

A CENTENNIAL SERMON

DESIGN, ECOLOGY, ETHICS  
AND THE  
MAKING OF THINGS

BY  
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THE CATHEDRAL OF ST. JOHN THE DIVINE  
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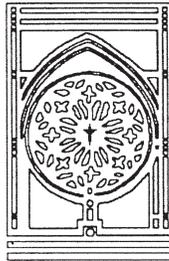


*Saving truth...the truth that saves.  
This is what sermons are supposed to be about.*

*What an appropriate honor to have the architect  
Bill McDonough preach the truth for the twenty first  
century at the Cathedral of St. John the Divine.*

*Let all who have ears hear!*

*The Very Reverend James Parks Morton  
Dean*



*It is humbling to be an architect in a cathedral because it is a magnificent representation of humankind's highest aspirations. Its dimension is illustrated by the small Christ figure in the western rose window, which is, in fact, human scale. A cathedral is a representation of both our longings and intentions. This morning, here at this important crossing in this great building, I am going to speak about the concept of design itself as the first signal of human intention and will focus on ecology, ethics, and the making of things. I would like to reconsider both our design and our intentions.*

*When Vincent Scully gave a eulogy for the great architect Louis Kahn, he described a day when both were crossing Red Square, whereupon Scully excitedly turned to Kahn and said, "Isn't it wonderful the way the domes of St. Basil's Cathedral reach up into the sky?" Kahn looked up and down thoughtfully for a moment and said, "Isn't it beautiful the way they come down to the ground?"*

*If we understand that design leads to the manifestation of human intention and if what we make with our hands is to be sacred and honor the earth that gives us life, then the things we make must not only rise from the ground but return to it, soil to soil, water to water, so everything that is received from the earth can be freely given back without causing harm to any living system. This is ecology. This is good design. It is of this we must now speak.*

*If we use the study of architecture to inform this discourse, and we go back in history, we will see that architects are always working with two elements, mass and membrane. We have the walls of Jericho, mass, and we have tents, membranes. Ancient peoples practiced the art and wisdom of building with mass, such as an adobe-walled hut, to anticipate the scope and direction of sunshine. They knew how thick a wall needed to be to transfer the heat of the day into the winter night, and how thick it had to be to transfer the coolness*

*into the interior in the summer. They worked well with what we call "capacity" in the walls in terms of storage and thermal lags. They worked with resistance, straw, in the roof to protect from heat loss in the winter and to shield the heat gain in summer from the high sun. These were very sensible buildings within the climate in which they are located.*

*With respect to membrane, we only have to look at the Bedouin tent to find a design that accomplishes five things at once. In the desert, temperatures often exceed 120 degrees. There is no shade, no air movement. The black Bedouin tent, when pitched, creates a deep shade that brings one's sensible temperature down to 95 degrees. The tent has a very coarse weave, which creates a beautifully illuminated interior, having a million light fixtures. Because of the coarse weave and the black surface, the air inside rises and is drawn through the membrane. So now you have a breeze coming in from outside, and that drops the sensible temperature even lower, down to 90 degrees. You may wonder what happens when it rains, with those holes in the tent. The fibers swell up and the tent gets tight as a drum when wet. And of course, you can roll it up and take it with you. The modern tent pales by comparison to this astonishingly elegant construct.*

*Throughout history, you find constant experimentation between mass and membrane. This cathedral is a Gothic experiment integrating great light into massive membrane. The challenge has always been, in a certain level, how to combine light with mass and air. This experiment displayed itself powerfully in modern architecture, which arrived with the advent of inexpensive glass. It was unfortunate that at the same time the large sheet of glass showed up, the era of cheap energy was ushered in, too. And because of that, architects no longer rely upon the sun for heat or illumination. I have spoken to thousands of architects, and when I ask the question, "How many of you know how to find true south?", I rarely get a raised hand.*

*Our culture has adopted a design stratagem that essentially says that if brute force or massive*

amounts of energy don't work, you're not using enough of it. We made glass buildings that are more about buildings than they are about people. We've used the glass ironically. The hope that glass would connect us to the outdoors was completely stultified by making the buildings sealed. We have created stress in people because we are meant to be connected with the outdoors, but instead we are trapped. Indoor air quality issues are now becoming very serious. People are sensing how horrifying it can be to be trapped indoors, especially with the thousands upon thousands of chemicals that are being used to make things today.

Le Corbusier said in the early part of this century that a house is a machine for living in. He glorified the steamship, the airplane, the grain elevator. Think about it: a house is a machine for living in. An office is a machine for working in. A cathedral is a machine for praying in. This has become a terrifying prospect, because what has happened is that designers are now designing for the machine and not for people. People talk about solar heating a building, even about solar heating a cathedral. But it isn't the cathedral that is asking to be heated, it is the people. To solar-heat a cathedral, one should heat people's feet, not the air 120 feet above them. We need to listen to biologist John Todd's idea that we need to work with living machines, not machines for living in. The focus should be on people's needs, and we need clean water, safe materials, and durability. And we need to work from current solar income.

There are certain fundamental laws that are inherent to the natural world that we can use as models and mentors for human designs. Ecology comes from the Greek roots *Oikos* and *Logos*, "household" and "logical discourse." Thus, it is appropriate, if not imperative, for architects to discourse about the logic of our earth household. To do so, we must first look at our planet and the very processes by which it manifests life, because therein lie the logical principles with which we must work. And we must also consider economy in the true sense of the word. Us-

ing the Greek words *Oikos* and *Nomos*, we speak of natural law and how we measure and manage the relationships within this household, working with the principles our discourse has revealed to us.

And how do we measure our work under those laws? Does it make sense to measure it by the paper currency that you have in your wallet? Does it make sense to measure it by a grand summation called GNP? For if we do, we find that the foundering and rupture of the Exxon Valdez tanker was a prosperous event because so much money was spent in Prince William Sound during the clean-up. What then are we really measuring? If we have not put natural resources on the asset side of the ledger, then where are they? Does a forest really become more valuable when it is cut down? Do we really prosper when wild salmon are completely removed from a river?

There are three defining characteristics that we can learn from natural design. The first characteristic is that everything we have to work with is already here—the stones, the clay, the wood, the water, the air. All materials given to us by nature are constantly returned to the earth, without even the concept of waste as we understand it. Everything is cycled constantly with all waste equaling food for other living systems.

The second characteristic is that one thing allowing nature to continually cycle itself through life is energy, and this energy comes from outside the system in the form of perpetual solar income. Not only does nature operate on "current income," it does not mine or extract energy from the past, it does not use its capital reserves, and it does not borrow from the future. It is an extraordinarily complex and efficient system for creating and cycling nutrients, so economical that modern methods of manufacturing pale in comparison to the elegance of natural systems of production.

Finally, the characteristic that sustains this complex and efficient system of metabolism

and creation is biodiversity. What prevents living systems from running down and veering into chaos is a miraculously intricate and symbiotic relationship between millions of organisms, no two of which are alike.

As a designer of buildings, things, and systems, I ask myself how to apply these three characteristics of living systems to my work. How do I employ the concept of waste equals food, of current solar income, of protecting biodiversity in design? Before I can even apply these principles, though, we must understand the role of the designer in human affairs.

In thinking about this, I reflect upon a commentary of Emerson's. In the 1830's, when his wife died, he went to Europe on a sailboat and returned in a steamship. He remarked on the return voyage that he missed the "Aeolian connection." If we abstract this, he went over on a solar-powered recyclable vehicle operated by craftspeople, working in the open air, practicing ancient arts. He returned in a steel rust bucket, spilling oil on the water and smoke into the sky, operated by people in a black dungeon shoveling coal into the mouth of a boiler. Both ships are objects of design. Both are manifestations of our human intention.

Peter Senge, a professor at M.I.T.'s Sloan School of Management, works with a program called the Learning Laboratory where he studies and discusses how organizations learn. Within that he has a leadership laboratory, and one of the first questions he asks CEO's of companies that attend is, "Who is the leader on a ship crossing the ocean?" He gets obvious answers, such as the captain, the navigator, or the helmsman. But the answer is none of the above. The leader is the designer of the ship because operations on a ship are a consequence of design, which is the result of human intention. Today, we are still designing steamships, machines powered by fossil fuels that have deleterious effects. We need a new design.

I grew up in the Far East, and when I came to this country, I was taken aback when I realized that we were not people with lives in America, but consumers with lifestyles. I wanted to ask someone: when did America stop having people with lives? On television, we are referred to as consumers, not people. But we are people, with lives, and we must make and design things for people. And if I am a consumer, what can I consume? Shoe polish, food, juice, some toothpaste. But actually, very little that is sold to me can actually be consumed. Sooner or later, almost all of it has to be thrown away. I cannot consume a television set. Or a VCR. Or a car. If I presented you with a television set and covered it up and said, "I have this amazing item. What it will do as a service will astonish you. But before I tell you what it does, let me tell you what it is made of and you can tell me if you want it in your house. It contains 4,060 chemicals, many of which are toxic, two hundred of which off-gas into the room when it is turned on. It also contains 18 grams of toxic methyl mercury, has an explosive glass tube, and I urge you to put it at eye-level with your children and encourage them to play with it." Would you want this in your home?

Michael Braungart, an ecological chemist from Hamburg, Germany, has pointed out that we should remove the word "waste" from our vocabulary and start using the word product instead, because if waste is going to equal food, it must also be a product. Braungart suggests we think about three distinct product types:

First, there are consumables, and actually we should be producing more of them. These are products that when eaten, used, or thrown away, literally turn back into dirt, and therefore are food for other living organisms. Consumables should not be placed in landfills, but put on the ground so that they restore the life, health, and fertility of the soil. This means that shampoos should be in bottles made of beets that are biodegradable in your compost pile. It means carpets that break down into carbon dioxide and water. It means furniture made of lignin, potato peels



*and technical enzymes that looks just like your manufactured furniture of today except it can be safely returned to the earth. It means that all “consumable” goods should be capable of returning to the soil from whence they came.*

*Second are products of service, also known as durables, such as cars and television sets. They are called products of service because what we want as customers is the service the product provides—food, entertainment, or transportation. To eliminate the concept of waste, products of service would not be sold, but licensed to the end-user. Customers may use them as long as they wish, even sell the license to someone else, but when the end-user is finished with, say, a television, it goes back to Sony, Zenith, or Philips. It is “food” for their system, but not for natural systems. Right now, you can go down the street, dump a TV into the garbage can, and walk away. In the process, we deposit persistent toxins throughout the planet. Why do we give people that responsibility and stress? Products of service must continue beyond their initial product life, be owned by their manufacturers, and be designed for disassembly, re-manufacture, and continuous re-use.*

*The third type of product is called “unmarketables.” The question is, why would anyone produce a product that no one would buy? Welcome to the world of nuclear waste, dioxins, and chromium-tanned leather. We are essentially making products or subcomponents of products that no one should buy, or, in many cases, do not realize they are buying. These products must not only cease to be sold, but those already sold should be stored in warehouses when they are finished until we can figure out a safe and non-toxic way to dispose of them.*

*I will describe a few projects and how these issues are implicit in design directions. I remember when we were hired to design the office for an environmental group. The director said at the end of contract negotiations, “By the way, if anybody in our office gets sick from indoor air quality, we’re going to sue you.” After wondering if we should even take the job, we decided to go ahead, that it was our job to find the materials*

*that wouldn’t make people sick when placed inside a building. And what we found is that those materials weren’t there. We had to work with manufacturers to find out what was in their products, and we discovered that the entire system of building construction is essentially toxic. We are still working on the materials side.*

*For a New York men’s clothing store, we arranged for the planting of 1,000 oak trees to replace the two English oaks used to panel the store. We were inspired by a famous story told by Gregory Bateson about New College in Oxford, England. It went something like this. They had a main hall built in the early 1600s with beams forty feet long and two feet thick. A committee was formed to try to find replacement trees because the beams were suffering from dry rot. If you keep in mind that a veneer from an English oak can be worth seven dollars a square foot, the total replacement cost for the oaks was prohibitively expensive. And they didn’t have straight forty foot English oaks from mature forests with which to replace the beams. A young faculty member joined the committee and said, “Why don’t we ask the College Forester if some of the lands that have been given to Oxford might have enough trees to call upon?” And when they brought in the forester he said, “We’ve been wondering when you would ask this question. When the present building was constructed 350 years ago, the architects specified that a grove of trees be planted and maintained to replace the beams in the ceiling when they would suffer from dry rot.” Bateson’s remark was, “That’s the way to run a culture.” Our question and hope is, “Did they replant them?”*

*For Warsaw, Poland, we responded to a design competition for a high-rise building. When the client chose our design as the winner after seeing the model, we said, “We’re not finished yet. We have to tell you about the building. The base is made from concrete and includes tiny bits of rubble from World*



War II. It looks like limestone, but the rubble's there for visceral reasons." And he said, "I understand, a phoenix rising." And we said the skin is recycled aluminum, and he said, "That's O.K., that's fine." And we said, "The floor heights are thirteen feet clear so that we can convert the building into housing in the future, when its utility as an office building is no longer. In this way, the building is given a chance to have a long, useful life." And he said, "That's O.K." And we told him that we would have opening windows and that no one would be further than twenty-five feet from a window, and he said that was O.K., too. And finally, we said, "By the way, you have to plant ten square miles of forest to offset the building's effect on climate change." We had calculated the energy costs to build the structure, and the energy cost to run and maintain it, and it worked out that 6,400 acres of new forest would be needed to offset the effects on climate change from the energy requirements. And he said he would get back to us. He called back two days later and said, "You still win. I checked out what it would cost to plant ten square miles of trees in Poland and it turns out it's equivalent to a small part of our advertising budget."

The architects representing a major retail chain called us a year ago and said, "Will you help us build a store in Lawrence, Kansas?" I said that I didn't know if we could work with them. I explained my thoughts on consumers with lifestyles, and we needed to be in the position to discuss their stores' impact on small towns. Click. Three days later we were called back and were told, "We have a question for you that is coming from the top. Are you willing to discuss the fact that people with lives have the right to buy the finest-quality products, even under your own terms, at the lowest possible price?" We said, "Yes." "Then we can talk about the impact on small towns."

We worked with them on the store in Kansas. We converted the building from steel

construction, which uses 300,000 BTUs per square foot, to wood construction, which uses 40,000 BTUs, thereby saving thousands of gallons of oil just in the fabrication of the building. We used only wood that came from resources that were protecting biodiversity. In our research we found that the forests of James Madison and Zachary Taylor in Virginia had been put into sustainable forestry and the wood for the beams came from there and other forests managed this way. We also arranged for no CFC's to be used in the store's construction and systems, and initiated significant research and a major new industry in daylighting. We have yet to fulfill our concerns about the bigger questions of products, their distribution and the chain's impact on small towns, with the exception that this store is designed to be converted into housing when its utility as a retail outlet has expired.

For the City of Frankfurt, we are designing a day-care center that can be operated by the children. It contains a greenhouse roof that has multiple functions: it illuminates, heats both air and water, cools, ventilates, and shelters from the rain, just like a Bedouin tent. One problem we were having during the design process was the engineers wanted to completely automate the building, like a machine. The engineers asked, "What happens if the children forget to close the shade and they get too hot?" We told them the children would open a window. "What if they don't open a window?", the engineers wanted to know. And we told them that in that case the children would probably close the shade. And they wanted to know what would happen if the children didn't close the shade. And finally we told them the children would open windows and close shades when they were hot because children are not dead but alive. Recognizing the importance for children to look at the day in the morning and see what the sun is going to do that day and interact with it, we enlisted the help of teachers of Frankfurt to get this one across because the teachers had told us the most important things was to find something for the children to do. Now the children have ten minutes of activity in

*the morning and ten minutes of activity when they leave the building, opening and closing the system, and both the children and teachers love the idea. Because of the solar hot-water collectors, we asked that a public laundry be added to the program so that parents could wash clothes while awaiting their children in school. Because of advances in glazing, we are able to create a day-care center that requires no fossil fuels for operating the heating or cooling. Fifty years from now, when fossil fuels will be scarce, there will be hot water for the community, a social center, and the building will have paid back the energy “borrowed” for its construction.*

*As we become aware of the ethical implications of design, not only with respect to buildings, but in every aspect of human endeavor, they reflect changes in the historical concept of who or what has rights. When you study the history of rights, you begin with the Magna Carta, which was about the rights of white, English, noble males. With the Declaration of Independence, rights were expanded to all landowning white males. Nearly a century later, we moved to the emancipation of slaves, and during the beginnings of this century, to suffrage, giving the right to women to vote. Then the pace picks up with the Civil Rights Act in 1964, and then in 1973, the Endangered Species Act. For the first time, the right of other species and organisms to exist was recognized. We have essentially “declared” that Homo Sapiens are part of the web of life. Thus, if Thomas Jefferson were with us today, he would be calling for a Declaration of Interdependence which recognizes that our ability to pursue wealth, health, and happiness is dependent on other forms of life, that the rights of one species are linked to the rights of others and none should suffer remote tyranny.*

*This Declaration of Interdependence comes hard on the heels of realizing that the world has become vastly complex, both in its workings and in our ability to perceive and comprehend those complexities. In this complicated world, prior modes of domination have essentially lost their ability to maintain control. The sovereign,*

*whether in the form of a king or nation, no longer seems to reign. Nations have lost control of money to global, computerized trading systems. The sovereign is also losing the ability to deceive and manipulate, as in the case of Chernobyl. While the erstwhile Soviet Republic told the world that Chernobyl was nothing to be concerned about, satellites with ten-meter resolution showed the world that it was something to worry about. And what we saw at the Earth Summit was that the sovereign has lost the ability to lead even on the most elementary level. When Maurice Strong, the chair of the United Nations Conference on the Environment and Development, was asked how many leaders were at the Earth Summit, he said there were over 100 heads of state. Unfortunately, we didn't have any leaders.*

*When Emerson came back from Europe, he wrote essays for Harvard on Nature. He was trying to understand that if human beings make things and human beings are natural, then are all the things human beings make natural? He determined that Nature was all those things which were immutable. The oceans, the mountains, the sky. Well, we now know that they are mutable. We were operating as if Nature is the Great Mother who never has any problems, is always there for her children, and requires no love in return. When you think about Genesis and the concept of dominion over natural things, we realize that even if we want to get into a discussion of stewardship versus dominion, in the end, the question is, if you have dominion, and perhaps we do have dominion, isn't it implicit that we have stewardship too, because how can you have dominion over something you've killed?*

*We must face the fact that what we are seeing across the world today is war, a war against life itself. Our present systems of design have created a world that grows far beyond the capacity of the environment to sustain life into the future. The industrial idiom of design, failing to honor the prin-*



*principles of nature, can only violate them, producing waste and harm, regardless of purported intention. If we destroy more forests, burn more garbage, drift-net more fish, burn more coal, bleach more paper, destroy more topsoil, poison more insects, build over more habitats, dam more rivers, produce more toxic and radioactive waste, we are creating a vast industrial machine, not for living in, but for dying in. It is a war, to be sure, a war that only a few more generations can surely survive.*

*When I was in Jordan, I worked for King Hussein on the master plan for the Jordan Valley. I was walking through a village that had been flattened by tanks and I saw a child's skeleton squashed into the adobe block*

*and was horrified. My Arab host turned to me and said, "Don't you know what war is?" And I said, "I guess I don't." And he said, "War is when they kill your children." So I believe we're at war. But we must stop. To do this, we have to stop designing everyday things for killing, and we have to stop designing killing machines.*

*We have to recognize that every event and manifestation of nature is "design," that to live within the laws of nature means to express our human intention as an interdependent species, aware and grateful that we are at the mercy of sacred forces larger than ourselves, and that we obey these laws in order to honor the sacred in each other and in all things. We must come to peace with and accept our place in the natural world.*

*William McDonough*

This sermon was conceived, written, and delivered by William McDonough. Mr. McDonough wishes to thank Paul Hawken for his assistance in preparing it for publication.