Towards A New Architecture?

Michael Ben-Eli
The Sustainability Laboratory, New York

Authentic Architecture Expresses Its Era

"A great epoch has begun.
There exists a new spirit."

Thus proclaimed Le Corbusier in his epochal 1923 book, Towards A New Architecture.[1] The book was recognized then and since as a milestone exposition of the modern movement in architecture that was taking root in Europe during the early part of the 20th century. It was an impassioned personal manifesto, which called for a new interpretation to the possibilities and needs of the time. It argued for manifesting an architecture free from stylish clichés and suffocating clutter, and truly reflecting the new integrity of the machine age.

Le Corbusier derived much of his inspiration from the great historical monuments of the past. The ancient pyramids and temples of Egypt, the towers of Babylon, the Parthenon, the Coliseum, the Santa Sofia, the designs of Brunelleschi and Michelangelo—these and other classical buildings provided valuable lessons about plan, function and form. But the then novel feats of engineering and technology—the new factories, granaries, hangars, cranes, the giant ocean-going ships, the airplanes, automobiles, and other mechanical devices—provided the impetus and driving elements for the new vocabulary he was advocating. Technology offered a fresh promise and the machine emerged as the new icon. Le Corbusier's declaration that "a house is a machine for living in,"[2] was the inevitable result.

Reinforced concrete, steel, and glass, as well as the elevator and other mechanical innovations were changing the landscape of possibilities, and leading architects of the time were similarly engaged in developing a new language befitting the emerging new world. Mies van der Rohe was reaching for a new synthesis of architecture and technology, giving expression to his rational, purist concept of the modern style. And while Frank Lloyd Wright was seeking his own authentically American expression of an "organic architecture,"[3] it was left to Buckminster Fuller to take the machine metaphor to a groundbreaking conclusion with his Dymaxion Dwelling Machines: the 1927 Dymaxion House, and the 1944 aircraft manufacturing-based technology of the Wichita House.[4]

In discussing the period's quest for a new architecture, Mies van der Rohe observed that architecture is about giving authentic expression to the particular civilization of its time.[5] What, then, will be the next expression? What should be the most appropriate design paradigm for our own time?

"Environment" and "green buildings" have emerged as current buzzwords, but in themselves, they do not always signal something truly new. In one way or another, all

buildings must respond to their environment, and in obvious ways, they always have. Indigenous structures through the ages are perfect examples. The igloos in Alaska, Bedouin tents in desert regions, mud buildings in the Sub-Sahara, stilt villages on river banks, the amazing living bridges of Cherrapunji in Northern India, and even cave dwellings, all display remarkable adaptation to particular environments. Cooper Union's very timely exhibition *Lessons from Modernism,* which inspired this essay, showcased excellent examples of environmentally-related design considerations. But do these, and similar current architectural manifestations, take us far enough?

Architecture, like civilization itself, is continuously evolving, and each people, each generation, has to integrate the relevant context of its time and synthesize the available materials, tools, issues, aspirations, possibilities, and culture in an unique expression of its built environment. Authentic architecture continuously redefines itself in a process of interpreting and giving expression to the particular characteristics of its age. In this regard, it appears that humanity is now poised on the verge of entirely new demands: social, economic, and environmental challenges as well as revolutionary design possibilities that are awaiting an innovative, radical integration. To explore the contemporary context, let us first extend the meaning of the term "Design."

Extending the Meaning of "Design"

In exploring the contemporary context, we might do well to start with the biggest possible picture and turn to the Hubble Space Telescope, which has been mapping our cosmic environment. The images produced by Hubble are awe-inspiring, and their significance to the speculative understanding of our place in the universe is huge. Take, for example, the image known as the Hubble Ultra Deep Field, with its subsequent series of exposures. It is the deepest portrait of the visible universe available thus far. It penetrates to about 400 million years after the Big Bang, showing the first galaxies to emerge after the birth of the cosmos. That is to say, it presents an image of events taking place nearly 13.2 billion years ago. The image itself captures a relatively tiny region of space, about 3 arch-minutes across, or approximately one thirteen millionth of the sky. It contains some 10,000 galaxies, giving a good sense of the immensity of the cosmic reality.

This is particularly significant if one pauses to contemplate the fact that when Le Corbusier was writing his book, astronomers were still arguing whether there were galaxies beyond the Milky Way. There are now estimated to be some 200 billion galaxies in the visible universe. So the physical environment that is subject to human awareness has expanded tremendously, both spatially and in time. Other Hubble pictures deliver images of a spectacular show, with objects at unimaginable distances and of inconceivable size. The whole is pulsating with dynamism. Now-familiar images of the Swan Nebula or the gas pillars of the Eagle Nebula—immense structures in their own right—capture regions that are hotbeds for continuous formation of new stars. There have even been recent sightings of planets in the process of formation. Galaxies of various ages, sizes, shapes, and colors are the staging grounds of processes of birth and decay, defying any concept of a static reality.

In this total environment, one can legitimately distinguish regions and processes of two fundamentally different kinds: regions of diffusion and dissipation of energy, and regions where energy is being compounded and consolidated. Planet Earth is one such energy-compounding region, where solar radiation is instrumental in forming multiple configurations of exquisite beauty and diversity. Order and complexity are being formed on our planet, manifesting in the formation of organic molecules, the evolution of living creatures, and whole ecosystems, and in the flowering and promise of human consciousness. This process proceeds against all odds, defying, if only momentarily, requirements of the second law of thermodynamics. Order creation and entropy emerge as two sides of one coin, and in this context, the human mind is potentially a most powerful anti-entropic force.

This perspective leads to an intriguing sequence of thoughts. Universe, our grand context, appears as a kaleidoscopic flux of constantly inter-transforming dynamic events. This means that reality continuously reorders itself. An illuminating point, in this respect, is that human activities and potentialities are an inseparable component of this all-embracing, self-organizing process. What's more, the immanent order inherent to cosmic processes is accessible to human intelligence. It is expressible in general principles or laws which, in themselves, offer powerful tools for order creation.

The idea of order creation is central to the concept of design. In the most general sense, design can be regarded as a process of deliberately channeling energies that otherwise would be diffused. It entails consciously applying intelligence to arranging, rearranging, and optimizing preferred configurations. Design, in this sense, is at the heart and very meaning of being human. It is our means for shaping reality, and ultimately participating, proactively and creatively, in the process of evolution itself.

A concept depicting a permanent struggle between chaos and order, between the forces of darkness and the forces of light, is at the center of many wisdom traditions. It is suggestive to interpret the prevailing global state of affairs in this context, since, even to a casual observer, it would appear that our current growth-at-all-costs civilization is flawed and entropic in nature. The consequence is a menacing disorder whereby, driven largely by un-thoughtful human activities, serious threats have emerged to the integrity of whole ecosystems, other forms of life, and to the well being of humanity itself. Ensuring a worldwide transition to an enduring sustainability regime is, therefore, the ultimate design challenge of our time.

The Sustainability Challenge

The term sustainability, which was introduced into the language only relatively recently, has quickly gained broad-based use. In the process, the underlying meaning has been watered down significantly. In this essay, the term is used in the context of the whole planet, the integrity and health of its biosphere, and the long-term well-being of humanity.

Elsewhere, I have defined sustainability as "a dynamic equilibrium in the processes of interaction between a population and the carrying capacity of its environment such that the population develops to express its full potential without producing irreversible adverse effects on the carrying capacity of the environment upon which it depends."[6]

It is this equilibrium that has been compromised in our time with the unprecedented explosion of human population, and the related rapid intensification in development activity everywhere around the world. At the heart of such equilibrium are flows of energy and matter: resources being consumed and byproducts being generated that have to be absorbed. As a growing number of scientists have been pointing out, in many instances, the planet's resource generation and byproduct absorption capacity are now being overwhelmed.

At present, the system is out of balance with many components of the biosphere showing serious signs of stress. The list is familiar. It includes ozone depletion, climate change, loss of biodiversity, soil erosion and desertification, diminishing fresh water resources, shrinkage of forest cover, and the growing income disparity between and within nations. This pattern needs to be reversed if worldwide systemic collapses of increasing frequency and severity are to be averted.

The required transformation is unprecedented in scope. It would demand a change in the values we hold, our view of the world, the ways we govern, the structure of our world economy, priorities in the use of technology, and the energy regime that underlies our current civilization. It would impact all aspects and all sectors of human activity. The ultimate objective of such a transformation is to foster a well-functioning alignment between individuals, society, the economy, and the regenerative capacity of the planet's life-supporting ecosystems. The change that is called for has, of course, important implications to the built environment. This is where architecture can play a leading role: by articulating a new vision and design vocabulary, offering new concepts and tools, and directly addressing some of the great dilemmas now facing humankind.

From single structures and the myriad objects associated with their use, to whole urban environments, the challenge of sustainability calls for a radically new architecture. The collective, contemporary task of establishing the concept of sustainability as the organizing principle on the planet should, heretofore, constitute the primary impulse in architectural design.

The Five Core Sustainability Principles – A Guiding Framework for Design

Sustainability, as suggested by the definition offered above, represents a particular system state in which two primary, interacting variables—in this case population and carrying capacity—are in a state of dynamic equilibrium. The underlying structure is that of a circular loop whereby these two interacting variables are linked interdependently. They co-create and continuously shape, define, and redefine one another. A particular environment prescribes what kind of population is possible in the first place, and

population, in turn, modifies and remakes the environment itself. The long history of the biosphere bears witness to this kind of interaction.

Living organisms and the large complex, dynamic systems that comprise the major components of the biosphere ─ atmospheric cycles, ecosystems such as rain forests and coral reefs, societies, institutions, economies, urban areas, and whole civilizations alike ─ all display similar characteristics inherent to circular interactions. All such systems consist of networks of multiple variables, myriad multi-loops and multiple interactions, all co-adjusting and co-accommodating to produce a state of dynamic equilibrium for the whole. In this context, sustainability can be regarded as a type of dynamic stability in which some quantity remains invariant. The invariance in question is the state of equilibrium itself, while the defining elements and detailed forces that produce it change with time.

A set of five core sustainability principles that I developed as part of the work of The Sustainability Laboratory,[7] offers a comprehensive framework prescribing the essential conditions for establishing sustainability as an enduring state. The principles are articulated in a generalized fashion, and they can be interpreted in specific relation to any delineation of human activity. Along with their operational implications, the five core principles can inform a new approach for conceptualizing and reshaping the built environment by enlightened design.

The principles are expressed in relation to five interrelated, key domains, each representing a primary vector of physical or non-physical variables that impact the interaction of humans with the world. The five fundamental domains are the material domain, the economic domain, the domain of life, the social domain, and the spiritual or value domain. Securing an effective sustainability regime requires the simultaneous integration of issues defined by all five dimensions. Let us briefly review the implications.

The ***material domain*** constitutes the basis for regulating the flow of materials and energy that underlie existence. The related first principle states the following: "Contain entropy and ensure that the flow of resources through and within the economy is as nearly non-declining as permitted by physical laws."[8]

The implications for design of the built environment are significant. Enacting this principle would require uncompromising design innovations: striving for the highest resource productivity; amplifying performance per pound of resources with each cycle of use; a complete switch to renewable, clean energy sources; the omni-conversion of waste into a useful resource by implementing closed-loop infrastructures of continuous flows of energy and matter; the establishment of a service, performance-based lease orientation (as distinct from ownership) in managing circulation of durable goods; and more. If such considerations were to be introduced comprehensively and fully by forward-looking design they would stand to produce a true, game-changing shift in the world.

The other four domains and their respective principles and operational implications complete the specifications for a new comprehensive design repertoire. Thus, for

example, the ***economic domain,*** which provides a guiding framework for creating and managing wealth, raises questions that inevitably impact and ultimately shape the built environment. What accounting framework is being utilized to measure economic values? Are cost externalities taken into account? Is a measure of well-being and human development embodied in economic cost calculations? What is the true nature of measures and mechanisms that regulate the distribution of resources, their use and allocation? What policies, rules, and regulations are employed in order to accentuate desirable outcomes and eliminate adverse ones? Are such policies piecemeal and fragmented, or do they optimize for the whole?

The ***domain of life*** provides the basis for appropriate behavior in the biosphere. We are neighbors to many other species and our own adaptive success in colonizing the planet comes at the too-often irreversible expense of many other forms of life. Design considerations related to this domain would primarily involve issues of land use patterns and configurations of spatial design. How does a given plan impact other forms of life? How would we configure an expanding built environment in ways that minimizes overall footprint and reduces encroachment on other species and their habitats? Could we even design to enhance biodiversity in areas of human deployment?

The ***social domain,*** in turn, provides the basis for social interactions, the nature and quality of which are of prime concern in designing the built environment. Beyond obvious considerations of public space and private experience, there are profound questions that reflect, and could actually help shape, the social order itself. What kind of governance system regulates our urban designs? Who dominates its prerogatives? What channels are open to users for shaping their own habitat? How is access to resources and possibilities determined? And can the built environment be so-designed that by its very nature it would actually educate the public, enhancing beneficial behaviors that promote spontaneous emergence of sustainability practices?

Finally, the ***spiritual or value domain,*** provides the necessary attitudinal, value orientation, and acts as the basis for a universal code of ethics. It is fundamental to the quality and coherence of the whole. Considerations of this domain may be dismissed out of hand by some. It is nevertheless of critical significance. Should we allow an egocentric, greedy, predatory civilization to dominate our lives, or should we strive to evolve an aware, self-restrained, inclusive, and nurturing world? Could enlightened design inspire society to move beyond familiar moral and ethical ambiguities that permeate so many aspects of everyday life? How uplifting is the experience of the built environment? Is it oppressive and stressful, or joyful and largely stress-free? Does it enhance well-being and happiness? And to what extent does it encourage the creative fulfillment of full human potentialities?

If the proposition that the sustainability challenge constitutes the primary design challenge of our time is accepted, then the five core sustainability principles offer the necessary guiding framework for change, and constitute a platform for a radically innovative architecture. But what would replace the machine as the contemporary icon? What would the most suitable driving metaphor be for the next revolution in design?

Towards a New Architecture

The growing awareness and interest shown by innovative design circles in seeking direct inspiration from the amazing workings of nature suggests the overall direction. Just as the machine provided the working metaphor and energizing icon for the architecture of the 20th century, biology and the living organism will offer the appropriate new icon for the built environment of the future. As an iconic symbol, the wonder of the mechanical device will increasingly be replaced by the enormous richness of living systems. Eco-Architecture, or Eco-Design, might accordingly be the appropriate terms for capturing the new organizing concept for the built environment.

Four major trends are currently converging to define a new global context that will redefine the architecture of our time. These trends include the untenable global stresses produced by the unsustainable aspects of the world economy; the game-changing advances that are being made in the material, information and biological sciences; the historical acceleration of the process of urbanization; and the emergence of a new global consciousness marked by more sensitive awareness of self and others, that is beginning to unite people, and especially young people, all over the world. These four epoch-shaping forces are interconnected. They interact, shape, and amplify one another, accelerating change in the process, and opening unimaginable new possibilities with the power of their synergies.

Urban systems offer a prime arena for exploring the implications of these trends in relation to the built environment. The reason is two-fold. Firstly, more than half of the world's population currently resides in urban areas. According to the World Health Organization,[9] cities around the world are growing by sixty million people each year, and some five billion people will be urban dwellers by the year 2030. A trend that started over six thousand years ago with the sparse emergence of the first cities is now reaching maturity and gaining accelerated momentum. Cities have become the predominant habitat of our species. At the same time, infrastructure is woefully inadequate, especially in the mega-cities of the developing countries where much of the growth is taking place,

Second, as actual eco-zones in their own right, urban areas embody all the issues invoked by the sustainability challenge. Cities provide the ideal setting, a veritable experimental laboratory for developing the necessary new design vocabulary. In urban areas, all the questions related to developing an effective sustainability-driven way of life—installing a sustainable physical infrastructure of material and energy flows; inaugurating an economic model that recognizes true social costs; evolving new modalities of governance and public service delivery; implementing strategies for relieving pressure on biodiversity hot spots; and shaping an inclusive value paradigm considerate of happiness and well-being of all—need to be integrated under one innovative design vision.

The new eco-architecture, driven by rigorous sustainability principles, will take us considerably beyond current practices associated with green buildings. These practices are still in their infancy. They are partial and largely fragmented and will not, in themselves, be sufficient to carry the day. Only a major shift in the design paradigm ─ a true second-order change ─ will produce the required next evolutionary leap. The built

environment will become better aligned with the regenerative capacity of the planet's life-supporting ecosystems and, like a rain forest, it will display in its own structure the same kind of vibrancy, variety, dynamism, intelligence, and adaptive inter-accommodating balance. More than reflecting simple machines, the new house and the new city will exhibit properties of the kind now associated exclusively with healthy ecosystems and life forms in general.

Just like a bird's nest, a beehive, or an anthill, the human built environment is a part of nature. Architecture, in this sense, is a manifestation of evolution, the same process that underlies stages in the complexification of matter, and continues all the way from simple organic molecules, through biology, to human society—its values, organization, culture, and associated technology. Technology itself has been externalized from internal mechanisms associated with genetic material to form the vast network of humanly created artifacts, all essentially extensions of metabolic, motor, and cognitive functions. This whole network will become the subject of radically innovative, integrated design.

Internalizing the sustainability principles in a new design vocabulary and reaching beyond merely superficial design gestures will pose many challenges. If successful, however, the results could be spectacular. Single structures and whole cities will be reshaped by multiple innovations that will make them virtually unrecognizable. Technology will everywhere increase performance capabilities and material subtlety, as it moves to approximate the elegant workings of the non-human-made living world. Structures and whole complexes, generated by imbedded codes, will be able to self-design, self-assemble, even self-construct and purposefully decompose and reassemble elsewhere. Smart design will vest materials, as well as specific functions and whole processes, with intelligence, making them, like true ecosystems, ever more responsive to their users, to other neighboring structures, to their own integrity, and to the effective functioning of the whole. Single structures and whole complexes will function like gigantic metabolic engines: they will harvest energy directly from the sun and regulate the flows of energy and materials in a continuous infrastructure designed to optimize for the whole. A constant theme of the new bio-design will be the integration of components into seamless aggregates, where forms, functions, structures, and processes will perform all their respective tasks flawlessly, without jeopardizing the context upon which their very existence depends.

The new possibilities will be realized by the spontaneous, open-source, collaborative effort of humanity, bonded by an embracing cloud of imaging, information-processing and communication networks. Such new technologies will foster the collective action that will usher in a harmonious, confident, peaceful, and sustainable world. One continuous organism—a world eco-city—with distinctive nodes celebrating unique, local cultural flavors, and linked with rural communities and vast flourishing pristine environments left in the wild, will form the physical backbone of a new planetary civilization.

The quest for a new architecture and the coming revolution in design will be fueled by the integration of all spheres of life and art. People everywhere will join forces, seizing the initiative to explore a new, emergent reality, and jettisoning in the process those weights of convention and burdens of precedence that are holding evolution back. In this

context, future possibilities are, to a great extent, limited only by the imagination, and the ever-present question, "What next?" should always remain open.

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[1] Le Corbusier, *Towards A New Architecture* (London: Percy Land, Humphries, 1927).
[2] Ibid.
[3] Frank Lloyd Wright, *The Natural House* (New York: Mentor Books, 1954).
[4] Robert W. Marks, *The Dymaxion World of Buckminster Fuller* (Carbondale: Southern Illinois University Press, 1960).
[5] Gustav Gili, ed., *Conversations with Mies van der Rohe* (New York: Princeton Architectural Press, 2006).
[6] Michael Ben-Eli, "Sustainability: The Five Core Principles – A New Framework," *The Sustainability Laboratories*, http://www.sustainabilitylabs.org/files/Sustainability%20-%20The%20Five%20Core%20Principles_0.pdf (accessed 29 Jan. 2013).
[7] Michael Ben-Eli, "The Cybernetics of Sustainability: Definition and Underlying Principles," in *Enough For All Forever*, ed. Murray, Cawthorne, Dey and Andrews (Champaign, IL: Common Ground Publishing, 2012).
[8] Ibid.
[9] World Health Organization, "Urban Population Growth," *Global Health Observatory*, http://www.who.int/gho/urban_health/situation_trends/urban_population_growth/en/ (accessed 29 Jan. 2013).