DEFINING A SUSTAINABLE AESTHETIC:

A NEW PARADIGM FOR ARCHITECTURE

by

David Barrett Douglass

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Abstract

This thesis explores the process of defining an aesthetic philosophy of sustainable architecture. An argument is made for the justification of the need for a sustainable architectural aesthetic over the continuation of the current sustainability paradigm. The various factors that influence the development of a sustainable aesthetic are also discussed, including urban growth, varying climate conditions, and the moral and social obligation that sustainability represents. In the end, three principles of a sustainable aesthetic are established: that sustainability represents a practical philosophy, that sustainability serves as the concept generator in the design process, and that sustainable architecture is universally specific to the constraints of its site. Several case studies are also examined in relation to these principles as well as more quantitative evaluation factors.

Chapter 1: Introduction – Facing the Facts

The single most pressing global issue of the current era is climate change. Politicians and policy makers may argue otherwise, but it must be clear that without addressing climate change all other issues become irrelevant. Poverty, disease, war and economy are not without consequence, but must be viewed through the lens of climate change. Global climate change has the potential to completely disrupt the geopolitical landscape. And yet, climate change is not just an issue for politicians, world leaders and business executives. If left unchecked, climate change will touch every person on earth, and as such, everyone has a responsibility to do their part. This responsibility extends especially to the profession of architecture, a major contributor of greenhouse gases. But the architectural profession still lacks any cohesive or holistic approach to the problem of "sustainability" despite many valiant efforts. It is time for a new approach, a new paradigm for architectural design.

1.1: The Reality of Global Climate Change

The validity of global climate change has been debated for decades, and over the years the ranks of skeptical scientists has steadily decreased. Recent studies and reports have all but silenced the few remaining doubters. The "Fourth Assessment Report" issued by the United Nations' Intergovernmental Panel on Climate Change concluded that it is almost certain that human activity has been the trigger of global climate change over the past 50 years, and even presents some evidence that the

natural forces at play may have even decreased the warming effect rather than enhancing it.[1] And with projections of greenhouse gas emissions predicting continuing increases for decades to come, it would only stand to reason that global climate change is not going away any time soon. Now that the evidence of climate change is exhaustive, it is time for action. Now that there is an understanding of where the problem comes from it is time to devise solutions.

1.2: "Architects Pollute"

In October of 2003 *Metropolis Magazine* published a study that shocked the architecture industry. Long-time passive design proponent Ed Mazria's study concluded that architecture consumes 48% of all energy in the United States and is responsible for more CO_2 emissions than transportation or "industry."[2] This is a fact that is still not greatly appreciated outside the architecture and building industries (and even in some cases within those industries). World leaders and policy makers continue to focus on factories, power plants and vehicle emissions, while the real problem is the normative buildings that we live and work in every day. One might argue that Mazria's statistics are something of an exaggeration, but even if vehicle emissions are a more significant factor than he suggests, a building's siting and location are a significant factor in transportation issues. And yet, despite the challenges ahead, there is hope for resolving climate change in architecture. Indeed,

[1] Intergovernmental Panel on Climate Change, Fourth Assessment Report, 2007.
[2] Hawthorne, October 2003, 103.

as Mazria argues, architecture may well be the only hope. "This is the most important moment in the history of architecture," Mazria says. "If architects don't attack this problem, then the world doesn't have a chance."[3]

Today, "sustainability" – and "green" and "eco-friendly" – have become consumer society buzzwords. Hybrids have revolutionized the automotive industry, and companies all over the world have started touting their "green" practices. And while these elements have begun to influence the architectural profession, with the advent of the US Green Building Council and their "Leadership in Energy and Environmental Design" (LEED) rating system, sustainability remains largely on the fringes of architectural practice today. The current design profession rewards envelope-pushing over practicality, and celebrity status over professionalism and ethical design. In pursuit of constantly changing tastes and higher stakes, sustainability has been relegated to a second-class status in this "starchitect" professional culture.

Increasingly, architects are beginning to understand that sustainability is a necessary and unavoidable part of the future. Energy standards such as California's Title 24 Part 6, and government mandated LEED accreditation for public projects in municipalities such as Chicago, Seattle, and Denver (among others) have required a more sensitive approach to building design. But "sustainable" design as a whole remains little more than a basic set of criteria, yet another code that architects must

[3] Hawthorne, October 2003, 105

comply with. This model has not produced a unified architectural solution. The potential impact and implications of sustainability requires a new way of practicing architecture.

1.3: The Missing Link: A Cohesive Sustainable Philosophy, A Sustainable Aesthetic

To truly be effective, sustainable architecture must go beyond checklists and material choices. Architecture needs a cohesive and holistic sustainable philosophy, a driving force behind the design and construction of buildings. Architecture needs a sustainable aesthetic philosophy.

Throughout recent architectural history and theory, the most powerful and potent architectural "styles" have been backed by strong theoretical, social, and even moral principles. The Arts and Crafts and Modern movements are strong examples of this, and even the Post-Modern movement was supported by a cohesive theoretical agenda. Sustainability represents the next logical step in this historical continuum, representing a response to the moral and social challenges of climate change. Architecture has a major responsibility in the prevention of catastrophic global climate change, and a sustainable architectural aesthetic philosophy can be that solution. But sustainability will not be an aesthetic of rigid stylistic dogma; there must be no design rules, or visual norms. Unlike every "style" that has come before, sustainable architecture will have (and already does have) many representations; and

this is possible because the over-arching theory of a sustainable aesthetic is not burdened by the stylistic agendas of previous architectural movements.

1.4: A Practical Sustainable Architectural Aesthetic

The word "aesthetic" implies a wide variety of meanings. It suggests philosophical theories of beauty, ideas as basic as "style," and even concepts about personal experience. Applying these various meanings to the practice of sustainable architecture makes for a complex challenge. But considering ideas of beauty, style or "aesthetic experience" may be premature in the discussion of sustainable architecture. It is first necessary to understand a sustainable architectural aesthetic in the basic noun form of the word, "a philosophical theory of what is aesthetically valid at a given time and place."[4] While this definition may be faulted for using the word it is defining, it makes a critical point. An aesthetic must be a philosophical theory, and as architecture is a practical field, resulting in real and usable products, any architectural aesthetic must first be a practical philosophy, a philosophy related to the practice and process of architecture. While an assessment of beauty and personal experience are a necessary aspect of aesthetic philosophy, these are results of aesthetic products, and therefore indefinable without a coherent understanding of the generating aesthetic philosophy. Indeed, the very nature of sustainable architecture requires that it take unique and different forms based on varying circumstances, making it impossible to "know" exactly what sustainability will "look

[4] "Dictionary.com" 2008

like” in any given circumstance. Even so, this thesis will argue that sustainable architecture warrants an aesthetic philosophy and that such a philosophy must be understood in terms of how architecture is designed and made in order to achieve the performance results that are the basis of sustainability. Establishing sustainability as the aesthetic motivation behind architectural design will be the basis of a new paradigm for the practice of architecture.

Chapter 2: Aesthetics, Architecture and Sustainability

Defining a new aesthetic paradigm for architecture is no simple task. Establishing any philosophical theory that is to be coherent, relevant and compelling requires an understanding of a broad range of background knowledge from the outset. This background knowledge establishes the basis on which the new philosophical theory is built. Identifying a sustainable architectural aesthetic philosophy is no different. Before establishing a definition it is necessary to understand the relevant background. In the case of an aesthetic of sustainable architecture, the necessary background knowledge can be broken into three categories: general aesthetic philosophy, architectural aesthetics and philosophy, and sustainable practice and theory. These three categories make up the basic building blocks of what will become a sustainable architectural aesthetic, and it is therefore vital to understand the background of these subjects in order to provide a strong basis for the argument that follows.

2.1: Aesthetic Philosophy

A discussion of aesthetics begins with the ancient Greek philosopher Plato, who viewed art as little more than imitation of a much more complex and interesting reality. "The real artist," he said, "who knew what he was imitating, would be

interested in realities and not in imitations."[5] Today society takes a much more noble view of the work of the artist, and the vast range of aesthetic theory and philosophy reflects this ever growing interest in the arts. It is crucial, however, to recognize that art and architecture, though they may have many similarities, are two vastly different topics. Indeed, even the broad term "arts" is too immense to be succinctly defined by any single aesthetic philosophy. As such, this exploration presents only a few (relatively contemporary) aesthetic philosophies that are particularly applicable to the field of architecture.

Artistic expression starts at a young age as Konrad Lange explains in "Illusion in Play and Art." He introduces the concept of "imagination play" as a form of artistic expression in children. As Lange explains, "children who do not like fairy tales and wish to hear only true stories will certainly not become poets."[6] While this may seem like an oversimplification, Lange notes that imagination play can take many forms, including the idea of "building games" as preliminary architecture.[7] Lange's focus is primarily on the development of artistic impulses as a child, but his ideas carry through to adult interactions, and are especially relevant to the field of architecture, where the architect is, in a sense, "playing at" inhabiting his clients' lives, in order to better understand how to design for them.

To truly understand aesthetics, it is necessary to begin to define the concept of beauty. This subject is expertly addressed by Samuel Alexander in "Beauty and

[5] Qtd. in Rader 1964, xvi
[6] Rader 1964, 13
[7] Ibid, 9

Illusion," where he describes the ephemeral concept of "beauty" (in art) as the ability to convey that which does not exist (or explicitly described). "The words of a poem are not merely descriptive," Alexander says, "but suffused with suggestions of feeling and significance which a mere scientific description would not possess."[8] While Alexander's comments are not specifically intended to describe architecture, this idea is especially applicable to buildings. A building is just a box until it begins to tell a story. This story is not told in words, but in shapes, and volumes, and space. And at its most basic, the best architecture is that which tells the best story.

This argument, however, raises the question of "taste," which leads to a discussion of a philosopher who makes an argument for a very specific "architectural" aesthetic. In *The Aesthetics of Architecture*, Roger Scruton begins by describing the necessity of understanding a building's "utility" in order to truly understand its value,[9] and the concept that aesthetic appreciation is a compound experience of thought and analysis.[10] However, in the end, Scruton's argument is nothing more than his assertion that classical architectural styles (specifically that of the Italian Renaissance) are "morally" superior to Modern styles.[11] While this position was consistent with the Post-Modern movement, popular when Scruton's book was published in 1979, his argument against Modern styles neglects the social and moral basis that Modernism was founded on. Furthermore, despite describing

[8] Rader 1964, 15
[9] Scruton 1979, 7
[10] Ibid, 72
[11] Scruton 1979

the importance of understanding architecture as fundamentally utilitarian, Scruton argues his point entirely on the basis of appreciating architecture as an object of art, and not as a useful tool.

Scruton's broken argument is further invalidated by Noel Carrol's proposal in "Art and Interaction" that, "following the conflicts and tensions within the development of art history is as central a component of the practice of art spectatorship as is having aesthetic experience."[12] In other words, to truly appreciate a work of art, the viewer must fully understand the art-historical context of the work. Carrol goes on to explain that even with a full understanding of the art-historical moment, being in the presence of art does not automatically result in aesthetic experience (an aesthetic appreciation of the work of art), and conversely, that an aesthetic experience may not always result from the appreciation of a work of "art."[13] As an example, Carrol describes the Marcel Duchamp work, *Fountain*(see Figure 1), which, to the untrained eye, is nothing more than urinal turned on its back, but to the savvy, it is an important piece of art, regardless of the resultant aesthetic experience.[14] It is through this lens that Scruton's ill-fated argument is fully understood. While Scruton's discussion of the immorality of Modern architecture was in keeping with the architectural rhetoric of the time, his argument misinterprets Modernism and its part in architectural history.

[12] Janaway 2006, 74
[13] Ibid
[14] Ibid

Figure 1: Marcel Duchamp's *Fountain*, 1917 ("Newberry" 2008)

Perhaps the most compelling aesthetic philosophy dealing with the built environment comes from Susanne Langer in her 1953 work *Feeling and Form*. Langer establishes the concept of "ethnic domain," giving an as yet unseen anthropological facet to the understanding of architecture.[15] As Langer describes, "that is the image of life which is created in buildings; it is the visible semblance of an 'ethnic domain', the symbol of humanity to be found in the strength and interplay

[15] Langer 1953, 95

of forms."[16] Perhaps the significance of this point takes for granted the fact that all art is human creation, and therefore inherently anthropological, but Langer touches on a point that separates architecture from the other arts. Art may symbolize the life of a culture, but architecture is the embodiment of that life. Just as Scruton and Carrol suggest that aesthetic experience is an active mental experience, Langer's argument underlines the fact that the aesthetic experience of architecture is dependent on participation, actively inhabiting an architectural space on a daily basis. "The architect creates its image: a physically present human environment that expresses the characteristic rhythmic functional patterns which constitute a culture."[17]

These are just a few examples of the hugely varied body of work on aesthetic theory. And while each example bears some significance to the field of architecture, aesthetic theory on its own is not sufficient to fully understand the complex nature of architecture. In order to fully grasp the complexity of architecture it is necessary to explore architectural theory and philosophy.

2.2: Architectural Aesthetics and Philosophy

The realm of architectural theory and philosophy is almost as vast and varied as that of aesthetic theory, and any thorough exploration quickly leads to the discovery of numerous wide-ranging topics that inform those theories. Architectural

[16] Langer 1953
[17] Ibid, 96

theory as it is understood today started with the 15th century Italian renaissance architect Alberti, whose work, based in part on the ancient Roman texts of Vitruvius, was intended to educate the nobility, and encourage their patronage. Ever since, there has been no shortage of varying opinions on how buildings should be designed and built. In keeping with the aesthetic philosophy of Noel Carrol mentioned above, architectural theory tends to be highly aware of historical context, often responding or reacting to what has come before.

It should come as no surprise then, that the "Modern Movement" in architecture has deep roots in the architectural theory that preceded it, and despite what seems to be glaring stylistic differences, Modernism has its foundations in the Gothic Revival and Arts and Crafts movements of the 18th and 19th centuries. Differences in appearance aside, all three of these "theories" were based on honesty of form and materials, the primacy of craft, and access to good design for all people. Perhaps the most well known theoretical work of the Modern Movement, and possibly even in all of architectural history, is Le Corbusier's *Towards a New Architecture*. Le Corbusier's seminal work discusses the difference and the connection between the engineer's aesthetic and architecture. "The Engineer," he says, "inspired by the law of economy and governed by mathematical calculation, puts us in accord with universal law. He achieves harmony."[18] But for Le Corbusier, architecture is about more than just harmony: architecture evokes

[18] Le Corbusier 1931, 1

emotion, and thereby achieves beauty. As he explains, "Architecture is a thing of art, a phenomenon of the emotions, lying outside questions of construction and beyond them."[19] He seeks to define an architecture that is fitting for the time in which he was living, a time of great technological advancement, fueled largely by the war machine of World War I. "When a problem is properly stated in our epoch, it inevitably finds its solution," he argues, in reference to the immense advances in aircraft, steamship and automobile technology he was witnessing.[20] "The architecture of to-day [sic] does not fulfill the necessary and sufficient conditions of the problem," he claims. "The reason is that the problem has not been stated as regards to architecture."[21] This statement, though intended to describe a very different time in architecture, continues to have relevance in the discussion of sustainable architecture today. Perhaps what is most interesting about Le Corbusier's writing is the extreme importance he places on the advancement of architecture. "Architecture or Revolution," he proclaims, suggesting that a failure to address the problems of architecture could lead to a failure of society. "Revolution," he says, "can be avoided." His words remain resonant today.

Not all architectural theory is as idealistic and forward-thinking as Le Corbusier, though. Industrial designer George Nelson, in his book *How To See*, takes a very matter-of-fact approach to the experience of the designed environment. While Nelson's theory is more in the realm of design aesthetics, it is especially

[19] Le Corbusier 1931, 19
[20] Ibid, 110
[21] Ibid, 112

applicable to architecture, as a field of design. Similar to many of the aesthetic theories discussed above, Nelson proposes that "seeing" (or our experience of the designed environment) is a complex interaction involving previous knowledge and experience.[22] "What you see may be what you get," he explains, "but what you see is also what you think."[23] Nelson goes on to support Modernist thought in his assessment of beauty. "Beauty," he says, "when we strip away the aesthetic jargon, seems to mean fitness to purpose in the deepest sense. Nature, which has always been our model, never concerns itself with beauty, but always strives for total fitness to an environment."[24] Taken literally, Nelson appears to take an even more extreme view than Le Corbusier, seeming to come down more on the side of the engineer's aesthetic than architecture. But his statement is also reminiscent of Vitruvius, who proposed that the three necessary qualities of architecture are "firmness, commodity, and delight," suggesting that through durable functionality, architecture achieves beauty. Architecture is more than just a container for holding people. If the arguments of Langer and Le Corbusier are taken into consideration, the aspect of emotion and cultural connection play an important role in the creation of "Architecture." These views must be taken into considered along with Nelson's definition of beauty.

Unfortunately, the grand ideals of the Modern Movement were eventually eclipsed by the harsh and minimal aesthetic that Modernism represented to the

[22] Nelson 2003
[23] Ibid, 91
[24] Ibid, 107

world. Without the social agenda to back it up, Modernism became little more than a "style," subverting the very honesty that it originally promoted. This fact was made especially clear in Robert Venturi's work *Complexity and Contradiction in Architecture*. Venturi proposes that decoration and "symbolic rhetoric" are necessary in architecture, and that a preferred formal approach is inevitable in the work of an architect.[25] But the true power of Venturi's argument lies in his discussion disproving the validity of Modern theory in architectural application. Despite their rhetoric, he claims, Modern architecture did rely on historical precedent and eventually devolved into more of a visual dogma than a meaningful movement. "The main trouble with rejecting formal systems in architecture," he claims, "is that the architects who do so in order to avoid the dangers of formalism, ironically, become more prone to formalism."[26] Yet, while Venturi's argument against the evolved standard of Modern architecture is valid and strong, he never lays out a meaningful defense of his preference for decoration, other than to say, "We like admitting symbolic rhetoric."[27] Venturi even goes so far as to suggest that "decoration" could save the world. Obviously, today it is clear that it takes more than base symbolic decoration to alleviate the problems of the world, but it is important to understand the significant historical moment that Venturi represents. When Venturi was developing his theories, Modernism no longer represented a coherent architectural philosophy. And his assertion that it is futile to reject

[25] Goldblatt and Brown 2005, 135-141.
[26] Ibid
[27] Ibid, 136

formalism is especially relevant to the development of a new sustainable aesthetic philosophy. Venturi was right in asserting that it was time for a new revolution in architecture, but the failure of Post-Modernism was its lack of meaningful social relevance. The intensely intellectual theory was only meaningful to people with a complex knowledge of architectural history. In terms of socially meaningful architectural theories, Post-Modernism was the beginning of the end.

Figure 2: A House by Robert Venturi, symbolic rhetoric wrought in architecture ("New York School of Interior Design" 2008)

The architectural discussion became only more convoluted as Post-Modernism gave way to Deconstructivism. A theory even more obscure and intellectualized than Post-Modernism, Deconstructivism, as Jeffrey Kipnis described, is about two things, "…first, to destabilize the meaning of apparently stable works and, secondly, to produce self-destabilizing works."[28] And as Jacques Derrida described, the goal was, "…to free architecture from all those external finalities,

[28] Goldblatt and Brown 2005, 166

extraneous goals."[29] Deconstructivism, was as much about a reexamination of architectural history as it was about creating new architectural works, and clearly had very little regard for reality. As prevailing architectural theory became more and more introverted and intellectualized, any real and relevant theory seems to have dropped off entirely. There is nothing left to "destabilize."

Today, almost as a counter-argument to the intellectual and theoretic movements that followed Modernism, architecture seems to have shed theory all together, becoming at worst little more than extreme formal exercises, and at best, exploring the limits of design software capabilities. There are, of course, notable exceptions, architects whose designs are motivated by more than just fashion and formal whim. Indeed, one of the best examples of the exceptions to the current architectural design climate is the sustainable architecture movement.

2.3: Sustainability Practice and Theory

In 1987, the United Nations' World Commission on Environment and Development defined "sustainable development" as, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[30] But sustainable architectural practice and theory predates this definition. Much of the groundwork for sustainable theory as we know it today was laid in the aftermath of the oil crisis of the 1970s by practitioners who, in some

[29] Goldblatt and Brown 2005, 148
[30] United Nations World Commission on Environment and Development 1987

cases, continue to work and advocate for more responsible design methodologies. Today, in part because of the 1987 definition, sustainability is understood as a much more complex issue than just energy independence. "Sustainability" now encompasses all of the varying facets of environmental sensitivity, as well as broader issues of health and well-being, and social responsibility. This complexity is born out in some aspects of sustainable architectural theory.

Despite the relatively contemporary advent of the concept of sustainability as it is known today, architectural historian James Steele argues in his recent work, *Ecological Architecture*, that climate responsive, eco-conscious design has been a part of the architectural development throughout the industrial era. Along with the usual suspects, Steele argues that architects not usually associated with sustainability such as Mackintosh, Le Corbusier, Kahn and many of the contemporary "high-tech" architects such as Richard Rogers and Renzo Piano all represent aspects of sustainable design.[31]

While many architects had been utilizing sustainable practices since before there was a word to define it, the field was really revolutionized by what Steele calls "The Solar Cult of the 1970s."[32] Motivated by the OPEC oil embargos of the 1970s, architects and educators such as Ed Mazria and Ralph Knowles began looking to the sun as an alternative source of energy.[33] Mazria supported "passive" design strategies, promoting a more complete connection to site, climate, and the sun,

[31] Steele 2005
[32] Ibid, 155
[33] Ibid, 155; Knowles 1981

publishing *The Passive Solar Energy Book* in 1979.[34] The text can serve almost as an instruction manual for employing many of the practices that have become standards in today's view of sustainable architecture. In 1981, Ralph Knowles published *Sun, Rhythm, Form* in which he outlined his concept of solar envelope and solar zoning, a theory that guarantees solar access to all properties.[35] While Knowles' strategy was developed primarily as a means to allow solar power generation in the face of the OPEC embargos, the right of solar access also has passive design and mental well-being implications.[36] While the oil crisis did result in a miniature frenzy of energy-saving and passive strategies, once the crisis ended and oil was available and inexpensive again, architects and consumers returned to the same old habits, and passive and low-energy architecture became relegated to the eccentric houses built of recycled tires and aluminum cans in secluded areas of the western United States.

Sustainability, though, is about more than just saving energy and passive strategies. Sustainability also has an important social aspect, perhaps best exemplified by the work of Hassan Fathy in Egypt. Driven by a nationalistic trend and the need to provide a low-cost construction technique, Fathy derived a system of construction based on traditional Nubian techniques using locally available and inexpensive materials.[37] Fathy utilized an understanding of the naturally ventilating

[34] Mazria 1979
[35] Knowles 1981
[36] Ibid
[37] Steele 2005, 84-93

microcosm of old Cairo, traditional Egyptian architectural methods and the climatic forces of the area to devise an architecture that needed no air conditioning despite its location at the edge of the Sahara.[38] Fathy's techniques earned him the attention and support of the Egyptian government, and while he did spend seven years in self-imposed exile in Athens due to political changes under President Nasser, he eventually returned to Egypt and regained the support of the government, even designing a rest house for President Sadat.[39] Unfortunately, Fathy's most important works, the town planning and low-cost housing projects, were never as successful as he had hoped.[40] Even so, the significance of Fathy's work cannot be underestimated. His ability to derive an inexpensive system of architecture using traditional materials and techniques that met modern needs without the necessity for mechanical ventilation is a pivotal model for the future of sustainable architecture.

A similarly fascinating example of sustainable architectural development is the work of Malaysian architect Ken Yeang. Witnessing the explosive growth throughout Asia, and especially in urban areas, Yeang concluded that the skyscraper would become an even more vital typology in the architectural future. However, recognizing the immense amounts of energy required to build and maintain a skyscraper he decided to develop a new methodology. Yeang has published two books on skyscraper design alone, *Reinventing the Skyscraper* and *The Skyscraper Bioclimatically Considered*, in which he outlines his strategies for saving energy and

[38] Steele 2005, 84-93
[39] Ibid
[40] Ibid

naturally ventilating, as well as methods for creating more livable space so far removed from the natural environment on the ground.[41] Yeang has also completed several naturally ventilated skyscrapers in his native Malaysia, an astounding achievement considering the extreme tropical climate. While some of Yeang's techniques and design choices may not be the most technically sustainable, his comprehensive re-imagining of the skyscraper typology serves as a unique example for sustainable development in the future.

Figure 3: Ken Yeang's Menara Umno, Penang, Malaysia ("The City Review" 2008)

Sustainable architectural theory continues to advance today, and there is no shortage of interesting and compelling ideas. Since 2002 the United States Department of Energy has sponsored the Solar Decathlon, a competition where 20

[41] Yeang, 1996; Yeang, 2002

college and university teams compete to design, build and operate the best solar powered house.[42] Intended to promote the use and development of solar technology, the competition is often a showpiece of the latest solar and low-energy technology and the future of architectural design. More and more practicing architects are joining the discussion as well. Philadelphia architects Stephen Kieran and James Timberlake recently published *Refabricating Architecture*, and taking a page from Le Corbusier, promote techniques used in automotive and aircraft production to revolutionize architectural fabrication.[43] And architect William McDonough, in conjunction with chemist Michael Braungart, have popularized the "cradle to cradle" concept, originally coined by Walter Stahel, a framework creating production techniques that are essentially waste free, in contrast to the "cradle to grave" paradigm where manufacturers take responsibility for waste.[44]

Sustainable theory continues to advance, as does architectural theory and aesthetic theory. And in the effort to develop a new sustainable architectural aesthetic philosophy it is vital to consider these developments. Just as Noel Carrol suggests, understanding the historical context is a vital part of the experience, and as Langer so eloquently describes, architectural aesthetic experience is much more than just looking at an object. Having established these basic background issues, it is

[42] "U.S. Department of Energy's Solar Decathlon" 2008
[43] Kieran and Timberlake 2004
[44] "Cradle to Cradle" 2008

possible to move forward with the process of defining a sustainable aesthetic philosophy for architecture.

Chapter 3: Problem and Process

The challenge of establishing a sustainable aesthetic philosophy is an enormous task. It requires wrangling a wide range of topics into a singular coherent idea. Some would even argue that establishing a new philosophy is not even necessary as sustainability is on the rise and there are new incentives and plans every day that promote it even further. However, the current paradigm is not working. The moral and social imperative that sustainability represents demands a new way of thinking, a new coherent and holistic approach to sustainable architecture. While the ethical implications of sustainability may be sufficient motivation for some, the broader appeal of an aesthetic philosophy will reach a wider audience. This appeal goes beyond environmental and even financial considerations. Many people who completely ignore such issues will gladly invest the necessary resources if they believe it will result in what they perceive to be a superior aesthetic. As an aesthetic movement, sustainability has the potential to have a far greater impact than as a moral obligation alone, especially considering the increasing popularity of all things "sustainable."

3.1: Establishing a Starting Point

Defining a sustainable architectural aesthetic presents two major challenges. In order to effectively discuss sustainable architecture, definitions – or understandings – must be established for both "architecture" and "sustainable."

The challenge in describing architectural aesthetics lies in the general lack of a compelling understanding of what exactly architecture is. Many theorists, writers, and historians have attributed architecture to the realm of the arts, and while this seems to be the most fitting in terms of describing the theoretical and aesthetic attributes of architecture, it denies several major factors in the reality of architecture. Structure and engineering must necessarily play a part in any understanding of what architecture is. Historical interpretation shows that major advances in architectural "styles" have often been accompanied by, if not resultant of, equally pivotal advances in structural understanding. While many "Modernist" architects were content with expressing architectural form in terms of structural honesty, it was fellow Modernist Le Corbusier who discredits the "engineer's aesthetic" as lacking in the emotive qualities of architecture. Clearly architecture must be understood as an amalgam of "art" and "engineering", and yet this description is still lacking in a complete understanding of the nature of architecture. Despite Scruton's insistence that Freudian and Marxist theory provide no compelling argument on the meaning of architectural form, much contemporary historical theory acknowledges the importance of socio-economic factors in architecture. It would seem that any interpretation of architecture must be three-pronged: that of art, engineering and socio-economy. It is nothing short of impossible to fully understand architecture without an understanding of all three factors, and no single factor can accurately or fully describe architecture by itself. It seems clear then that architecture must be

understood in a new light. Architecture must be understood as archaeological-anthropological object, not merely as art, engineering, or socio-economic product.

Sustainability is an equally complex concept. In their 1987 report entitled "Our Common Future" the United Nations' World Commission on Environment and Development defined sustainable development as, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[45] While this definition seems hopelessly vague, it is necessarily so. Sustainability is about more than just saving energy and reducing carbon emissions. The challenges that future generations will face are unknown, and by leaving the definition open-ended, the Commission has appealed to our moral duty to leave a better world for future generations. As such, this definition can be applied to all aspects of life, including architecture. And while the field of architecture is striving to meet the challenges of sustainability, it is not living up to this definition.

3.2: The Failure of the Current Sustainability Paradigm

Sustainability is more respected in the architectural industry today than it has ever been before. Trade publications have been established that are solely devoted to sustainability; product manufacturers are tripping over each other to proclaim themselves the most environmentally friendly, and the LEED rating system has become a selling point. But much of this characterization of sustainability seems to

[45] United Nations World Commission on Environment and Development 1987

have less to do with saving the world than it does with making money. Sustainability as it exists today has become a consumer commodity.

The failure of the current sustainability paradigm is rooted in this commoditization. The frenzy for all things green has created a phenomenon called "greenwashing," where consumers are misled about the true environmental nature of a company's practices, products or services. In an effort combat this, a variety of rating systems have been developed to provide a way of certifying sustainable buildings. Unfortunately these rating systems have evolved to become little more than checklists, and have little bearing on how architects design. To further complicate the situation, so-called sustainable architects have divided into two camps, one promoting a return to traditional techniques, the other suggesting that the solution lies in technology. To the outside observer, the argument seems irresolvable. And all of this is added to an already vacuous design climate that architecture inhabits today. Clearly it is time for a new paradigm.

3.3: Understanding the Contemporary Social Climate

Any new approach to sustainable architecture must obviously take into account an understanding of the contemporary condition. Today, for the first time in history, more people live in urban areas than in non-urban areas. While this fact can be advantageous to the development of sustainable architecture, it also poses many challenges, and must be adequately understood. In addition, the wide variety of building types and the unique challenges of diverse climates negate any one-size-fits-

all solution. It must be clear that methods to design a home in the tropics are not the same as those for a skyscraper in a desert city. As such, it may be useful to employ a categorization strategy to efficiently approach these complexities.

3.4: The Modern Example and the Moral and Social Imperative of Sustainability

The last time architecture had a meaningful moral and social philosophy in support of a design aesthetic was the Modern Movement. Following in the footsteps of the Gothic Revival and the Arts and Crafts Movement, the social equality philosophy that motivated Modernism is part of what has sustained its relevance so long after the height of the movement. Modernism will serve as an important example in the development of a new architectural philosophy, but at the same time, it is vital to remember the pitfalls that led to the eventual downfall of the Modern Movement.

3.5: Defining a Sustainable Aesthetic

After establishing the necessity for a new aesthetic philosophy of sustainable architecture, the challenge of defining the new sustainable aesthetic still remains. In this pursuit it is necessary to consider the arguments above. Working definitions of architecture and sustainability are obvious requirements. No less important, though, is an understanding of why and how the current "sustainability" paradigm is failing in the architecture and building industry. Of course, no aesthetic theory would be

valid without an understanding of the contemporary social climate. And finally, as a new philosophy based on social and moral responsibility, it is necessary to remember historical examples such as the modern movement, and understand how and why these movements came to prominence, and then eventually failed. Taking all of these considerations into account, the challenge of deriving a new aesthetic theory can be broken down into three major factors.

The very nature of an "aesthetic" presents the first problem of establishing a new architectural philosophy. Aesthetic theory, as it exists today, is primarily concerned with the observation or appreciation of the artistic achievement. However, in order to be effective, the sustainable aesthetic must be a practical philosophy that can be implemented in the design of buildings.

This new practical philosophy must inform the way that sustainability is approached in the design process. Today, for the most part, sustainability is viewed as yet another programmatic element that must be resolved in pursuit of a coherent building design. The resolution to all the programmatic complexity in architecture usually comes in the form of an over-arching concept that gives meaning to how the pieces are put together. In this new philosophy sustainability must be that organizing concept.

Finally, in pursuit of a truly sustainable aesthetic, architectural solutions must strive to be both specific and universal. Buildings must relate to the specific challenges and constraints of each unique site, inherently specific solutions. And

yet, by taking a unique approach to each site, and striving to find the best solution, the result is also inherently universal in terms of sustainable approach and achievement.

With these three basic requirements – that a sustainable aesthetic represents a practical philosophy, acts as an organizing concept generator, and is universally specific – it is possible to create a new sustainable paradigm for the future of architecture and the earth.

3.6: Case Studies and Quantitative Evaluation

While the three factors just discussed represent a proposed definition of a sustainable architectural aesthetic, sustainability must be more than just words. To be truly effective sustainable architecture must meet intention with action, and the only way to verify this is through measuring post-occupancy factors, especially focusing on energy use and resource consumption. While the implementation of "sustainable aesthetic" principles should result in successful quantitative results, this assertion can only be validated by actual measurement and data collection.

The factors outlined in this chapter may seem disparate and unrelated, but an understanding of each is vital to the creation of a successful sustainable aesthetic philosophy. A sustainable architectural aesthetic theory must consider the complexity of the meanings of both "sustainable" and "architecture," as well as the

varied social and historical factors that impact those meanings. It is only through this holistic process that a successful sustainable aesthetic can be defined.

Chapter 4: The Failure of the Current Sustainability Paradigm

Sustainability – also known as "green," "eco-friendly," or "environmentally conscious" architecture – has become increasingly desirable and marketable. Hybrid cars are increasingly popular. Grocery shoppers carry reusable shopping bags. And businesses, corporations, and television shows are scrambling to "go green." Even the media giant NBC Universal recently launched the website greenisuniversal.com, touting the corporations "green" initiatives. Yet, despite all of these advances, sustainability remains largely on the fringes of the architectural profession. Of course, there is no shortage of efforts to change this, but the fact remains that the architecture industry is monopolized by so-called "high design" architects. These architects are continuously expanding the limits of form and structure, but at what cost?

The evidence is glaringly obvious. It would seem like a positive development that *Architectural Record*, the official publication of the American Institute of Architecture (AIA), has begun publishing a dedicated journal for sustainable architecture, called *GreenSource*. The AIA has made sustainability a major priority for the future. But if sustainability is so important, why is it not gracing the pages of the monthly glossy *Architectural Record*, perhaps the most

widely read trade publication in the United States, and instead relegated to an offshoot "specialty" magazine only published quarterly?

4.1: Greenwashing

Being "green" takes more than just saying so. Unfortunately, there are far too many companies and leaders in the world who are trying to convince consumers otherwise. The online encyclopedia wikipedia.com defines greenwashing as "the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service."[46] And as "green" practices have become more and more marketable, greenwashing has become a bigger and bigger problem.

Perhaps the most obvious example of greenwashing comes from energy companies. Coal, gas and oil commercials show happy families frolicking in vast park-like landscapes and touting their "cleanliness" and forward thinking, when in reality fossil fuel energy generation continues to be one of the leading causes of greenhouse gas proliferation. Sadly, the architectural profession is equally susceptible to these tactics.

4.2: LEED and Sustainability Rating Systems

In an effort to combat misleading claims, rating systems have been developed throughout the world and in the United States to quantifiably verify a building's

[46] "Greenwash" 2008

"greenness." The most common system in the United States is LEED (short for "Leadership in Energy and Environmental Design") developed by the United States Green Building Council (USGBC), a non-profit organization devoted to promoting sustainable building practices. LEED has become nationally accepted, adopted as a standard by many municipalities and even the federal government's General Services Administration. And it has become the gold standard for architects striving for sustainability. Even the major corporate firm HOK used LEED as the basis for the second edition of their popular book, *The HOK Guidebook to Sustainable Design*, using the system to evaluate each of the case studies.[47] The LEED system has even become recognizable to consumers, sometimes being used as a selling point for condominium and housing developments. The advances in sustainable design that LEED represents and the general increase in awareness that the system has brought about cannot be denied. But LEED is far from the be-all-end-all criterion for sustainability that many suggest it is.

Indeed, LEED has more than its fair share of problems, represented at the very least by the constant revision process that the system has gone through since its inception. There are currently eight LEED systems (for New Construction, Homes, Commercial Interiors, Core and Shell Developments, Schools, Retail, Healthcare, and Existing Buildings), and a ninth in development (for Neighborhood Developments).[48] This is evidence of the fact that it is exceedingly challenging to

[47] Mendler, Odell and Lazarus 2006
[48] "USGBC: U.S. Green Building Council" 2008

develop one over-arching system to evaluate all buildings, and yet, the complexity of having so many different rating systems with so many different standards has created a great deal of confusion. Another factor that the LEED system has yet to address is the vast and varied climates in the United States (and around the world). In response, the USGBC announced in late 2007 that the next version of LEED would abandon the building-specific systems, instead creating one comprehensive system that responds more to regional and climate distinctions.

While it is not entirely unexpected for rating systems like LEED to experience a certain amount of "growing pains," the problems with the system extend beyond the bureaucratic paperwork maze that it has created. Of course it comes as no surprise that achieving LEED certification costs money, but the registration fees that the USGBC charges for each applicant building represent only a fraction of the resources in time and energy required to file the necessary paperwork and documentation. Because of this, LEED certification is often financially prohibitive for all but the most financially sound architecture firms or clients who are willing to foot the bill for the extra costs (a very rare occurrence in the costly building industry). Perhaps the most alarming problem though, is the fact that all but one of the LEED systems completely ignores what happens after the building is completed. And LEED's "Existing Buildings" rating system focuses more on building operations and maintenance, than the actual performance of the building.[49]

[49] "USGBC: U.S. Green Building Council" 2008

Even the most successful LEED buildings (which fall into one of four classifications: Certified, Silver, Gold or Platinum) may fall short when it comes to actual building operations. As exemplified by the case studies in the *HOK Guidebook*, buildings rarely perform exactly as designed. In each of HOK's examples where actual building performance data was known, at least one aspect of energy use performed worse than expected.[50]

When the USGBC devised the LEED building ratings and professional accreditation programs, the hope must have been to inspire an increase in education and awareness of sustainable design in architecture, and it certainly has achieved this goal. Sadly, though, today the LEED system does little to inform the way buildings are designed. Far from creating a quantitative or verified definition for sustainable architecture, the LEED system as it is today is often little more than an afterthought; a specification exercise undertaken after the building design is decided. In addition, the LEED system focuses mainly on material choices instead of the long-term energy usage that has a much more significant impact on greenhouse gas emissions. Rather than combating greenwashing, the LEED system has only encouraged a whole sub-industry of consultants who are experts at getting by with the minimum requirements.

It is necessary to acknowledge the important advancements that the USGBC and the LEED programs represent for sustainable architecture. However, at the same

[50] Mendler, Odell and Lazarus 2006

time, it is crucial to note that LEED is not the only part of the sustainability equation. While LEED certification may result in energy savings and emissions reductions, it completely neglects the more holistic moral and social factors of sustainable architecture. Sustainability must become much more than just a plaque at the front door.

4.3: The Tradition-Technology Debate

Sustainable architectural theory comprises a wide range of opinions and points of view, and this variety encourages a valuable and diverse debate. Perhaps one of the most prevalent challenges in sustainable architecture is the debate between tradition and technology. Both arguments have clear merits, but dismissing one in favor of the other may be detrimental to the advancement of sustainable design.

Traditional and vernacular architecture represents generations of trial and error. For thousands of years civilizations had to find creative solutions to the challenges of their climates using locally available materials, developing a rich architectural history that is a vital part of cultural legacies. However, the anti-historical approach of the Modern Movement and the ethnocentrism of the historical point of view of much of the twentieth century have left these traditional approaches behind. There are, of course, exceptions to this neglect of vernacular techniques, perhaps best exemplified by the mud-brick system that Hassan Fathy developed in Egypt at the height of the Modern revolution that was happening around him. Unfortunately, Fathy's return to tradition did not gain widespread success as was

hoped, and an attempt to recreate the system in New Mexico in the United States required architectural concessions which negated the original low-cost value of the technique.[51] This unfortunate result is often far too common in attempts to recreate traditional architectural vernacular in the United States and elsewhere, where the result is little more than vague pastiche, approximating the imagery while completely neglecting the value of the vernacular technique.

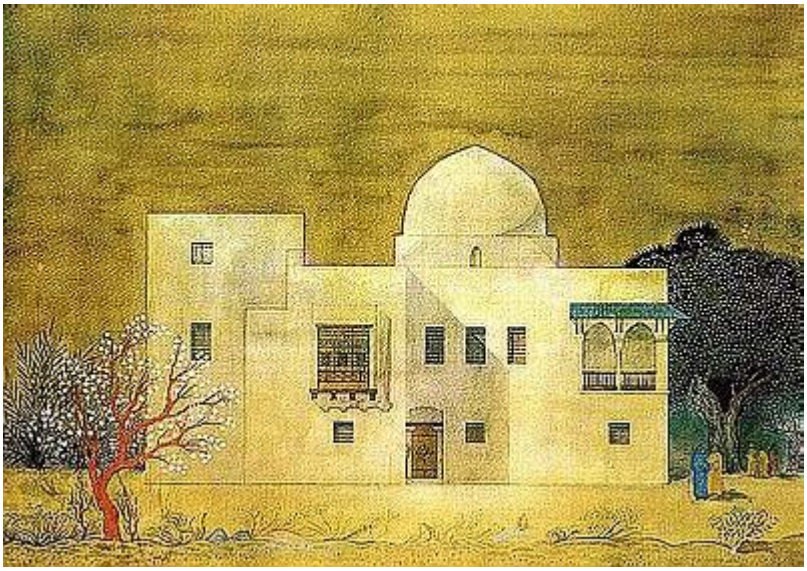

Figure 4: A Painting by Hassan Fathy, a traditional vernacular approach to sustainable architecture ("KATARXIS" 2008)

The opposite end of the spectrum is the school of thought that believes that technology alone has the power to solve the sustainable architecture challenge. Indeed, this point of view is not without precedent. Throughout history man has been able to overcome the challenges of life through invention and innovation. This fact manifests itself most powerfully in architecture in the way that computers have revolutionized the design process. And yet, it seems that the more architects use

[51] Steele 2006, 92

computer technology to push the limits of possibility, the more the human dimension is neglected in design. To be sure, "Building Information Modeling" (BIM) tools can be helpful in understanding the reality of architecture in ways that were impossible before, but much of the advanced technology in use in architecture today seems to be used purely for formal exploration, rather than enhancing the value of buildings. In terms of sustainability, there has been no shortage of technological advances. Technology has made mechanical systems more efficient and building envelopes tighter in order to use less energy. Technology has made alternative energy generation more realistic through solar electricity and hot water generation, and even wind and geo-thermal power. It is certainly possible for buildings to be completely energy independent using only these "high-tech" means. But such technology driven strategies remain prohibitively costly for many clients in the United States, not to mention the rest of the world. And as Ralph Knowles argues in his recent book *Ritual House*, technology has not made our architecture more interesting or unique:

> "On the one hand, the architect can think beyond basic protection for the body as a motive for design. On the other hand, the resulting monotony does not create any stimulus that might enrich our lives. Modern technology has allowed us to homogenize the world, to act indifferently to the separate rhythms of places."[52]

Clearly, despite the value in technological advances, technology can not be the only solution for sustainable architecture.

[52] Knowles 2006, 73

Obviously there is no one "silver bullet" solution to sustainable architecture. Traditional and vernacular typologies teach valuable lessons, but are often difficult to adapt to twenty-first century lifestyles. On the other hand, technology provides useful tools in the creation of sustainable architecture, but cannot solve the entire problem on its own. Instead of choosing one or the other, architecture must have an understanding of both as James Steele argues. "To set tradition and technology against each other is to establish a false dialectic; a more accurate approach may be to discover where they concur or overlap and how this may be applied to environmental problems."[53] Taken separately, these two approaches have had only limited impact, but used hand in hand, vernacular techniques and technological advances have the potential to revolutionize architecture.

4.4: The Failure of the Current Design Standard

Perhaps the largest challenge that sustainability faces today is the fact that "design-minded" architects seem oblivious to the change going on around them. After a self-destructive downward spiral of overly academic architectural theory over the past 50 years, architecture has been left practically devoid of any real meaning. Today, architects in search of conceptual motivation stray further and further from the form-follows-function tenet of Modernism, instead pushing the envelope toward an increasingly perilous precipice in search of "starchitect" status. There are, of course, exceptions to this scenario, but they are few and far between, consumed by a

[53] Steele 2005, 15

design culture that promotes formal experimentation over the creation of useful and quality spaces for human habitation. This may sound like a doomsday scenario for the future of the architectural profession, but in reality it provides an encouraging prospect for change. Vacant of any moral or social motivation in a time when social responsibility is held in such high esteem, architecture will soon be forced to change its ways.

Today's sustainable design paradigm is broken. Corporations and products make environmental claims without any supporting evidence. Rating systems intended to combat greenwashing have only perpetuated the status quo. And the architectural profession is locked in an exploration of formal impossibilities. As Sam Grawe, editor-in-chief of *Dwell Magazine* noted in a recent issue, "Being green, or carbon neutral, or sustainable has become just another fad, gone the way of acid-washed denim."[54] Of course, Grawe is not dismissing sustainability. He goes on to suggest that the future requires a more careful, more thorough approach to understanding sustainability.[55] And he is right. Without a new strategy sustainability will become just another fleeting moment of hyperactive architectural history. If the sustainability movement continues on its current path, it is almost certain to fail. In order to become the successful and widespread movement that it should be, sustainability must be represented by a cohesive and holistic philosophy.

[54] Grawe, November 2007, 41
[55] Ibid

A sustainable architectural aesthetic represents just such a philosophy, a solution to the failure of current sustainability paradigm.

Chapter 5: Understanding the Contemporary Social Climate

Architecture does not exist in a vacuum. More than any of the other arts, architecture is dependent on social conditions. Architecture is at the mercy of the volatility of the economy, government regulation, and public opinion. Navigating these various factors is a complex undertaking, made only more complex by the contemporary realities of urban growth and the inherent intricacies of a diverse planet.

5.1: Explosive Urban Growth

For the first time in human history, more people live in cities than in rural areas. At first glance, this sounds like a positive development for sustainability at least when measured on a per capita basis. Densely populated urban centers tend to encourage use of mass-transit systems, and multi-family housing is generally more energy-efficient than single family suburban sprawl. Examples like New York City and Tokyo come to mind where very few residents own cars, basic daily services are located within walking distance, and families live in more compact and efficient spaces than their suburban counterparts. But there is more to these cities than their dense and active urban cores. New York and Tokyo have suburban sprawl too, often enough to rival even the vast expanse of metropolitan Los Angeles. Indeed, the

eastern seaboard of the United States from Boston to Washington, DC constitutes a nearly 500 mile stretch of almost solid urban-suburban development. Further complicating the situation, the vast majority of the urban growth happening in the world today is not in these developed nation scenarios, but rather in developing nations, often without the means to build the infrastructure necessary to support such explosive growth. In Beijing, despite an extensive subway system, roads are choked with traffic as car ownership increases exponentially, and the air is thick with smog from automobile exhaust and pollution blown in from far-away power plants and factories. Pollution levels in Beijing are so extreme that for the upcoming 2008 Summer Olympics the government will have to impose driving restrictions and possibly even force factories to shut down during the Games. In Sao Paulo, Brazil, traffic is so congested that it is not uncommon for business executives to commute to work in helicopters.

This explosive growth is motivated by a desire in the developing world to join the ranks of developed nations, and this change and growth will continue regardless of the desires of developed nations for controls and strategy. As such, it is vital that the architectural profession approach this urban growth sensitively, understanding that it will not wait for appropriate solutions. Truly sustainable solutions cannot be just for the cities of developed nations, but must also consider the needs and challenges of the growing cities in developing nations.

5.2: A Complex Building Industry in a Complex World

All buildings are not created equal. Different functions and building types require a wide range of different approaches. And the world holds a plethora of microclimates, each requiring a unique approach. While the modern movement attempted to create a homogenous approach to all of these varying complexities (hence the name "The International Style"), today it is clear that there is no single architectural solution.

The complexity and variety of architectural typologies is an understood challenge in today's building industry. Zoning, building codes, and regulations take this into account every day, prioritizing certain building types, or even certain aspects of a building, over others. This complexity becomes even more pronounced when climate factors are taken into account. The four major climate types (hot-arid, hot-humid, temperate and cold) each present unique challenges. When specific microclimatic conditions, wind patterns, or sun angles are taken into account, the variety of situations to be found is almost endless.

In the face of all of this complexity, it is useful to have a strategy to help understand each specific situation. Despite the inherent intricacies of this challenge, the strategy may be fairly simple. It seems that a strategy of categorization would be an effective approach to managing the complexity of the architectural profession. While categorization can inevitably result in "pigeon-holed" solutions, if approached thoughtfully, it can also provide a useful starting point from which to derive

solutions specific to each individual problem. It is often said that architects must be generalists; that they must know a little bit about everything. A categorization technique is a perfect match for the generalist professional model. By understanding basic solutions to a wide variety of problems, architects can create unique and creative results for each specific problem they are faced with. Obviously an architectural solution for a dense urban lot would not be the same as the solution for a rural site. Techniques used in cold climates would, of course, not be appropriate for the desert. And the differentiation doesn't stop there. It is also important to consider factors of tradition and technology, and their appropriateness in each specific situation, as well as the unique socio-political factors at play. Specificity is one of the major challenges of creating sustainable architecture; a sustainable architectural aesthetic, and categorized solutions, can help to provide the most appropriate sustainable solutions available.

Chapter 6: Saving the World Through Architecture – The Modern Example and the Moral and Social Imperative of Sustainability

Despite what may appear to be a relatively passive product, the architectural profession can have a very real impact on social situations. Today, the most common example of architecture effecting society is the all too common outraged public response to some new unpopular project. But luckily, architecture has the power to effect positive change as well.

Recent Nobel Prize winners Muhamed Yunus and the Grameen Bank are an excellent example. Yunus' Grameen Bank Housing Project, first initiated in 1984, offers small loans to the rural poor of Bangladesh without requiring collateral, providing them with the basic components to build a house, including a concrete slab, concrete columns and a corrugated metal roof.[56] The program has allowed 45,000 families who would otherwise never have been able to own their own property to build safe and dry homes; and by building the homes themselves, the program has achieved greater success than most social housing programs, with a payback rate of almost ninety-eight percent.[57] Indeed, the program has been so successful that is has been replicated all over the world, and has had such a major impact that Yunus and the Grameen Bank were awarded the Nobel Peace Prize in

[56] Steele 2005, 205
[57] Ibid

2006. Obviously not all architecture can have Nobel-caliber impact, but the Nobel committee's recognition of Al Gore and the Intergovernmental Panel on Climate Change for the 2007 Peace Prize acknowledges the fact that global climate change has the potential to cause serious geo-political challenges. But these are challenges that architecture has the potential to alleviate.

Thankfully, morally and socially motivated architectural movements are not without precedent. Indeed, the rich and complex history of modern architecture is rife with social agenda. Le Corbusier even went so far as to present the stark ultimatum: "Architecture or Revolution."[58] While this point of view may seem extreme, it can serve as a useful example for the development of a sustainable aesthetic theory. An understanding of the social motivations and imperatives of sustainable architecture is vital to the success of a sustainable aesthetic.

6.1: The Moral and Social Motivation of Modernism

Since the industrial revolution, some architects have been motivated by a moral duty to improve social conditions through changing the built environment. While today their contributions are judged almost solely on stylistic content, their social impact cannot be denied.

Despite what appear to be glaring stylistic differences, many historians argue that architect, designer and writer Augustus Pugin and his Gothic Revival movement in mid-nineteenth century England was the beginning of the Modern Movement.

[58] Le Corbusier 1931

Motivated by the appalling conditions of industrial revolution England (and his Catholic faith), Pugin, through his encyclopedic built work and his two most influential written works, *Contrasts* and *The True Principles of Pointed or Christian Architecture*, advocated Gothic as the style that represented a more stable time, and had the potential to change society. To Pugin, the Medieval period in which Gothic architecture developed symbolized a time of social harmony, and the ultimate selflessness that was required to construct such epic religious monuments, a sentiment that was largely absent in the fury of the industrial revolution.[59] Pugin's short life may not have produced the social change that he had hoped for, but his work did inspire the Houses of Parliament and Big Ben, perhaps England's most recognizable buildings, and his praise for the structural honesty of Gothic architecture may have been the original motivation for what would become Modern architecture.

As Modern architecture developed, some theories became increasingly extreme. In contrast to Pugin, Adolf Loos, for example, likened "ornament" to crime, claiming that cultural evolution was equivalent to the removal of ornament, and that modern culture required a lack of embellishment.[60] As an illustration, he claimed that, "Any modern man who wears a tattoo is either a criminal or a degenerate."[61] While Loos' theory is not entirely motivated by the desire for social change, he did promote the concept of an architecture that was appropriate to the

[59] Ruhl 2003, 456
[60] Lupfer 2003, 676
[61] Qtd. in Lupfer 2003, 676

current state of social development, laying the ground work for the Modern architects who would follow.

Europe in the late nineteenth and early twentieth centuries was in a time of upheaval. Industrialization was changing the face of civilizations that had been largely unchanged for centuries. As cottage industry gave way to industrial production, economies were thrown into upheaval as peasant agricultural workers were forced to take factory jobs where working conditions were bleak and pay was dismal. Needless to say, living conditions for the average European were less than pleasant. These conditions inspired first English and then German designers to pursue means of craft and architecture that were accessible to all people. This sentiment led the formation of the Deutsche Werkbund and later the Bauhaus to explore these ideas. The socialist agenda of the German modernists was only further motivated by a war founded on secretive government treaties and agreements. In response, architects like Peter Behrens, Walter Gropius and Mies Van Der Rohe advocated architecture that promoted transparency and flexibility (as a means of economy). Advances in building technology allowed for less massive structural members and more expansive areas of glazing, further emphasizing the social metaphor of the architecture.

This same social upheaval opened the door to the rise of the Nazi regime in Germany between the World Wars. While the motivations may have been similar, the resulting theories of the Nazis and the Bauhaus did not entirely agree. The

Bauhaus was eventually shut down, and many of the German modernists fled, fearing persecution for their inconvenient philosophies and in some cases also their religion. Two of the most prominent, Gropius and Mies Van Der Rohe, arrived in America, where they had been introduced years earlier by Philip Johnson's "International Style" show at the Museum of Modern Art in New York. In the United States, the socialist ideology that built Modernism was somehow co-opted, where Modern architecture became more a tool of corporate success that social equalization. None the less, the social message of Modern architecture did leave its mark in America, where even Frank Lloyd Wright sought to achieve an affordable architecture for all people, even if only to limited success.

Figure 5: Large expanses of glass at the Bauhaus is Dessau, Germany ("Science Across the World" 2008)

Perhaps the most compelling example of the social motivation of Modern architecture is that of Le Corbusier. No doubt influenced by the work happening in

Germany and England, and reacting to the aftermath of World War I, Le Corbusier presents a dilemma for the social condition he confronted: Architecture or Revolution.[62] The Modernism that Le Corbusier envisioned was clearly more than just a one-building-at-a-time approach, he proposed projects on a massive scale, reinventing entire cities, and he truly believed that architecture could solve the problems of society. Le Corbusier envisioned mass-production techniques that would make housing affordable for all people, improving living conditions for the working poor. These ideas were far from fantasy, as was evidenced by the momentous effort produced by the war-machine of World War I, and yet the mass-produced homes that Le Corbusier foresaw are only beginning to become reality in the "pre-fab" trend that is growing today. What is most telling about the architectural theory of Le Corbusier, though, is the idea that architecture has the power to effect meaningful social change. Architecture finds itself in a similar situation today, where the threat of global climate change looms larger every day. But just as Le Corbusier first proposed in the 1920s and 1930s, architecture can be the solution, "Revolution can be avoided."[63]

Unfortunately, despite all the positive social change sought in modern architecture, the movement was eventually brought down by an over-emphasis on stylistic achievement. An increasing desire to express structural materials and Modern style eventually evolved into decorative techniques that eclipsed the honesty

[62] Le Corbusier 1931
[63] Ibid, 289

that originally defined Modernism. Furthermore, as technology developed in the Modern era, environmental control systems such as air-conditioning made Modern architecture feasible in extreme climates, neglecting more traditional methods that had been perfected over centuries. But these environmental control systems were often highly energy-intensive, making them very costly, and even the best air-conditioning systems were often no match for harsh desert climates. This arrogance that the "International Style" represented only accelerated the downfall of Modernism. Sadly, the overt preference for visual dogma undermined the moral motivations that developed Modernism in the beginning and opened the door for the intellectualized and inaccessible architecture that followed.

6.2: The Moral and Social Imperative of Sustainability

Just as Modern architecture was motivated at the start by a desire for social change, so too must sustainable architecture. This may seem like a foregone conclusion considering the basic tenets of sustainable architecture, and yet it is of crucial importance to the success of a sustainable architectural aesthetic. The potential results of global climate change are well known thanks to the contributions of the media and the popularity of films like Al Gore's *An Inconvenient Truth*. While these reports often present worst-case and "doomsday" scenarios, the perils that the planet faces are real and critical. Obviously one of the most frightening impacts of climate change is the potential for rising sea levels that could leave many coastal cities in the United States under water, not to mention the huge segments of

the world's population who live in very low lying areas of the developing world where even small amounts of rising waters could leave millions homeless. But rising sea levels are only one factor in this complex situation. Climate change and other results of human actions have resulted in significant decreases in biodiversity in some areas, which can have major negative impacts on entire ecosystems. Humans may be capable of withstanding climate change, but most other species are much more sensitive to even the most minor of changes, and human life is dependent on maintaining the biodiversity that keeps ecosystems thriving.

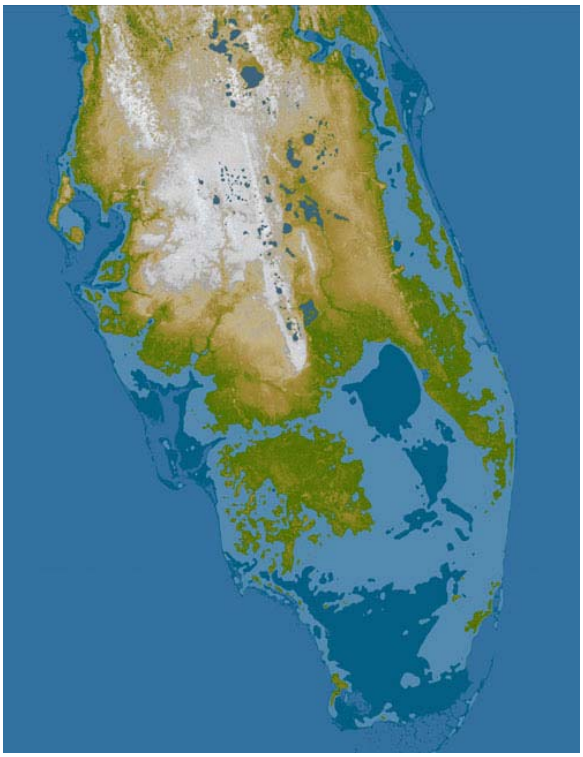

Figure 6: The potential impact of rising sea levels in Florida ("NASA" 2008)

Considering the possible negative impacts of global climate change, it would seem clear that all people have a moral obligation to do all they can to change that

fate. Architecture, as one of the largest contributors to climate change, has an even greater obligation to effect change. Sustainability, in an effort to curb climate change, is more than just a social issue – it is an ecological and biological issue as well. As technology has developed throughout history it has generally been to the benefit of society. Today though, the effects of industrial growth and modern lifestyles have the potential to displace hundreds of millions of people, mostly in developing nations that do not have the resources to protect and relocate the victims. But modern advancements and technology also have the potential to prevent such disasters when harnessed in the right ways. Those who have the ability, have the moral obligation to prevent catastrophic climate change. Sustainability must be more than just the popular thing to do, or the profitable thing to do, it must be the right thing to do. Only with this priority at the core can a sustainable aesthetic avoid the fate of modernism and achieve lasting success.

Chapter 7: Defining a Sustainable Aesthetic

Sustainability is at a critical juncture in its brief life-span. Every day, sustainable and ecologically responsible techniques, practices, services and products become more popular and marketable. And yet, as popularity increases, accountability seems to be on the decline. There are even those who have given up on "sustainability" altogether, claiming that the word itself has been so misappropriated over time as to render it essentially meaningless. To combat this decline, the architectural profession needs a cohesive sustainable aesthetic theory to ensure meaningful results and lasting success. However, the creation of such a theory is not without its obstacles, and these challenges must be addressed in order to define a meaningful aesthetic.

7.1: Aesthetic Appreciation versus Aesthetic Application

One of the most daunting challenges in developing a new aesthetic theory for sustainable architecture is the difference between aesthetic appreciation and aesthetic application. First and foremost, a sustainable aesthetic must be understood as a practical philosophy of aesthetic application. Most aesthetic theory provides a framework for understanding and appreciating art. While this is useful for exploring aesthetic and emotional responses to the arts, it is nearly impossible to create a work of art (or architecture) based on theories of aesthetic appreciation. Architecture, if nothing else, must meet some basic practical needs, so any meaningful architectural

theory must have practical application. As history has shown, the more intellectual an architectural theory becomes, the shorter its lifespan. Therefore, a sustainable aesthetic must be a practical theory that can be applied in any building situation.

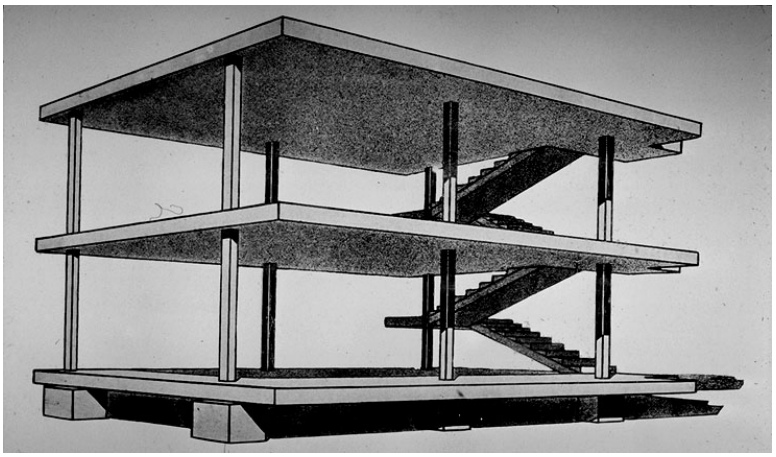

Figure 7: Le Corbusier's "domino" system, a practical aesthetic philosophy ("USC – University of Southern California" 2008)

Examples of practical aesthetic theories abound in the history of architecture, but by far the most well known are those of Le Corbusier. The Domino house and the Five Points of Architecture are so ingrained as the tenets of modernism that they are still a major part of architectural education today. Le Corbusier's theories, based in part on the advancements of the manufacturing in the automotive, aviation and shipbuilding industries, may seem outdated, but the development of a practical aesthetic product serves as a valuable lesson for the development of a sustainable aesthetic. It is important to note the difference in approach between Le Corbusier's Modernist theory and the motivating forces of a sustainable aesthetic. Le Corbusier's Five Points – pilotis, free plan, free façade, ribbon windows, and roof gardens – while based in the technological advances of the era, resulted in a definite

formal aesthetic. The "Five Points" of a sustainable architecture, on the other hand, could include such factors as optimal solar orientation and natural ventilation, which are not motivated by formal priorities, but have definite formal implications.

7.2: Sustainability as Programmatic Complexity and Organizing Concept

In order to be truly effective, sustainability must also be a driving force in the design process. Architecture is a complex process that involves organizing a wide variety of disparate, and sometimes contradictory, requirements into a cohesive whole. In order to direct the decision making process, architects often devise a singular over-arching "concept" to bring the various factors together. The concept becomes the driving force of the building, defining how the elements come together to create "architecture." Concepts can take a wide variety of forms, from basic organizational ideas to grand social statements, but either way, the concept is the basis for a vast majority of today's architecture.

Integrating sustainability in architecture only adds to the programmatic complexity of creating architecture. To be truly effective, sustainability must be considered in every aspect of designing a building, from the orientation on the site to the paint on walls. It is no wonder that architects choose to ignore sustainability when it can make an already intricate process even more difficult.

But sustainability should not be seen as an obstacle to architectural design. Indeed, it can be the exact opposite. Instead of adding sustainable practices to the

long list of required factors in a building, a sustainable aesthetic will use sustainability as the concept that brings all those requirements together. This may seem like an obvious conclusion, but sustainability as a conceptual driver is actually the ultimate solution to the complexity of architecture. Today, many architects try to force formally driven concept buildings into the increasingly sustainable box that is reality. Rather than solving problems, they are only creating more problems. On the other hand, when sustainability is the motivating concept, as it must be in a sustainable aesthetic, the conceptual basis eliminates one of the major elements of programmatic complexity. Instead of forcing sustainable principles on a formal envelope, sustainability drives the form. Instead of specifying high-efficiency (and often high-cost) systems to meet energy codes, the building design inherently creates efficiency without the aid of specialized mechanical equipment.

Malaysian architect Ken Yeang used a similar strategy when he undertook to reinvent the way skyscrapers are designed. Yeang's approach assumes that continuing global development will necessitate the continued building of skyscrapers, but that increasing strain on resources makes the current skyscraper design paradigm impossible to maintain. Instead of relying solely high-tech systems and materials to make existing skyscraper design more efficient, Yeang sought to completely re-imagine the skyscraper typology. Yeang's "bioclimatic" approach has resulted in several entirely naturally ventilated skyscrapers in the equatorial tropical climate of Malaysia, no small feat for sustainability.

Figure 8: Ken Yeang's Menara Mesiniaga, sustainability as concept generator (Figueroa, 2004)

7.3: Sustainable Solutions: Specific and Universal

By nature, sustainability requires solutions that are specifically suited to each unique situation. Therefore, a universal visual aesthetic system cannot work for sustainable architecture. Sustainable architecture simply cannot have one singular aesthetic expression, but rather an infinite number of variations. At first glance this would seem diametrically opposed to the concept of a cohesive sustainable aesthetic. The development of one sustainable aesthetic theory that can be effectively applied to all architectural situations requires a universal approach, but the specificity required by sustainability makes this impossible. This argument denies the answer

that it holds. The sheer impossibility of replicable solutions for different architectural problems leaves only one possible common thread: specificity. Sustainable architecture must be universally specific.

Figure 9: Light scoops at Renzo Piano's High Museum in Atlanta protect the galleries from direct sunlight ("AV Monografias & Arquitectura Viva" 2008)

Architect Renzo Piano is a master of harnessing natural light in museum and gallery spaces. Art and direct sunlight, however, are not a good combination, and Piano is forced to find ways to let natural light into the galleries without allowing any direct rays into the space. Each museum has its own unique set of requirements that necessitate unique solutions, and in every case Piano has created a finely tuned system to control natural light. Each solution is unique to its own environment and to the building which it serves, but the universality of the approach is recognizable in the work.

Figure 10: Rick Joy's architecture takes advantage of the only locally available building material, soil ("Cooper Hewitt, National Design Museum" 2008)

Another example of place specific architecture is the work of Rick Joy. Working mostly in the desert climate of southern Arizona, Joy utilizes the only construction material that is naturally abundant, building homes out of rammed earth. In addition to reducing the embodied energy of his buildings by using a locally available material, the high mass of the earthen walls helps to regulate the diurnal temperature swings of the desert, keeping the houses cool in the heat of the day, but warm in cold nights.

The work of Renzo Piano and Rick Joy represents only a small microcosm of this concept of universal specificity, but it serves as a valuable example. A sustainable architectural aesthetic must exemplify the precision of Piano's

daylighting systems, only magnified to a whole-building scale. When a building is truly in tune with its place, the results should be obvious. However insular and withdrawn contemporary society has become, humans are still aware of the natural forces of the Earth.

Having addressed the challenges inherent in creating an architectural aesthetic theory, a sustainable aesthetic can be broken down into three major factors. First of all, a sustainable aesthetic must be a practical philosophy. To be meaningful and valuable, there must be more than just theory; it must result in a product that addresses the motivations that brought about the aesthetic in the first place. Secondly, a sustainable aesthetic must be an organizing concept generator. To be truly "sustainable," that goal must be driving the decisions of the design process. And finally, a sustainable aesthetic must be universally specific in its application. Every sustainable building must be born out of its place and the forces at work in that place. While there are useful examples for each of these factors individually, it is possible that there is no perfect precedent for the sustainable aesthetic philosophy presented here.

All told, these three factors would appear to be a formula for a dull and scientific architecture, completely devoid of the joy that is made possible by quality design. At a recent symposium at the University of Southern California, Cecil Balmond, structural engineer and Deputy Chairman of the global engineering firm

Arup, suggested that there is something innately appealing about a strong formal concept.[64] This proposal would seem to be at odds with an architecture that is based on sustainability as described above. But what is to say that the strong formal concept cannot be derived from a sustainable aesthetic. Aesthetic theory has shown that aesthetic response is based on knowledge. As George Nelson said, "What we see is what we bring to seeing."[65] And what do humans know better than the patterns of the sun, the power of the wind, the rejuvenating energy of the rain. When a building harnesses these natural forces, when it responds to the infinitely unique characteristics of its place, there is an inherent human response. It is an aesthetic response. They experience beauty.

[64] Arup 2008
[65] Nelson 2003

Chapter 8: Case Studies – The Reality of a Sustainable Aesthetic

After establishing the basic tenets of a sustainable aesthetic, architecture still faces major challenges in implementing those principles to reduce global climate change. Though the value of using "sustainability" as a basis is the broad reach that it implies, the word itself does not suggest any concrete goals or benchmarks. While the focus of this study has been primarily on theoretical and philosophical aspects of sustainable design, the resulting architecture must exhibit quantitative progress in order to make any meaningful difference. As such, it is necessary to evaluate several case studies, both in terms of philosophical approach, as well as quantitative achievement.

8.1: The Importance of Post-Occupancy Evaluation

The importance of a coherent sustainable aesthetic philosophy is undeniable. And yet, without substantial and measurable progress any sustainable philosophy is meaningless. Because the broad term "sustainability" encompasses so many varied aspects, from site selection to water use, it is difficult to determine one single comparable factor to evaluate architecture. This fact is clearly exemplified by the wide variety of factors considered in the LEED system, and the number of revisions the system has gone through. To be sure, issues of indoor air quality and material

selection are important to the cause of sustainability. However, the largest single contributor to global climate change caused by architecture is energy use over the life of the building. It is one thing to design buildings with more efficient energy use in mind, but actual performance is a very different matter, and the only way to accurately measure energy use is through post-occupancy evaluation (POE). Only by measuring energy use once buildings are fully operational can the effectiveness of the sustainable design strategies they employ be evaluated.

8.2: The Value of Qualitative Post-Occupancy Factors

While numeric data is essential to an understanding of the success or failure of sustainable design features, it is also vital to acknowledge the less measurable aspects of post-occupancy evaluation. Some factors of human comfort can be quantified, such as comfortable temperature and humidity levels, but even then individual comfort can be so wide-ranging as to be unquantifiable. Architecture, though, is about more than just providing shelter, and it is also about more than just quantifiable measures of comfort. It is difficult, if not impossible, to define what it is that allows buildings to cause such unquantifiable responses as joy for their inhabitants, and yet this is a vital factor in the success or failure of architecture. As Le Corbusier suggested, it is the power to touch emotions that sets architecture apart from engineering. Despite Le Corbusier's emphasis on the primacy of Architecture, the emotional response to buildings may have more to do with Langer's "ethnic domain" concept, which involves memory and cultural cues. Whatever the source of

emotion in architecture, it is vital to remember that quantitative data is not the only factor of building performance. Architecture must not lose sight of its more ephemeral responsibilities.

8.3: Evaluating the Case Studies

Sustainability involves many measurable factors in various areas, but for the purpose of the case studies presented below, the main focus will be on energy use. While all factors of sustainable design are important, long term energy use has the largest impact on greenhouse gas emissions and climate change. The materials in a building, for example, are only made once in most cases, whereas the building itself could potentially consume energy for hundreds of years. In these case studies the unit of comparison for energy use will be kBtu/sq ft/year, a unit that accounts for both differences in building area and seasonal climate extremes. Even so, it is important to consider that different building types in different climate zones will have different energy use requirements and expectations.

In addition to the quantitative data presented, each case study will also be evaluated in relation to the three factors of a sustainable aesthetic, as defined in the previous chapter. To summarize, a sustainable aesthetic must:

- represent a practical architectural philosophy
- use sustainability as a concept generator
- create universally specific solutions to local site forces

As discussed in Chapter Seven, in addition to resulting in an aesthetic that is truly sustainable, it is expected that these principles will also result in architecture that provides well-being and joy. These three factors will be considered in determining whether or not the case studies presented are examples of a sustainable aesthetic philosophy, and whether that aesthetic approach coincides with the quantitative performance data.

8.3: Case Study: Seattle Public Library – Form over Efficiency

The new Central Library in Seattle, Washington is a much celebrated building, not least of which for its achievement of a LEED Silver rating. However, despite the LEED rating, the Seattle Central Library may not be the best example of sustainable design. Opened in 2004, the new Central Library replaced a 1960s building that was inadequate to house the library's vast collections or to serve the growing population in Seattle. The design of the new building, by Dutch firm OMA (headed by Rem Koolhaas), was intended as a reinvention of the library typology, addressing the complexity of collecting emerging new media, as well as the necessary flexibility to accommodate a growing (or shrinking) collection of printed material.[66] By virtue of its location in Seattle, the building was also required to meet very stringent local energy and sustainability regulations that far exceed national standards. As a result, the new building is both architecturally innovative and energy

[66] "Office for Metropolitan Architecture" 2008

conscious. Even so, the Seattle Central Library is not representative of a sustainable aesthetic.

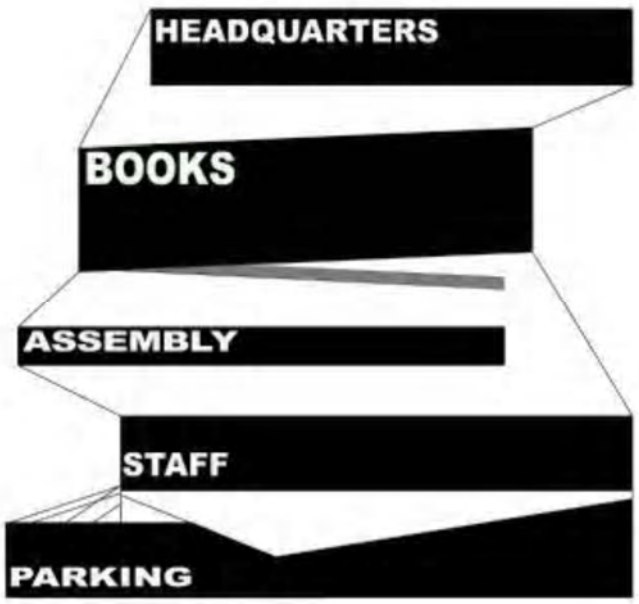

Figure 11: Sectional diagram of program organization ("Office for Metropolitan Architecture" 2008)

In terms of quantitative results, it has been rumored that the new Central Library does not live up to the highest standards of efficiency. In reality, the post-occupancy data for the new building has shown the energy saving measures to be relatively successful. The City of Seattle sustainable building policy requires that all public buildings over 5000 square feet achieve a LEED Silver rating or better.[67] In order to receive LEED points for energy efficiency buildings are required to be designed to outperform a certain baseline level based on ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) standards. ASHRAE standards are different for each building based on size, occupancy and

[67] "Seattle.gov" 2008

other factors. According to a 2006 report, the Seattle Central Library's baseline standard was 129 kBtu/sq ft/year, and in order to achieve the necessary LEED points the building was designed to a level of 86 kBtu/sq ft/year.[68] These energy use levels are not especially conservative, but are representative of the unique nature and occupancy of a library building. After one year of occupancy though, the Central Library building was performing much better than even the design standard, only consuming 50 kBtu/sq ft/year.[69] Clearly the quantitative energy use data would suggest that the energy saving design strategies and mechanical systems are working far better than was originally expected for this building. However, taking a broader view, the actual energy use values may not be as impressive as this single case data suggests. While the actual energy use exceeds the ASHRAE baseline by over 60%, it only exceeds the City of Seattle's code by ten percent.[70] In comparison, the recently completed library at the University of California at Merced (a similar building type, although only about one third the size) is only expected to require 28 kBtu/sq ft/year (based on simulations).[71] It is difficult to compare energy use between two buildings without more detailed information, but this comparison would suggest that the performance of the Seattle Public Library could have been even better.

[68] Turner 2006
[69] Ibid
[70] "The Seattle Public Library" 2008
[71] Boehland, January 2008

Perhaps the missing link that is hindering the Seattle Central Library from performing even better is the lack of integration of sustainability in the conceptual design process. Based on the three factors discussed in Chapter Seven, this building would definitely not fit into a model of a sustainable aesthetic. It could be argued that the Central Library does meet the requirement of ascribing to a practical sustainable philosophy (the first factor of a sustainable aesthetic) in its adherence to the City of Seattle's requirement that the building be LEED Silver certified, but since this factor was not a driving force in the design it is a difficult argument to make. As mentioned, the new Central Library was intended as a reinvention of the typology, and this idea is what drove the conceptual development of the building, thereby negating the use of sustainability as a concept driver (the second factor). At a recent symposium of engineers from the global firm Arup, Brian McKinley, who was one of the leading mechanical consultants on the Seattle Library, suggested that the form of the building was actually derived from site specific approaches to sustainable practice.[72] Unfortunately, rather than illustrating this claim, the images and diagrams shown suggested quite the opposite; that instead of responding to local forces, the form dictated how differing strategies would be applied to conserve energy. Instead of revealing a holistic approach to sustainable design, McKinley's presentation demonstrated the myriad solutions required to resolve the extreme form of the building with the strict energy requirements in Seattle.[73] While form is not always

[72] Arup 2008
[73] Ibid

the best indicator of sustainable intentions, in this particular case it is clear that there is no consideration for solar orientation. The argument could be made that this represents a certain level of locally specific response, in accordance with the third factor of a sustainable aesthetic, but that argument is weak at best. It seems that requiring triple-paned and fritted glass to prevent excessive heat gains suggests an overall design that is generally unresponsive to the local conditions of the site. It might have been much more sustainable to limit the use of glass on the building, placing it only where it was actually the most advantageous material.

Figure 12: Seattle Central Library (Douglass, 2007)

To be sure, the Seattle Central Library is a compelling example of architectural ingenuity, and the surprising performance data are a testament to the

success of government mandated sustainability practices like those in place in Seattle and the solutions that Arup applied to the architect's concept. Unfortunately, the design lacks any coherent approach to sustainability, and therefore fails to meet the requirements of a sustainable aesthetic. The sustainable features of the Seattle Central Library are forced to take a back seat to the symbolic design concept and the resulting form of the building. Indeed, visitors to the library would probably have no idea of its sustainable merits if not for the conveniently located placards throughout the building. While the data emphasizes the library's sustainable qualities, the building form tells a different story.

Figure 13: Extensive glazing allows ample natural light but can also result in excessive heat gain. The image also shows the lack of coordination between daylighting and electric lighting (Douglass 2008)

8.4: Case Study: Hawaii Gateway Energy Center – The Power of an Integrated Design Process

The Hawaii Gateway Energy Center at the Natural Energy Laboratory of Hawaii (NELHA) presents a striking counterpoint to the Seattle Central Library. While only about one tenth the size of the Seattle Library, and located in a vastly different climate, the Gateway Center is none the less a remarkable example of the power of the synergy of design and sustainable practice. Intended as a "gateway" and visitors center to the Hawaii Ocean Science and Technology Research Park, the 3600 square foot building consists of a conference and educational center as well as administrative space. Designed by Ferraro Choi and Associates, the brief for the building called for cutting-edge technology, zero-net energy use, and an emphasis on new and alternative energy sources, as a reflection of the work that NELHA does.[74]

Figure 14: Hawaii Gateway Energy Center ("Ferraro Choi and Associates" 2008)

[74] "Ferraro Choi and Associates" 2008

In order to meet these rigorous requirements, the building design incorporated multiple energy saving strategies, earning a LEED Platinum rating (the highest rating available). The most obvious strategy is the use of photovoltaic panels, arranged on large space trusses, angled to capture solar energy. When the building was published in *GreenSource Magazine* in July of 2007, the 20kW array was providing 110 percent of the electricity needs of the building.[75] In addition to solar power, the building utilizes a unique passive ventilation system that negates the need for any mechanical systems. Thermal chimneys integrated into the copper roof, creating a natural stack-effect flow, drawing in cold air that is passed through coils of cold seawater which is pumped up from 3000 feet below the surface.[76] These two systems are combined with more active features like occupancy and daylight sensors to reduce energy consumption for electric lighting, which is never used during the day, thanks to ample natural light.[77] All in all, the building expects that purchased energy usage will be only 3.5 kBtu/sq ft/year (extrapolated from data from the first five months of occupancy).[78] While it is not surprising that a building with such intensive solar energy generation and no mechanical ventilation (aside from the pumps circulating the seawater) would have such low purchased energy use, the actual numbers are still remarkably low. In comparison, the Water and Life Museums, in Hemet, California, which uses a 540kW array (a higher kW/sq ft ratio

[75] Roberts, July 2007
[76] Ibid
[77] Ibid
[78] Ibid

than the Gateway Center), still expects to have to purchase 20.3 kBtu/sq ft/year. The Hawaii Gateway Energy Center has clearly achieved a feat of energy efficiency.

Figure 15: Extensive photovoltaic arrays generate electricity for the Gateway Center while also shading windows from direct solar gain ("G Living" 2008)

What makes the Gateway Center even more successful is its expression of a sustainable aesthetic philosophy. In terms of the three factors of a sustainable aesthetic, the Gateway Center may be the ideal example. In accordance with the desires of the client, the building proudly shows off its energy saving features. The client's demand for a sustainable project that showcased new and alternative energy sources represents a practical approach to architecture, in line with the first factor. Because of this demand, sustainability was the major driver of the design process. As the Ferraro Choi website describes, "The architectural approach for the HGEC project was to design a building which took advantage of all available sources of natural energy,"[79] clearly ascribing to the principle that a sustainable aesthetic should be a concept generator. The stated goal of utilizing all available resources

[79] "Ferraro Choi and Associates" 2008

automatically implies specificity to the site, the final factor of a sustainable aesthetic. Both the solar arrays and the thermal chimneys are optimized for the natural forces on the site, with access to the southern sun, and the prevailing southern winds; glazing and overhangs are designed to allow natural lighting at all times during the day; and the passive cooling systems utilize the thermal power of the ocean at the project's front door.[80] The Gateway Center represents an extreme example of sustainable theory influencing built form, in sharp contrast to the Seattle Central Library, but it is important to note that expression of sustainable design is about more than just large expanses of photovoltaics, and that each building must express its sustainability in ways that are most appropriate to each unique site.

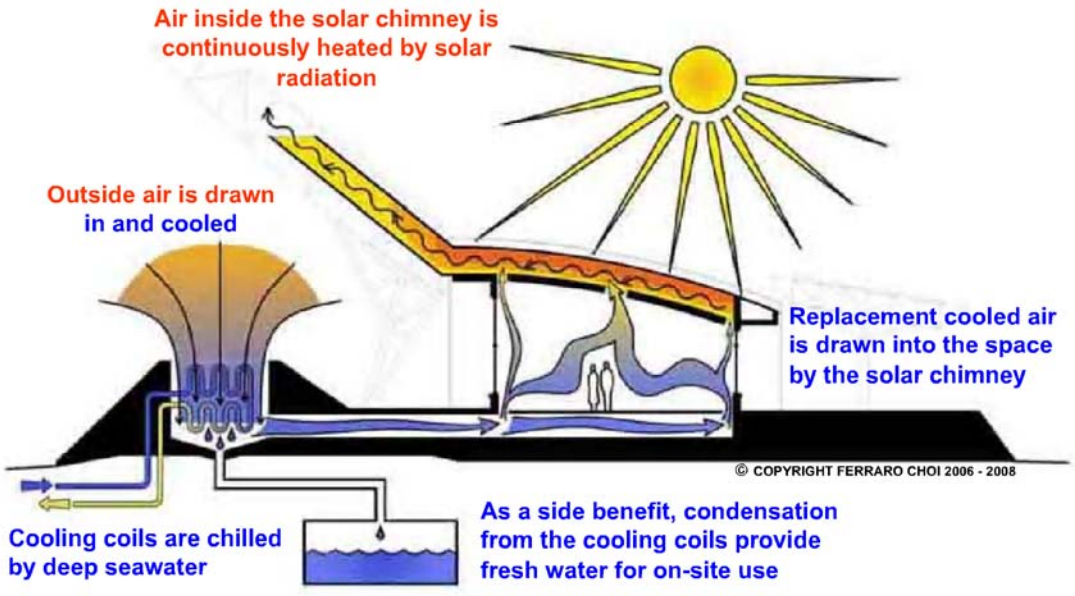

Figure 16: Diagram of HGEC's Passive Ventilation System ("Ferraro Choi and Associates" 2008)

[80] Roberts, July 2007

Like all buildings, the Gateway Center is still experiencing some growing pains. On the rare occasion of northerly winds, the photovoltaic arrays direct the wind down the thermal chimneys, negating their effectiveness.[81] On the other hand, on the average day, the ventilation system works so well that some people are too cold.[82] In spite of these relatively minor problems, the Hawaii Gateway Energy Center clearly illustrates the power of a sustainable design concept which takes advantage of natural forces. The building clearly demonstrates its commitment to alternative energy, and the performance data definitely substantiates this approach. Not only does the performance data support the Center's claims to sustainability, but building form is also a clear expression of a sustainable aesthetic philosophy, where an awareness of site forces, and environmentally conscious techniques provided the inspiration for the design process.

8.5: The HOK Example – Lessons Learned

The minor glitches experienced at the Hawaii Gateway Energy Center are just a small example of a much larger problem: no matter how good the design simulations and computer models are, the actual building does not always perform as expected. While examples like the Seattle Central Library, which performs much better than expected, are encouraging, they are certainly not the norm. This problem is clearly expressed in the case studies presented in *The HOK Guidebook to*

[81] Roberts, July 2007
[82] Ibid

Sustainable Design. Since its founding in 1955, global architectural firm HOK (Hellmuth, Obata + Kassabaum, Inc.) has been committed to "making a measurable difference in the world," an undertaking that focuses heavily on sustainability.[83] As part of this commitment, the firm published *The HOK Guidebook to Sustainable Design* in 2000. The second edition, published in 2006, contains 18 case studies of HOK designed sustainable projects, six of which contain post-occupancy energy use data. In all six cases some aspect of actual energy use was greater than predicted.[84] In some cases, overall energy use was higher than expected while electricity demand was lower than expected, and in other cases the opposite was true.[85] This is not necessarily a reflection of the effectiveness of HOK's design strategies, but rather a statement of the unpredictability of the building industry and the realities of actual building use. Equipment may be installed incorrectly, mechanical systems may fail, and occupancy patterns may change, all of which can affect building performance in ways that are difficult to measure in computer simulations. And, of course, in some cases, sustainable and energy efficient strategies do not perform as well as expected, even when everything else goes right. It is vital to the progress of sustainable architecture that these uncertainties in the design process are understood. As a reflection of that, each of the completed projects documented in the *The HOK Guidebook* includes a section called "Lessons Learned," where the successes or

[83] "HOK: ideas work" 2008
[84] Medler, Odell and Lazarus 2006
[85] Ibid

failures of each project are discussed in order better inform future projects.[86] It is this sort of inquisitive approach that is critical to the development of sustainable architecture. Only through experimentation and measurement can truly effective strategies be established.

8.6: The Challenge of Post-Occupancy Data Collection

The importance of the "Lessons Learned" example presents another challenge in the development of sustainable architecture. The only way to truly measure the success or failure of sustainable strategies is in a post-occupancy context. Only when a building is fully occupied and operational can it be effectively assessed. As previously discussed, this is one of the major problems with the LEED system, which bases its ratings only on the design and construction process. There are some systems, such as the Energy Passport program in Germany, which include mandatory post-occupancy measurements to validate energy efficiency, but such programs are not yet widespread. Post-occupancy evaluation presents its own set of complex problems though. Because of the nature of building use and climate patterns, it generally takes at least a year to compile any reliable post-occupancy data. In the meantime, owners and architects are forced to wait and see whether their investment has paid off, a frightening thought in an industry where standards are changing almost constantly. And yet, post-occupancy evaluations are critical to understanding the relative value of sustainable design practices. In order to create a

[86] Mendler, Odell and Lazarus 2006

more effective sustainable design industry, post-occupancy data collection and evaluation must become the norm instead of the exception.

Chapter 9: Conclusion

It has become increasingly clear in recent years that global climate change is a major issue for the future and that architecture has a substantial impact on that climate change. While advances have been made in terms of sustainable practices in the building industry, architecture is still lacking a cohesive and holistic approach. The current paradigm is failing. In order to maintain the progress of environmentally conscious architecture, the architecture profession needs a new approach to sustainability. Architecture needs a sustainable aesthetic, a coherent philosophy that can guide each project from beginning to end.

9.1: The Process of Establishing a Sustainable Aesthetic

Establishing a sustainable aesthetic involves many varied aspects. It is, first of all, necessary to understand the historical context of aesthetic and architectural theory as well as sustainable design theory and practice in order to gain a full understanding of the meaning of "architecture" and "sustainability." Furthermore, it is essential to consider the failures of the current design paradigm, both in terms of sustainability and in architecture as a whole. The sustainable design standards currently in practice in the United States emphasize the wrong factors, and the architecture industry is burdened by a preference for formal exploration that is generally lacking in social relevance. Of course, it is also important to acknowledge the complexity of architecture in the twenty-first century global context. Urban

populations are constantly expanding and diverse climate conditions represent a wide variety of unique challenges, especially for sustainable architecture. Finally, it is imperative to understand that sustainability must be more than just the latest trend. Sustainable architecture has to be more than just the fashionable or profitable thing to do, it must be the right thing to do. Architects, especially in developed nations have a moral and social obligation to address the challenges of global climate change that are created by the built environment.

9.2: Defining a Sustainable Aesthetic

In Chapter Seven, three factors of a sustainable aesthetic were established, resulting from the process outlined above. First and foremost, a sustainable aesthetic must be a practical philosophy. It must be able to produce real physical architecture to have any effectiveness. Secondly, in order to bring together all the disparate aspects of architectural design, a sustainable aesthetic must be an organizing concept generator. By using sustainability as a design concept generator, environmental priorities inform all aspects of the design process. And finally, any singular aesthetic must represent a universal approach, but sustainability requires solutions that are uniquely specific to each situation. In order to reconcile these differences, a sustainable aesthetic must represent universally specific solutions to the wide variety of architectural problems.

9.3: The Necessity of Quantitative Factors

While the aesthetic factors just outlined represent an important new approach to sustainable design, it is vital to consider quantitative performance factors as well. As discussed in Chapter 8, architecture must make quantitative gains in order to effectively combat climate change. The largest quantitative factor in architecture is energy use, but there are also other important quantitative factors such as water usage, indoor environmental quality, and recycled materials just to name a few. These factors, and the many other aspects of environmentally conscious design, must be considered as part of a sustainable aesthetic approach to architecture.

9.4: Reconciling the Aesthetic and the Quantitative

At first glance, aesthetic philosophy and quantitative performance seem to be diametrically opposed concepts. However, when the aesthetic philosophy is motivated by a responsibility to quantitative performance, the result can represent both aesthetic quality and high performance. As suggested by the case studies presented in Chapter 8, any building can be optimized to improve energy performance, but when the design focuses on sustainability and energy savings from the beginning the results can be extraordinary. The Seattle Central Library is admirable in its energy use considering the building type and occupancy, but the lack of emphasis on sustainability in the design process limits the potential for high performance. The Hawaii Gateway Energy Center, on the other hand, prioritized

efficiency and alternative energy sources from the outset of the design process, and the result is an iconic building that also has remarkable performance data. Obviously these two examples represent extreme cases, and it is difficult to define exactly what would make the Seattle Central Library more representative of a sustainable aesthetic without a much more detailed understanding of the specific constraints of the site and the program. Even so, these examples present a clear lesson. It is not good enough to simply apply efficient materials and systems to any building and call it "sustainable." Sustainable practices must inform the design process from the beginning in order to produce truly environmentally conscious results. And it only seems natural that when sustainable strategies are prioritized throughout the life of the project, the quantitative results will be far greater than if those same strategies are only considered as stop-gap measures at the end of the design process. Sustainable architecture requires quantitative performance data to validate the effectiveness of the design strategies, and a sustainable aesthetic philosophy enhances building performance by prioritizing environmental strategies throughout the design process.

Many questions still remain in the establishment of a sustainable aesthetic. What will it look like? And how will people react? These are just a few of the important factors that are still facing this new architectural paradigm. These questions are entirely valid, and in time, the answers to these questions will be found. But these subjects cannot be approached haphazardly. In order to approach these

topics, it is first necessary to establish a practical philosophy of exactly what a sustainable aesthetic is based on, and only once these factors have been implemented can the subjects of appearance, beauty and human reaction be considered.

With the gravity of the global climate change situation, it is clear that the architecture industry must soon face the facts and change its ways. But it is not enough to impose sustainable features on any design aesthetic. It is also not enough to simply say that a building is sustainable. Only when the design and the performance data support these claims can a building be truly sustainable. And a first step in achieving that success is the implementation of a sustainable aesthetic for architecture.

Chapter 10: Future Work

Developing a sustainable aesthetic architectural theory is not a singular event, but rather a continuing process of experimentation and adjustment. As processes and technologies change, so too will the results of such an aesthetic. Clearly, defining the parameters of a sustainable aesthetic must be only the beginning of this architectural movement.

10.1: Continuing the Discussion

Obviously the argument presented in this thesis represents just one point of view on the development of a sustainable aesthetic philosophy. It is vital that this discussion continues and that new points of view are presented. The principles and ideas presented here are not meant to be a final definition, but rather a starting point for debate, exploration and experimentation. In order for the new aesthetic philosophy proposed to remain relevant it must be placed in cultural context and that can only be achieved through further analysis, assessment and discussion.

10.2: Further Case Studies

Perhaps the most important factor in the continued development of a sustainable aesthetic is further case studies. The study presented here only included a few case studies, which is clearly not sufficient to establish broad patterns of sustainable techniques. As was established, sustainable practices must be verified

with quantitative data. And the only way to get such quantitative data is through more and continued post-occupancy case studies. The more data that is made available the better informed architects will be in employing various sustainable strategies.

10.3: Qualitative Post-Occupancy Evaluation (POE)

Studies have already shown that buildings that integrate sustainable factors and practices can improve productivity and the general health of the occupants, but other more qualitative impacts of sustainable architecture are more difficult to measure. And yet, it is these ephemeral qualities of joy, livability and general pleasure that dictate the success or failure of architecture in the end. It would seem that buildings that respond to natural forces and rhythms would make for more pleasant environments to live and work in. However, these factors must be further studied and measured to validate these claims. The development of a sustainable aesthetic is largely dependent on the success of performance related quantitative data, but it is also important to recognize the impact of qualitative factors and how they will impact the development of that aesthetic.

10.4: Encouraging Behavioral Modification

In a recent article in *Metropolis Magazine* architect Stephen Kieran of the Philadelphia firm Kieran Timberlake discussed the unique behavioral modification effect that the dashboard display of the Toyota Prius has, illustrating whether the car

is running on electricity or gas.[87] Kieran suggests that just as his car encourages him to change his behavior to better the environmental impact, so too can architecture.[88] While Stephen Kieran and James Timberlake attempt to integrate such behavioral modification techniques as expressing the water cycle on the site of the recently completed Sidwell Friends School in Washington, DC,[89] the results of such strategies are relatively unmeasured. Kieran and Timberlake have touched on a very important factor in the advancement of sustainability: people cannot expect to continue all of their current energy intensive habits, but rather, must also adjust to new and more sustainable lifestyles. And if architects design buildings that encourage these modifications, or at the very least accommodate them, it could have a significant impact on the success of a sustainable aesthetic. But these strategies and techniques must continue to be experimented with and tested in order to truly understand their effectiveness.

10.5: Built (and Measured) Examples

One of the most important factors for future work is the development of actual built examples that are designed using a sustainable aesthetic philosophy. While it is useful to apply the principles of a sustainable aesthetic developed here to existing buildings, the only way to truly gauge the effectiveness of the approach is with buildings designed with this philosophy in mind from beginning to end. It

[87] Chen, July/August 2007
[88] Ibid
[89] Ibid

seems only logical that buildings designed with sustainability in mind from the start would result in successful performance data, but real buildings must be built, with real measurements taken, to confirm these expectations. It would seem only logical that any building that claims to be sustainable should be required to present the data to support those claims. While quantitative factors are generally straightforward, assessing whether or not a building was designed according to the sustainable aesthetic philosophy defined here is a somewhat more complicated process. And yet, sustainable approaches should be clearly apparent as reactions to prevailing site conditions, and performance data should support and validate a sustainable aesthetic approach to the design process.

10.6: Appearance and Aesthetic Reactions to Sustainability

Perhaps, the most significant factor in defining a sustainable aesthetic in its entirety is an understanding of what that aesthetic will look like, and how it is perceived. But aesthetic appreciation and aesthetic creation are two very different things. And aesthetic appreciation can only be measured after a philosophy of aesthetic creation is implemented. As a result, it may take time to truly and completely understand the full implications of the sustainable aesthetic philosophy outlined here. Furthermore, the very nature of understanding "what it looks like" is inherently contradictory to the sustainable aesthetic philosophy outlined above, which suggests that each solution must be uniquely specific to its problem. And yet, it would seem that even the idea of "universal specificity" would have recognizable

characteristics. Possibly the most important factor of all is how this new aesthetic is perceived. The success or failure of any aesthetic is heavily influenced by public acceptance, and while any change is usually met with resistance, the general trend towards all things green seems encouraging for this new sustainable aesthetic, in whatever form it takes. This discussion only begins to touch on the complexity that still remains in establishing a sustainable aesthetic.

These examples only scratch the surface of the work yet to be done in developing a sustainable aesthetic. Rather than establishing a complete and final approach to sustainable architecture, the study presented here is meant to serve as only the beginning of a movement that must begin to take charge in the building industry in order to combat the challenge of global climate change.

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