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From Principles to Practices/

Creating a Sustaining Architecture for the 21st Century

By William McDonough & Michael Braungart
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William McDonough and Michael Braungart recently celebrated the 10th anniversary of their groundbreaking manifesto, [The Hannover Principles: Design for Sustainability](#) with the publication of a new, updated edition. This essay is adapted from the new edition, which is available from [William McDonough + Partners](#) and [MBDC](#).

Just over a decade ago, when the City of Hannover, Germany, asked us to develop a set of design principles for the 2000 World's Fair, design for sustainability was in its infancy. While the desire to move toward a solar-powered world had gained significant momentum among the environmentally conscious by 1992, and the ideas that inform ecological design had begun to manifest themselves in encouraging innovations in "green" architecture and technology, a coherent framework for applying sustainable design to all sectors of society had yet to emerge. Imagining designs that celebrated nature and technology, human health and vibrant commerce was even further off the map.

The Hannover Principles were conceived to lay the foundation for this hopeful, new paradigm. We knew at the time that our efforts were just a first step. Though we were striving to identify universal principles based on the enduring laws of nature, we also understood that our knowledge of the world was incomplete. So, too, was our ability to predict all the many ways in which the creativity of the world's designers, architects, business leaders, and NGOs would push design for sustainability beyond the limits we could imagine in 1992. Thus, we saw the Principles as a living document - a set of enduring ideals and an open system of thought that would evolve as it was put into practice.

And evolve it has. Our firms, and many others, continue to use the Principles in their original form. Yet, as the Principles are applied in the design process or used to guide everyday decision-making, new ideas and practices emerge. The language we use is a good example. Whereas some of the Principles were originally expressed with urgent "shoulds" and "musts," today we use a more celebratory language that reflects our evolving goals. Rather than aspire to a respectful co-existence with nature, we aim to celebrate human creativity and the abundance of the living earth with designs that create mutually beneficial relationships between people and the natural world. The Principle's basic tenets, however, continue to be the standard for our designs. The result: the Principles remain an enduring touchstone, their rigor drives innovation, and our sustaining

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design paradigm continues to mature.

To those familiar with the Principles, they have become common sense; to those just discovering them, it might be useful to see how their application begets enormous creativity. The generative power of Principle six provides a good example. Principle six says Eliminate the concept of waste. In 1992 this was a radical new concept. Designers and engineers were typically focused on reducing waste, on trying to be "less bad." The conventional wisdom held that using less energy and fewer materials and limiting the amount of toxic chemicals released into the air, water, and soil would guarantee a sustainable world. But Principle six demands something entirely different. Rather than attempting to mitigate the destructive effects of architecture and industry, eliminating the concept of waste demands that we begin to see our designs in a wholly positive light.

Pursuing that goal over the past decade has driven the evolution of an entirely new approach to design. When one takes seriously the idea that the concept of waste can be eliminated in the worlds of architecture, commerce, manufacturing, and transportation-indeed, in every sector of society-the purview of design shifts radically. Not only are we obliged to include the entire material world in our design considerations, we are asked to imagine materials in a whole new way. In today's world of trying to be "less bad," materials typically follow a one-way path to the landfill or incinerator, and waste managers intervene here and there to slow down the trip from cradle to grave. But when we are no longer content with simply managing waste more efficiently, we can begin to create and use materials effectively within cradle-to-cradle systems, in which there is no waste at all.

Rather than seeing materials as a waste management problem, cradle-to-cradle thinking sees materials as nutrients that cycle through either the biological metabolism or the technical metabolism. In the biological metabolism, the nutrients that support life on Earth-water, oxygen, nitrogen, carbon dioxide - flow perpetually through biological cycles of growth, decay and rebirth. There are no waste-management problems. Instead, waste equals food. The technical metabolism is designed to mirror natural nutrient cycles; it's a closed-loop system in which valuable, high-tech synthetics and mineral resources circulate in an endless cycle of production, recovery and reuse.

By specifying safe, healthful ingredients, designers and architects can create and use materials within these cradle-to-cradle cycles. Materials designed as biological nutrients, such as textiles for draperies, wall coverings and upholstery fabrics, can be designed to biodegrade safely and restore the soil after use, providing more positive effects, not fewer negative ones. Materials designed as technical nutrients, such as infinitely recyclable nylon carpet fiber, can provide high-quality, high-tech ingredients for generation after generation of synthetic products-again, a harvest of value. And buildings constructed with these nutritious materials and designed to "fit" within local energy flows articulate and enhance the connection between people and nature. Already well established through the work of our firms and our clients, cradle-to-cradle thinking represents an ongoing revolution in design. Its source and sustenance: The laws of nature adapted to human design in the Hannover Principles.

When the Principles become practices, when industrial and architectural systems are modeled on the earth's

flows of energy and nutrients, the notion that humanity must limit its ecological footprint is turned on its head. Indeed, as cradle-to-cradle thinking continues to be enriched by the inspired work of our colleagues, we are increasingly able to design products and places that support life, that create footprints to delight in rather than lament. This changes the entire context of the design process. Instead of asking, "How do I meet today's environmental standards, designers are asking "How might I create more habitat, more health, more clean water, more prosperity, more delight?"

Questions such as these, emerging from the daily application of the Hannover Principles, are stimulating the worldwide evolution of cradle-to-cradle design. They are driving a growing movement of principled designers who are deeply engaged in developing safe materials, products, supply chains and manufacturing processes that allow us to celebrate human creativity and the world's natural abundance. In fact, just one year after the publication of the original edition of The Hannover Principles, we had the opportunity to develop a cradle-to-cradle upholstery fabric, Climatex Lifecycle, which is produced with completely safe ingredients and biodegrades after use. The design and production of Climatex Lifecycle transformed a factory burdened with toxic wastes into one with only positive emissions, signaling the real-world efficacy of "waste equals food."

Just so, The Hannover Principles and cradle-to-cradle thinking are moving nations as vast and influential as China to begin to apply the intelligence of natural systems to their development plans. They are guiding the design of community plans that connect people to nature and to each other. They are inspiring the design of buildings like trees, which harvest the energy of the sun, sequester carbon, make oxygen, distill water and provide habitat for thousands of species.

And more. Imagine everything we do or make as a gesture that supports life, inspires delight and expresses intelligence in harmony with nature. Imagine buildings with on-site wetlands and botanical gardens recovering nutrients from circulating water. Fresh air, flowering plants and daylight everywhere. Beauty and comfort for every inhabitant. Rooftops covered in soil and plants nourished by falling rain. Birds nesting and feeding in the building's verdant footprint. Imagine, in short, buildings as life-support systems in harmony with energy flows, human souls and other living things.

Inspired by the Hannover Principles, architects at William McDonough + Partners have already designed buildings such as these. From an environmental studies center on the campus of **Oberlin College** to the corporate offices of **Gap Inc.**; from the **Herman Miller "GreenHouse,"** a factory where you feel you've spent your day outdoors, to the **Museum of Life and the Environment**, which explores the deep connections between natural and cultural history both in the Appalachian Piedmont and beyond - today's cradle-to-cradle designs are testaments to the lively relationship between principles and practices.

And we are now seeing the Principles influence the work of a host of influential companies. **Ford Motor Company** has launched the cradle-to-cradle renovation of its famous Rouge River industrial site with a new manufacturing facility, a factory with a living roof and a landscape of wetlands and swales that naturally purifies storm water runoff. Ford also

introduced in 2003 the Model U, the world's first automobile designed to embrace the cradle-to-cradle vision.

Other business leaders are following suit. Shaw Industries, the largest producer of commercial carpet in the world, has begun to apply the Hannover Principles and cradle-to-cradle thinking to the company's product development process. Working with MBDC, Shaw is doing a scientific assessment of the material chemistry of its carpet fiber and backing to ensure that every ingredient is safe. The result: an infinitely recyclable, completely healthful carpet tile made from true technical nutrients that eliminate the concept of waste.

Clearly, cradle-to-cradle design makes good sense economically and socially. This is especially visible in the workplace. When designs for large-scale factories and offices are modeled on nature's effectiveness, they generate delightful, productive places for people to work. This not only encourages a strong sense of community and cooperation, it also spurs enormous leaps in productivity and allows efficiency and cost-effectiveness to serve a larger purpose.

Consider: Ford's living roof and constructed wetlands revitalize the landscape while filtering stormwater runoff for \$35 million less than conventional technical controls. Herman Miller's GreenHouse generated increased worker satisfaction and productivity gains of 24 percent, which paid for the \$15 million building in a single year. The Gap, Inc. building, maximizing local energy flows, exceeds California's strict energy requirements by 30 percent. By aiming to maximize positive effects, these designs outperformed buildings that set efficiency as their highest goal.

The principles of cradle-to-cradle design can be applied to entire cities and regional plans. Working with the City of Chicago, WM+P drew upon the example of the Hannover Principles to serve Mayor Richard Daley's quest to make Chicago "the greenest city in America." The Chicago Principles, which will be announced in 2003, will provide a reference point as the City develops community plans and cradle-to-cradle systems that will make it a national model of how industry and ecology, nature and the city can flourish side by side.

Looking ahead, we see Chicago becoming a hub of green manufacturing and transit, energy effectiveness, and cradle-to-cradle material flows. A place in which every material moves in regenerative cycles, from city to country, country to city, all the polymers, metals, synthetic fibers and communications software flowing safely in the technical metabolism, all the photosynthetic nutrients flowing in the biological metabolism. All of which adds up to flourishing human communities, places that generate and enjoy an abundance of ecological, economic and cultural wealth.

There is really no end in sight - and that's the point. As we seek constant improvement by the sharing of knowledge, as our understanding of the world evolves, the Hannover Principles will continue to be our touchstone and inspiration for new designs. This process, merely a decade old, has already created hopeful changes in the world and is transforming the making of things into a regenerative force. Ultimately, we believe the principled practice of design will lead to ever more places and ever more products that honor not just human ingenuity but harmony with the exquisite intelligence of nature. And when that becomes the hallmark of good design, we will have

entered a moment in human history when we can truly celebrate our kinship with all life.

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