we found out that they wanted dryness, because the biggest problem they have is moisture buildup. So we used wool, which absorbs water, and ramie, a plant similar to nettles, which provides a strong structural fiber that wicks water. The wool in the fabric absorbs moisture and the ramie wicks it away, so you're cool in the summer, warm in the winter, and comfortable all the time. Is it ecologically intelligent? Is it just? Ramie has been organically grown for thousands of years without any help from the chemical industry. And we hope the sheep in New Zealand are happy—they're free-ranging sheep.

Once we had developed the cloth, we had the finishes, the dyes, and all the rest of the process materials to consider. Remember the smokestack analogy: the filters have to be in our heads, not on the ends of pipes. Design filters. Our design filters told us that if this fabric were going back to the soil safely, it had to be free of mutagens, carcinogens, heavy metals, persistent toxins, bio-accumulatives, endocrine disrupters, and so on. Then we approached sixty chemical companies, and when we asked them to join us and put their products through this review, they summarily declined. Finally, the chairman of Ciba Geigy in Basel agreed to let us in.

Michael Braungart and our scientific colleagues reviewed *8,000* chemicals in the textile industry using this "design filter" and had to eliminate 7,962. This left 38 chemicals. We created the entire fabric line with those 38 chemicals. Everything we needed—dyes, auxiliaries, fixatives, et cetera—came from those 38 chemicals. The fabric has won gold medals and design awards and is a success in the marketplace. It is good business, and it is also creating a new standard for business excellence.

After the fabric was in production at the factory in Switzerland, a strange thing happened. Inspectors came to inspect the water coming out of the factory, and they thought their equipment was broken. They didn't find the things they expected to find. So they went to the front of the factory and checked the inflow pipes. As they expected, the water going in was Swiss drinking water. Their equipment was fine. It turned out that during the manufacturing process the fabrics were further filtering and purifying the water. Consider this concept: when the water coming out of your factory is as clean as the water going into your factory, and the water going into your factory is Swiss drinking water, that means you can cap the pipe. That means you would rather use your effluent than your influent. If you don't have anything bad coming out of the factory, there's nothing to regulate. Isn't that interesting: there are no more regulations implicit in this complete redesign. In fact, there are less! In this case, there may be none at all. This is not eco-efficiency—this mill is not "less" bad. It's not bad, period. We did not say we wanted to cut our cadmium or our mercury as much as we can. We completely redesigned this product based on a new set of principles. Welcome to the Next Industrial Revolution.

What happened within the chemical industry as a result of all these efforts is also interesting. Naturally, your ordinary engineers who were using conventional materials got a little nervous, because implicit in what we were doing was an analysis of what had gone on before. Why were they using this chemical? Why all this cobalt? Why all this antimony? Why all these heavy metals? Why mutagens? Why carcinogens? The chemists told us that because their customers wanted something blue, their job was to figure out how to make it blue, not to solve environmental or health problems—just to make sure to tell customers to be careful handling the stuff and stay within regulatory limits. Is this ethical? Is this intelligent?

Regulatory structures cost a lot of money and require the government to tax their commerce in order to get the money to set up a regulatory structure. Then, the same people the government just taxed have to spend money to set up an anti-regulatory structure to respond to the regulatory structure. Now, have we made anything yet? How are we doing on competition in world markets? What does it mean when environmental regulation all of a sudden prevents you from being in the marketplace and competing with Taiwan, Korea, and the Philippines, where their environmental regulations are not so stringent and they can make things more cheaply? What ends up happening is that commerce, which is looking for the quickest, cheapest thing, goes to Taiwan, goes to Korea, and buys chemicals and dyes because they are much less expensive than the locally produced ones. But because these cheap materials are not produced as carefully, what customers get from them is what we call "Products Plus": you get the dye, plus, perhaps, PCBs, plus heavy metals, plus carcinogens, plus all of these other things you did not intend to buy but that come with the cheap product. Instead of going to someone who is working hard to be clean and good, commerce goes to companies that have figured out how to compete purely on an economic basis. That's a tough economic situation.

The Dutch realized that if their industries could police themselves, the government would not have to regulate them, and they would not have to place those compliance cost burdens on their industries. They could compete in world markets. So they created the Green Plan, which asks Dutch commerce to figure out the quickest, most effective solution to environmental problems, and if commerce doesn't do that then the government says it will have to step in to regulate. Now that all of this is taking place, imagine what would happen if the textile industry in Holland started to look around and ask, "How do we do this?" And suddenly, because of our redesign, here is Ciba Geigy with a package of thirty-eight chemicals that will make any color safely. To guarantee quality, all you have to do is specify their whole package. But you must use their package exclusively, or other chemicals reviewed with the same "design filter," because in order to guarantee quality you can't contaminate it with materials from some other supplier who has not been reviewed. As a result of using this exclusive protocol, you do not need special storage rooms for hazardous waste. You do not need to file with regulatory agents for handling hazardous material. Your workers are not wearing protective equipment anymore because there is nothing to fear. Within the textile industry this little revolution starts: "Wait a minute! I hear over there they're not exposing their workers to carcinogens. Why can't we do that?" And the chairman of a major chemical company looks pretty smart for having taken the obvious next step in Total Quality Management.

Let's look at the concept of Total Quality Management, at the ideas started by W. Edwards Deming. He began as a statistician who was sent into factories to monitor production during World War II. Since so many men were at war, women had gone in to work in the factories, and he was there to judge the statistical effect. Let's abstract this story for a moment to get the main point of his discovery: a statistician goes into the factory, and he notes that the men who had manufactured artillery shells before the women took over produced, say, approximately a thousand shells a day, with an inspector throwing out "rejects" at the end of the process. The men expected lemons, they expected failure. They anticipated it and planned on it.

After the men had gone to war, the statistician watched the women at work to see what would happen. He watched them make twenty shells in the first week, forty in the next, then eighty, then a hundred, then three hundred, then five hundred, then seven hundred, then nine hundred, then twelve hundred, then fourteen hundred. They leveled off at a thousand, and all the shells were perfect. Production was up, quality was up. The statistician investigated the system more closely to find out what had happened, and guess what he found out? The women talked to each other. They sat in the round and discussed their mutual problems and needs. There was no hierarchy, no inspection. They went about their business and shared the worst work. They also adopted the policy that they would not accept the concept of failure: the idea of making an artillery shell that would blow up in their husbands' faces in the middle of the war was absolutely unacceptable to them. They eliminated the concept of failure. They did not count on failure, and the result was Total Quality Management.

When the men came back after the war, the statistician explained what had happened, but the men told him they had hierarchies, they had quotas, they were inspection-based, and they had just won a major war. So the statistician moved on to a more hospitable audience in Japan, and the rest is history.

The United States eventually profited from his experience. I remember when you used to buy a car and you hoped it wouldn't turn out to be a lemon. No one expects a lemon today, but when I was a kid, you didn't want to be the one who got the lemon. You were expecting one to come off the line. Then "Quality" became "Job One" at Ford after years of being "Job One" in Japan, which captured huge pieces of the auto market. That was literally due to Deming.

The Total Quality Management concept started a revolution in production. Because those women rejected the concept of failure—the concept of a defective product Total Quality Management can be seen as a working engagement to the concept of zero defects. Just-in-time delivery came along as a result of high interest rates, high handling costs, and expensive inventory, and can be seen as providing the benefits of zero inventory. Zero accidents have always been a noble goal, and now, with total redesign, we can have zero emissions and zero waste (of undesirable materials). As Gunter Pauli likes to say, this is the next step in Total Quality Management.

The organic fabric we designed is a *Product of Consumption*; after its useful life, it goes back into the organic metabolism and feeds the soil. We're also working with Guilford of Maine, a subsidiary of Interface Corporation, to design the *Product of Service* version of fabrics, and we're working with partners in the chemical industry to develop and redesign polyester products that eliminate concerns for heavy metal residues from catalytic reactions, so people will no longer be exposed to them. Then, if we actually do recycle these materials back into the human environment, we will not be recycling heavy metals. We're also designing new dye protocols. In fact, we've recently identified a whole new line of dyes to go with polyesters based on our "design filters." The resulting fabrics will be safe and recyclable forever. They will never need to go into a landfill.

Interface Corporation is a major U.S. carpet and textile manufacturer that wants to lead the way in the Next Industrial Revolution. Ray Anderson, Interface Inc.'s founder and chairman, read about our concepts in Paul Hawken's *Ecology of Commerce*, and was moved by this important book to transform his business.

Interface Corporation is also adopting our *Product of Service* concept and the eco-leasing concept that goes with it for their large carpet business. They are calling it their *Evergreen Lease*. One way to understand how this concept has revolutionary economic implications is to think of it this way: If you buy a conventional carpet you buy a liability, not an asset. When you finish with it you're going to have to pay to get it removed. What does that mean to American business, to natural flows and materials, to prosperity? The chairman of Interface understood the problems of such a system. By adopting the Product of Service concept, his company will continue to own the material but will effectively lease it and maintain it for the customer that wants the use of it. When the customer has finished with the service of the carpet, Interface will take back their *technical nutrient.*

However, it's not enough to take a carpet back if it's not designed properly. The average carpet is nylon embedded in fiberglass and PVC. It was never designed to be recycled. You can really only "downcycle" it: you shave off some of the nylon material, and then you're left with a material "soup" that you can't use effectively. We've redesigned the actual carpet and its entire delivery system so a customer can say, "I don't like red anymore. I want blue," without feeling guilty. Right now, when you order a carpet you're contributing to the destruction of natural systems, because you're basically taking a bunch of petrochemicals the manufacturer compiled to make the product and then throwing them "away" in a landfill. Under the new protocol, your carpet order would create jobs and the negative material flows would go down or be eliminated. Consequently, when you want to change your carpet color you can have fun instead of feeling guilty. The old design process requires virgin or imperfect recycled material; the new design employs people to re-circulate technical nutrients. So you can trade throwing away petrochemicals for jobs.

What else does this new protocol mean to commerce? If our companies and countries expect to be wealthy in the future, why would they put the valuable nutrients of their industry into a landfill? The essence of our argument to Ray Anderson was simply this: If you'd been using this concept from day one, you would have four

billion pounds of technical nutrients designed for use in your industry. That's how much carpet you've made since you started the company. Four *billion pounds,* and where is it? It's in holes in the ground, or on its way there. The street value of this? Over one billion dollars. This is how you could accrue capital over time and accrue assets: by designing carpet to constantly become technical nutrients for your own company. Michael Braungart and I can apply this thinking to almost any industry with similar results.

On the regional level, we helped create the concept of Zero Emissions Zoning for Chattanooga, "the Pittsburgh of the South." Chattanooga had what Dave Crockett called a "civic heart attack" in 1968. The city was rated as having the worst air quality in the country—even worse than Los Angeles. So the city's civic leaders looked at this problem and decided to clean up their own air. They've been doing this for the last thirty years. But when their eco-industrial concept was initially proposed, a lot of industry CEOs said, "Zero Emissions Concept? What are you talking about? No corporation is going to accept it. No one will come here and do business." Then Gunter Pauli, who worked with Ecover in Europe and is now at the United Nations University in Tokyo, arranged an international conference and announced one of the first companies to agree with the Zero Emissions Concept in Chattanooga: DuPont. The chairman of DuPont actually stood up in Chattanooga and declared zero emissions a goal for his entire company. This is not a marginal event. This is big business.

Many industrial leaders claim there is no such thing as a factory without emissions. What we are talking about is zero waste and unwanted emissions. But we did it in Switzerland, so we respond with Amory Lovins's famous phrase, "It exists, therefore it is possible." I think these new design assignments are the most exciting and revolutionary ways of approaching commerce. And I believe that commerce is the primary engine of change, which is why I am involved with and respect the power of commerce so deeply.

Paul Hawken introduced me to the book *Systems of Survival,* in which Jane Jacobs states that humans have developed two fundamental systems for their own survival: the syndrome of the guardian and the syndrome of commerce.'° A guardian is, for example, the government, a system that is meant to preserve, protect, and maintain. We grow very nervous when our government officials get cozy with commerce, because the guardian is meant to shun commerce. You should not be able to buy a government official. And the guardian's biggest fear is a traitor, someone who has sold out—a commercial term. The government will kill a traitor. It will go to war, and it can incarcerate and even kill you if you threaten the state or society. It's the only system that can legally sanction murder and duplicity.

So the guardian is slow, serious, and reserves the exclusive right to kill. Commerce, on the other hand, is meant to be quick, creative, adroit, and honest. If you are dishonest, people will stop doing business with yo ; because it doesn't take them long to realize that their involvement with you is not profitable if you cheat, lie, or steal. Now, let me restate the characteristics of the guardian versus those of commerce: the guardian is simple, slow, direct and even brutal when it feels the need to be. Commerce is quick, clever, and honest. As Jacobs points out, every time you put the two together you get what she calls a "monstrous hybrid."

When a city or town calls for Zero Emissions Zoning, what are they saying? That's the guardian saying, "Don't try to kill us. We'll do transportation and schools, but don't try to kill us, business." Then business—It would be DuPont in Chattanooga's case—says, "We can do that. With no complex regulations, we can figure out how not to release anything that will kill you. That's our job." The guardian wouldn't need to regulate commerce, and commerce wouldn't have to figure out how to respond to detailed micromanaged regulations, but only if commerce designs comprehensive production systems that don't release toxic emissions. Commerce doesn't need to be in the killing business.

We must, by design, allow commerce to do what commerce does best: be creative, be inventive, be quick, be smart, and be honest. And let government do what government does best simple, important things like saying, "Don't kill us." Then our arrangements get less confused and complex.

Finally, I believe our primary design assignment, and the question we should ask ourselves in business in the future, comes down to this: How do you love all the children? Not some of the children. Not just your own children. All of the children.

Jaime Lerner has been working with the whole city of Curitiba, Brazil, around this precept. He has been developing systems that respect all the children's needs for safe shelter and food, health care, education, transportation, creative opportunity, dignity, and hope. When it was time for the city to build a public library, instead of San Francisco's response—a central 100-million-dollar mausoleum for books—Curitiba's leaders asked themselves how they could provide library services for every single child in the city, including the impoverished ones in the flavelas. They decided that with their limited budget, all they could afford was many tiny libraries, each the size of a small house.

In front of every library they put a "friendly beacon of knowledge," a brightly colored and illuminated lighthouse for visibility and security. A volunteer forester, teacher, or parent sits in a little room behind a window and watches the street, reads a book, and makes sure the children are safe going to and from the library. The library holds the reference books the children need for school, as well as books the poorest children can "buy" in exchange for compostible garbage. Curitiba's goal is to put one of these libraries in each neighborhood, within easy walking distance of every child in the city. The children will have all the books they need for school, and they'll also have access to the World Wide Web. That's how they decided to design a library in Curitiba.

How do you love all the children? Well, for one thing, imagine that your outlet pipes are immediately upstream of your inlet pipes, and you'll begin to understand. We have to take responsibility for all the children, for all the generations. We're all going to have to do this, not just those "in charge." It's going to require massive creativity—massive creativity. It's going to require a complete redesign of commerce itself.

Let's get creative and start redesigning a new kind of prosperity for ourselves, but let's make sure this prosperity includes everyone else, including our seventh generation to come. Design for all of our prosperity, not just your own prosperity. We can start by eliminating our destruction masquerading as consumption, and begin to enjoy the search for our rightful and responsible place in the natural world. Get prosperous. Get very prosperous, because then people will want to imitate you. But honor that thing in yourself, that creativity in your spirit and your place that is really the sacred trust for all generations. We need to design a system of production and consumption and a system of commerce that will allow everyone life, liberty, and the pursuit of happiness in their own place, free from remote tyranny—the remote tyranny that is us and our bad design.