Chris Ellington
Twentieth Century Architecture

Towards a New Philosophy: Architecture as Organic Machine

The history of architecture is as much a history of philosophy as it is a history of building. In many cases, the physical structure of the architecture pales in comparison to the importance of the ideas *behind* the architecture. One might even go so far as to claim that building philosophy is the true form of architecture, while the buildings themselves are merely objects that, to varying success, crystalize that building philosophy in physical form. Architecture has been seen through many eyes in the course of human history; as shelter from nature, as human space rejecting nature, as holy space where gods reside, etc.; but the onset of the modern movement in the twentieth century brought new building philosophies into being that completely redefined what architecture means to humanity. These the *building as organism* and *building as machine* philosophies.

Good.

Today, another movement is stirring that further redefines how we think of architecture. This is the sustainable or “green” movement. The driving goal of this movement is to make buildings with minimal impact on the environment in both the short and long run. This new philosophy of building encompasses not merely the aesthetic and functional quality of forms and materials, but goes further to address the entire socio-cultural constructs that go into building, as well as placing previously unprecedented import on the efficiency of building systems. This new architectural philosophy cannot be completely defined within neither the *building as organism* nor the *building as machine* philosophies. With this in mind, it becomes appropriate to call the philosophy of sustainable architecture by a new name. The building philosophy behind

This is a really nice paragraph. Strong argumentation with a lot of ground covered in a short space. Excellent.

green architecture is that of an organic machine, one that is tied to the world within and without and possesses systems ready for constant reexamination and improvement. Many buildings today appear to adhere to this organic machine philosophy of architecture.

The *building as organism* philosophy has origins far back in the history of architecture, but the one who is primarily responsible for solidifying it as an architectural philosophy was Louis Sullivan. Sullivan was concerned with the stifled, revivalist nature of American architecture at the time, and sought to create a new architecture whose forms were the result not of tradition but original thinking about the building's program. He didn't exactly think of the building as some kind of animal, but as a product of natural selection:

> This is the problem; and we must seek the solution of it in a process analogous to its own evolution - indeed, a continuation of it - namely, by proceeding step by step from general to special aspects, from coarser to finer considerations.
>
> It is my belief that it is of the very essence of every problem that it contains and suggests its own solution. This I believe to be natural law. (Andrew 59)

In this way, the building's forms are dictated by the nature of the building's functions. As Sullivan also coined the term "form follows function," this philosophy of building seems especially appropriate for him. The building becomes a united whole rather than a pastiche of different stylistic forms. Unfortunately, even in Sullivan's own work, it is difficult to pin down what forms resulted from the kind of "natural selection" he spoke of, and many of his arguments had significant problems in logic and execution (Andrew 65). Even so, this philosophy of building as organism was passed on to a young Frank Lloyd Wright as well as countless other architects throughout the century, who further transformed the *building as organism* philosophy and still use it today.

Within a few years, another architect whose buildings had strong philosophical underpinnings came into the fore. This was Le Corbusier, a French architect who invented an entire architectural philosophy and style of his own. One aspect of his philosophy was to see the home as a "machine for living" while other types of buildings would be machines designed for their specific programs (Curtis 168). Like Sullivan, Le Corbusier wasn't the creator of this philosophy, but its chief interpreter. Also like Sullivan, the philosophy of "building as machine" had the purpose of creating impetus to improve and grow. Le Corbusier saw the engineering of ships and cars at the time as constantly improving and gaining in perfection, while conversely the design of buildings at the time was stagnant and still. Le Corbusier even went as far as to make direct comparisons between engineering and architecture through photos in his book *Towards a New Architecture*, where the progressive growth of Greek architecture was compared to the technological and aesthetic improvement of cars and ships (Curtis 169). While Sullivan argued for a sort of natural selection to arrive at the forms that most fit the function of the building, Le Corbusier saw that improvement coming from thinking of buildings as machines to be re-engineered and redesigned as technology and expertise improve. In the end, both arguments are very similar in intent despite being quite different in execution. Both were crying out for new forms that worked better than the old while maintaining aesthetic beauty. In short, both arguments called for new, modern architecture.

Good, nuanced contrast.

However, neither outlook can successfully encompass the goals of sustainable architecture. The first reason is simply one of time, the sustainable movement is completely different than the modern, and thus cannot be defined using the same

Nice transition.

building philosophies. Furthermore, while both arguments match some of the ideals of sustainable architecture, neither does so completely.

Seeing the home as a “machine for living” has many aspects to it matching the ideals of sustainable architecture. The chief being simply that machines can be redesigned to work better for less energy. When a building is seen as series of systems; an electrical system, a plumbing system, a ventilation system; it seems natural that these systems should improve as technology improves. This matches very well with sustainable design, where the efficiency of building systems is integral to reducing overall rates of consumption. Embracing new building techniques and technologies, such as prefabrication, modular construction, and new methods of recycling building materials, also meld well to the ideals of sustainable design.

Excellent.

Yes.

Even so, there are problems with this building philosophy. The first is simply that seeing a building merely as a series of systems is a gross and dangerous oversimplification that ignores the more human aspects of how and why we live within space, as well as the fact that an efficient system will not necessarily result in a reduction of consumption. Furthermore, the home as a “machine for living” philosophy insinuates that it is a singular entity, which is far from the truth. The building must instead be seen in terms of its environment. It is not a world in itself, but has major effects on the world during the periods of construction, use, and demolition/decay. For example, choosing one material over another determines whether it is shipped from Boston or Bangladesh or whether a new gravel mine is needed. The building must also be adapted to the climate in which it is situated in order for its systems to work properly. Such decisions in design and construction must be made with thought to their

consequences on the world without in order to be considered sustainable. Clearly, the philosophy of building as machine lacks what it takes to totally encompass the goals of sustainable architecture.

Recently, seeing architecture as organism has become a popular way of looking at sustainable architecture, and not without good reason:

> If we imagine architecture as an organism instead of a machine, a new idea is created about how it will interact with its environment. While a machine is thought to function independently of its environment, (which it does not), an organism has a balanced existence with it, responds to challenging conditions, and goes through a life cycle (Jones 1).

When seen in terms of its environment, the building becomes part of a larger whole, an organism within an ecosystem of human activity within the larger ecosystem of the Earth itself. There are other aspects to the organic analogy that match well with the ideals of sustainable design. If the building as a whole were seen as an organism, its inner would become like organs and systems of living things. In order to operate on the standard of us "modern" people, every building must breathe (be well ventilated), maintain constant temperature (thermal comfort), process water (plumbing), feed (use electricity) in order to perform actions, and utilize the sun for warmth, light, and energy. These are characteristics of living things as well, and maximizing these in architecture while minimizing the materials and technologies needed for them through the designed forms of the building is a large aspect of sustainable design. The organic analogy goes even further to describe some architectural morphologies. Type forms found in bodies, such as *skin*, *spine* and *mouth*, also have their architectural equivalents. The final connection between architecture and organism can be seen in their relations to climate. Building forms, like living organisms, must be specifically adapted to their climates in

order to work at their optimal level. Designing buildings to their climates is as old as architecture itself, but is gaining much more import in the rise of sustainable architecture. For these reasons and more, the "building as organism" philosophy and the ideals of sustainable architecture seem to match very well.

This is again an excellent paragraph, covering a lot of ground very succinctly.

Unfortunately, this analogy between building and organism can only be taken so far. One weakness comes from Sullivan's own words as he writes about how the type forms of natural organisms perfectly reflect their functions, "the form, oak-tree, resembles and expresses the purpose of function: oak... the form, horse, resembles and is the logical output of the function, horse (Andrew 59)." This cryptic statement is wrong to attribute to sustainable architecture if for no other reason than it assumes there to be a "perfect" form for every function. Once this "perfect" form is achieved, no other one need be explored. This goes against both the ideals of sustainable architecture and the nature of organisms themselves. Living things are in a constant state of flux, and the existence of extinction in nature should be evidence enough that there is no perfect form. Architecture is no different, and deserves constant transformation to keep evolving.

Excellent.

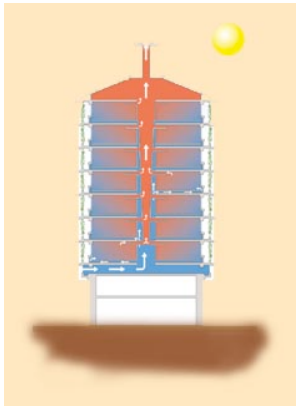
Further danger in the "building as organism" philosophy lies in the misconceptions that can arise from the term "organic," as well as over-reliance on nature to solve every human problem. Art Nouveau had some of the most organic forms in history, but none of them resulted in a reduction in consumption. Just because something looks organic in form does not mean that it will be a sustainable building. If the "building as organism" philosophy were to become the norm, people would equate to organic with sustainable forms regardless of their actual efficiencies. Another

Good.

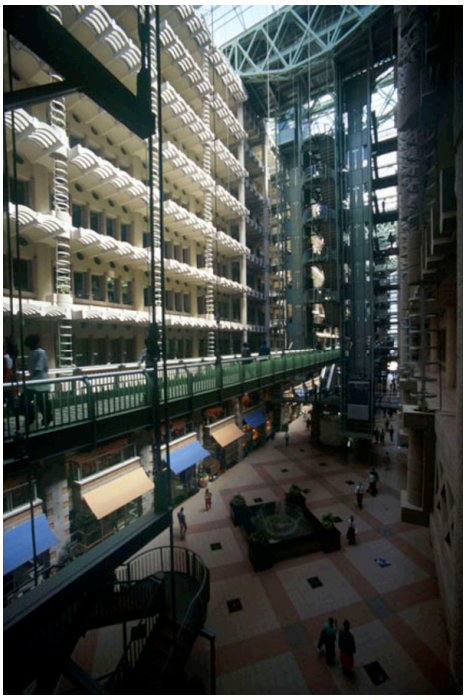
weakness in the “building as organism” philosophy stems from the fact that it is impossible to look to nature for a solution to every architectural problem,

> There are no precedents for the symbolic communication of ethical convictions in the plant and animal kingdoms. Nature may originate new forms because new functions require them, but painstaking judicial deliberations are not among the functions to be found in nature (Andrew 67).

The notion that the building is an organism is extremely close in many ways to the ideals of sustainable architecture, but is unable to encompass them entirely without creating dangerous insinuations. Thinking of buildings only as organisms suggests a lack of technological rigor in sustainable design, which would be patently false. Sustainable design is known for utilizing both high and low tech methods as long as they work, but the philosophy of “building as organism” would not convey that. Therefore, the only way to look at sustainable architecture is as a combination of the technological and scientific benefits of the machine philosophy with the universally connected, biomimetic, and down-to-earth aspects of the organic viewpoint.



The Eastgate shopping center/office building in Harare, Zimbabwe is a good example of this kind of reconciliation. Eastgate was designed by Michael Pearce to use the same heating and ventilation strategies as the termite mounds of the same area (Bram 77). A termite mound may not be an organism itself, but the way in which the structure is made to “breathe” and maintain thermal comfort without an HVAC system does coincide with the “building



as organism" philosophy. However, the fact that the heating and ventilation strategies of termite mounds work well for termites does not necessarily mean that it will work well for humans. The laws of heat transfer and fluid dynamics change drastically between the human and termite scales. In order to see if the building's ventilation strategies would actually work, Pearce looked to the *Ove Arup* engineering group to do a rigorous set of computer simulations. The group came back with a specific set of rules for the design of the building, such as the fact that no direct sunlight could be allowed on the external walls (Eastgate). The Eastgate building did indeed turn out to work remarkably well, using some 10% of the energy of conventional buildings of similar size. However, to assume that is success is merely the result of natural cut-and-paste would be simply wrong, it was only after careful testing by our favorite machines, computers, that the concept was shown to be valid and was given a strategy for successful implementation. In this way, a building of sustainable design successfully took ideas from nature and translated them into human architecture. This was brought about through a synthesis of the "building as organism" philosophy (breathing, constant temperature), and the "building as machine" philosophy (no assumptions, careful testing and improvement). Only through an integration of these two philosophies was this building possible.

Good.

Although the Eastgate building demonstrates great strides in the way of sustainability through the organic machine philosophy, there are some ideals of green architecture that it does not specifically address. One of these is embodied energy, or the energy required to manufacture, ship, and install the materials that make up the building. Addressing the logistics of construction takes the building from being a singular object to being a part of a larger environment. This can be considered an extension of the organic philosophy, where organisms are not singular but part of a larger ecosystem. One building that accomplishes this as well as the other ideals of sustainable architecture is called the Livinghomes RK1 design. Winner of the Bottom Line Design Award, this home is entirely made from prefabricated pieces. This means that the entire house was manufactured in a factory in pieces and then shipped to the site (Truppin 58).

Prefabrication greatly reduces waste and energy use by increasing the efficiency of manufacture. It also decreases the time and energy spent in construction, apparently the prefab pieces of Livinghomes RK1 can be assembled in only a day (Bottom)! Recycled materials were used in the countertops, tiles, insulation, and steel structures as well. This type of thinking, of the building as an entity comprised of materials with energy embodied within them and connected to a larger system, is reminiscent of the way organisms are made from other organisms and are part of a larger ecosystem

themselves. In this way, the embodied energy in building materials can be considered an extension of the organic philosophy of building. Conversely, it is just as easy to argue that prefabrication is of the machine philosophy due to its heavy use of industrial manufacturing techniques and new technology. Furthermore, RK1 is also equipped with low-energy LED lights, solar panels, and an environmental monitoring system to track energy use. These technologies meld more with the machine philosophy of building, but can also be described in organic terms (using the sun for energy, etc.). Thus, Livinghomes RK1 is another building that uses both an organic and machine philosophy of architecture to create a true example of sustainable design.

So far the examples of sustainable design that utilize an organic-machine philosophy of building have been a large commercial building and a single-family dwelling. Sustainable design is by no means limited to those types, however, and can be applied to communities and complexes as well. When this occurs, the organic philosophy of architecture that shows the building within a larger context becomes even more pronounced. Even so, technologies that seem to run closer to the machine philosophy are what makes such sustainable architecture possible in the first place. Even when actual organisms are used in the architecture, using only an organic view of building would paint an incomplete picture. One such example is the Gap headquarters in San Bruno, California. This complex of buildings uses the largest habitat roof in the United States (Gissen 110). The roofs contain soil and grasses that retain and filter water while creating a place for local birds and plants to live. Conventional roofs can pollute the local soil and water by allowing rainwater to absorb harsh chemicals from their material structures, but this building prevents that. A green roof may seem like the

ultimate example of the organic philosophy, but the truth is that they are not easy to build. Especially when one considers the sloping nature of this roof, one appreciates how much skill, planning, and technology were necessary to install it successfully using what more resembles a machine philosophy. Also, the building itself has such features as roof ventilators, under-floor air, and operable windows. Though not complex machines, they aren't exactly organs either. Thus Gap headquarters further demonstrates how organic-machine philosophy is implemented in sustainable architecture.

When one further increases the scale of sustainable architecture, the organic-machine philosophy of building takes on a whole new light. Take the unbuilt Shanghai Master plan by Richard Rogers (Gissen 164). From above, it looks like some giant amoeba crawling along the cityscape. However, exploration into its actual workings reveals a heavy reliance on the technologies of public transportation, modular construction techniques, renewable energy use, and every other aspect of the "building as machine" philosophy that is relevant to sustainable design. It is here that one fully realizes the true nature of the organic-machine philosophy. After all, all organisms are machines anyway. On the scale of this 480,000 person community full of parks and gardens, the design itself becomes an organism that lives, breathes, uses energy and

materials, and makes energy as well. The technological, yet interconnected nature of sustainable architecture is finally understood on a scale that could actually make a significant difference in energy and resource consumption, if only it had been built.

The organic philosophy of sustainable architecture seems to be the prevailing view of how green design should be implemented, but this is dangerous. Architects should never forget that buildings are indeed machines built by humans for living, even if their design strategies were taken from nature. Therefore it is of utmost importance that we keep a constant sense of scientific and technological rigor in sustainable design. When we see the building as an organic machine, the true nature of sustainable architecture is revealed. The building is an entity with certain systems that must work well and efficiently, but is also a single unit within the much larger context of the greater ecosystem. It is not static but open to constant evolution, and looks to nature for inspiration while relying on emerging technology for execution. This is the philosophy behind sustainable architecture, and can help lead the built environment towards a new future.

Nice summary.

Works Cited

Content Sources:

Andrew, David S. Louis Sullivan and the Polemics of Modern Architecture. Urbana and Chicago: University of Illinois Press, 1985. 59-67.

Bram, Posthumous. "The Building as Organism: Eastgate in Harare (Zimbabwe)." Archis 5 (1999): 77-80.

Curtis, Wiliam J.R. Modern Architecture Since 1900. New York: Phaidon Press, 1996. 168-9.

"Eastgate Centre, Harare." Wikipedia. 2007. 12 December 2007. <http://en.wikipedia.org/wiki/Eastgate_Centre,_Harare>

Gissen, David, ed. Big and Green. New York: Princeton Architectural Press, 2003. 62, 110, 164.

Jones, Peter Blundell. "Sustainable Architecture." Summary of article from The Architectural Review (Jan 2001): 1.

"Livinghomes RK1." bottomlinedesignawards.com. 13 December 2007. <http://www.bottomlinedesignawards.com/2007/winners/livinghomes-rk1.html>

Truppin, Andrea. "Prefab Goes Green." Modernism 9.3 (2006): 58-65.

Image Sources

"And the Winner Is..." archimagazine.com. 2007. 13 December 2007. <http://www.archimagazine.com/arogers.htm>

"Big and Green." nbm.org. 2003. 13 December 2007. <http://www.nbm.org/Exhibits/current/big_and_green.htm>

"Biomimicry ..." blogspot.com. 2007. 13 December 2007. <http://caitlinamandaspencer.blogspot.com/2007/06/biomimicry-nature-as-model-measure-and.html>

"Cocktail Party Physics." twistedphysics. 2007. 13 December 2007. <http://twistedphysics.typepad.com/cocktail_party_physics/2007/02/index.html>

"La Termitiere." fourmirouge.org. 2007. 13 December 2007. <http://www.fourmirouge.org/HTML/f/h/eastgate_harare.html>

"Livinghomes." prefabs.com. 2007. 13 December 2007. <http://www.prefabs.com/PrefabHomes/LivingHomes/RK1.htm>

A

Chris,

An excellent final paper. You managed to bring together high level discussion and detailed project analysis in a relatively short space, thereby giving your paper both breadth and depth. Best of all you balanced these two imperatives nicely and didn't sacrifice one in favor of the other. This isn't always an easy thing to do but you handled the integration very smoothly. I think the thesis of the fusion of organic and machine-based architectural thinking within the sustainable architecture movement is a superb one and as you suggest, does indeed amount to a marriage of alternatives that were largely (though not exclusively) held apart under modernism. Well done!

Luke